## Lesson Plan 2022-2023

## (EVEN SEMESTER)

**SUBJECT: PROPERTIES OF MATTER AND KINETIC THEORY OF GASES CLASS: B.Sc. 2th Sem**

**Associate Professor: Mr. Ajit Singh**

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| **DURATION** | **SYLLABUS TO BE COVERED** |
| **1st Feb- 25th feb** | Rotation of rigid body, Moment of inertial, Torque, angular momentum, Kinetic  Energy of rotation. Theorem of perpendicular and parallel axes (with proof), Moment of inertia of solid sphere, hollow sphere, spherical shell, solid cylinder, hollow cylinder and solid bar of rectangular cross–section, Fly wheel, Moment of inertia of an irregular body, Acceleration of a body rolling down on an inclined plane. |
| **27th Feb- 25th March** | Elasticity, Stress and Strain, Hook’s law, Elastic constant and their relations, Poisson’s ratio, Torsion of cylinder and twisting couple, Determination of coefficient of modulus of rigidity for the material of wire by Maxwell’s needle, Bending of beam (its magnitude), Cantilever and Centrally loaded beam, Determination of Young’s modulus for Bending moment and the material of the beam and Elastic constants for the material of the wire by Searle’s method. |
| **27th March –**  **22nd April** | Assumption of Kinetic theory of gases, pressure of an ideal gas (with derivation), Kinetic interpretation of Temperature, Ideal Gas equation, Degree of freedom, Law of equipartition of energy and its application for specific heat of gases, Real gases, Vander wall’s equation, Brownian motion( Qualitative). |
| **24th April – 15th May** | Maxwell’s distribution of speed and velocities (derivation required), Experimental  verification of Maxwell’s law of speed distribution: most probable speed, average and r.m.s. speed, Mean free path, Transport of energy and momentum, Diffusion of gases. |

## Lesson Plan 2022-2023

## (EVEN SEMESTER)

**SUBJECT: STATISTICAL PHYSICS CLASS: B.Sc. 4th Sem**

**Associate Professor: Mr. Ajit Singh**

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| **DURATION** | **SYLLABUS TO BE COVERED** |
| **1st Feb- 25th feb** | Microscopic and Macroscopic systems, events-mutually exclusive, dependent and independent. Probability, statistical probability, A- priori Probability and relation between them, probability theorems, some probability considerations, combinations possessing maximum probability, combination possessing minimum probability, Tossing of 2,3 and any number of Coins, Permutations and combinations, distributions of N (for N= 2,3,4) distinguishable and indistinguishable particles in two boxes of equal size, Micro and Macro states, Thermo dynamical probability, Constraints and Accessible states, Statistical fluctuations, general distribution of distinguishable particles in compartmentsof different sizes, Condition of equilibrium between two systems in thermal contact—β parameter, Entropy and Probability (Boltzman's relation). |
| **27th Feb- 25th March** | Postulates of statistical physics, Phase space, Division of Phase space into cells, three kinds of statistics, basic approach in three statistics. M. B. statistics applied to an ideal gas in equilibrium- energy distribution law (including evaluation of α and β), speed distribution law & velocity distribution law. Expression for average speed, r.m.s. speed, average velocity, r. m. s. velocity, most probable energy & mean energy for Maxwellian distribution. |
| **27th March –**  **22nd April** | Need for Quantum Statistics: Bose-Einstein energy distribution law, Application of B.E.statistics to Planck's radiation law B.E. gas, Degeneracy and B.E. Condensation, Fermi-Dirac energy distribution law, F.D. gas and Degeneracy, Fermi energy and Fermi temperature, Fermi Dirac energy distribution law, Fermi Dirac gas and degeneracy, Fermi energy and Fermi temperature, Fermi Dirac energy distribution law for electron gas in metals, Zero point energy, Zero point pressure and average speed (at 0 K) of electron gas, Specific heat anomaly of metals and its solution. M.B. distribution as a limiting case of B.E. and F.D. distributions, Comparison of three statistics. |
| **24th April – 15th May** | Dulong and Petit law. Derivation of Dulong and Petit law from classical physics. Specific heat at low temperature, Einstein theory of specific heat, Criticism of Einstein theory, Debye model of specific heat of solids, success and shortcomings of Debye theory, comparison of Einstein and Debye theories. |

## Lesson Plan 2022-2023

## (EVEN SEMESTER)

**SUBJECT: ATOMIC AND MOLECULAR SPECTROSCOPY CLASS:B.Sc. 6th Sem**

**Associate Professor: Mr. Ajit Singh**

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| **DURATION** | **SYLLABUS TO BE COVERED** |
| **1st Feb- 25th feb** | Introduction of early observations, emission and absorption spectra, atomic spectra, wave number, spectrum of Hydrogen atom in Balmer series, Bohr atomic model(Bohr’s postulates), spectra of Hydrogen atom , explanation of spectral series in Hydrogen atom, un-quantized states and continuous spectra, spectral series in absorption spectra, effect of nuclear motion on line spectra (correction of finite nuclear mass), variation in Rydberg constant due to finite mass, short comings of Bohr’s theory, Wilson sommerfeld quantization rule, de-Broglie interpretation of Bohr quantization law, Bohr’s corresponding principle, Sommerfeld’s extension of Bohr’s model, Sommerfeld relativistic correction, Short comings of Bohr Sommerfeld theory, Vector atom model; space quantization, electron spin, coupling of orbital and spin angular momentum, spectroscopic terms and their notation, quantum numbers associated with vector atom model, transition probability and selection rules. |
| **27th Feb- 25th March** | Orbital magnetic dipole moment (Bohr megnaton), behavior of magnetic dipole in  external magnetic field; Larmors’ precession and theorem. Penetrating and Non-penetrating orbits, Penetrating orbits on the classical model; Quantum defect, spin orbit interaction energy of the single valance electron, spin orbit interaction for penetrating and non-penetrating orbits. quantum mechanical relativity correction, Hydrogen fine spectra, Main features of Alkali Spectra and their theoretical interpretation, term series and limits, Rydeburg-Ritze combination principle, Absorption spectra of Alkali atoms. observed doublet fine structure in the spectra of alkali metals and its Interpretation, Intensity rules for doublets, comparison of Alkali spectra and Hydrogen spectrum . |
| **27th March –**  **22nd April** | Essential features of spectra of Alkaline-earth elements, Vector model for two valance electron atom: application of spectra. Coupling Schemes;LS or Russell – Saunders Coupling Scheme and JJ coupling scheme, Interaction energy in L-S coupling (sp, pd configuration), Lande interval rule, Pauli principal and periodic classification of the elements. Interaction energy in JJ Coupling (sp, pd configuration), equivalent and non-equivalent electrons, Two valance electron system-spectral terms of non-equivalent and equivalent electrons, comparison of spectral terms in L-S And J-J coupling. Hyperfine structure of spectral lines and its origin; isotope effect, nuclear spin. |
| **24th April – 15th May** | Zeeman Effect (normal and Anomalous),Experimental set-up for studying Zeeman effect, Explanation of normal Zeeman effect(classical and quantum mechanical), Explanation of anomalous Zeeman effect(Lande g-factor), Zeeman pattern of D1 and D2 lines of Na atom, Paschen-Back effect of a single valence electron system. Weak field Stark effect of Hydrogen atom. Molecular Physics: General Considerations, Electronic States of Diatomic Molecules, Rotational Spectra (Far IR and Microwave Region), Vibrational Spectra (IR Region), Rotator Model of Diatomic Molecule, Raman Effect, Electronic Spectra. |