

**Session: 2022-2023 (Even Semester)**

**Lesson Plan**

**Name of the Teacher: Dr. VINOD KHATKAR , ASSOCIATE PROFESSOR**

**Subject: PHYSICS (Theory)                      Class: B. Sc. 6<sup>th</sup> Sem.**

**Physics Paper: I (Solid State and Nano Physics)**

**Paper's Code: NPH06(I)**

**Max. Marks: 50(External Assessment: 40 Marks, Internal Assessment: 10 Marks)**

**Contact Hours Per Week: 5**

**Physics Paper: II (Atomic and Molecular Spectroscopy)**

**Paper's Code: NPH06(II)**

**Max. Marks: 50(External Assessment: 40 Marks, Internal Assessment: 10 Marks)**

**Contact Hours Per Week: 5**

| Sr. No. | Week | Dates                    | Topic   |
|---------|------|--------------------------|---|
| 1       | 1st  | 20-02-2023 to 25-02-2023 | Crystalline and glassy forms, liquid crystals, crystal structure, periodicity, lattice and basis, crystal translational vectors and axes. Unit cell and Primitive Cell, Wigner Seitz primitive Cell, symmetry operations for a two dimensional crystal,   |
| 2       | 2nd  | 27-02-2023 to 04-03-2023 | Bravais lattices in two and three dimensions. Crystal planes and Miller indices, Interplanar spacing, Crystal structures of Zinc Sulphide, Sodium Chloride and Diamond, X-ray diffraction, Bragg's Law, experimental X-ray diffraction methods.   |
| 3       | 3rd  | 06-03-2023 to 11-03-2023 | K-space and reciprocal lattice and its physical significance, reciprocal lattice vectors, reciprocal lattice to a simple cubic lattice, b.c.c. and f.c.c. Historical introduction, Survey of superconductivity, Superconducting systems, High Tc Superconductors, Isotopic Effect,  |
| 4       | 4th  | 13-03-2023 to 18-03-2023 | Critical Magnetic Field, Meissner Effect, London Theory and Pippard's equation, Classification of Superconductors (type I and Type II), BCS Theory of Superconductivity, Flux quantization, Josephson Effect (AC and DC),<br>Class test   |
| 5       | 5th  | 20-03-2023 to 25-03-2023 | Practical Applications of superconductivity and their limitations, power application of superconductors. Definition, Length scale, Importance of Nano-scale and technology, History of Nanotechnology Benefits and challenges in molecular manufacturing. Molecular assembler concept,  |
| 6       | 6th  | 27-03-2023 to 01-04-2023 | Understanding advanced capabilities. Vision and objective of Nanotechnology, Nanotechnology in different field, Automobile, Electronics, Nano-biotechnology, Materials, Medicine.<br>Introduction of early observations, emission and absorption spectra, atomic spectra, wavenumber, spectrum of Hydrogen atom in Balmer series,                 |
| 7       | 7th  | 03-04-2023 to 08-04-2023 | 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,<br>Class test |

| Sr. No. | Week | Dates                    | Topic   |
|---------|------|--------------------------|---|
| 8       | 8th  | 10-04-2023 to 15-04-2023 | shortcomings 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, Shortcomings of Bohr-Sommerfeld theory, Vector atom model; space quantization, electron spin,   |
| 9       | 9th  | 17-04-2023 to 22-04-2023 | coupling of orbital and spin angular momentum, spectroscopic terms and their notation, quantum numbers associated with vector atom model, transition probability and selection rules. Orbital magnetic dipole moment (Bohr magneton), behavior of magnetic dipole in external magnetic field; Larmor's precession and theorem. Penetrating and Non-penetrating orbits,  |
| 10      | 10th | 24-04-2023 to 29-04-2023 | Penetrating orbits on the classical model; Quantum defect, spin orbit interaction energy of the single valence 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, Rydberg-Ritz combination principle, Absorption spectra of Alkali atoms.<br>Class test  |
| 11      | 11th | 01-05-2023 to 06-05-2023 | observed doublet fine structure in the spectra of alkali metals and its interpretation, Intensity rules for doublets, comparison of Alkali spectra and Hydrogen spectrum. Essential features of spectra of Alkaline-earth elements, Vector model for two valence 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. |
| 12      | 12th | 08-05-2023 to 13-05-2023 | Interaction energy in JJ Coupling (sp, pd configuration), equivalent and non-equivalent electrons, Two valence 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. Paschen-Back effect of a single valence electron system.  |
| 13      | 13th | 15-05-2023 to 19-05-2023 | Weak field Stark effect of Hydrogen atom. 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.<br>Class Test   |
| 14      | 14th | 20-05-2023 onwards       | Revision  |