**Subject:** Physics
**Semester:** Five
**Course Name: Atomic and Molecular Physics**
**Existing Base Syllabus: HS Physics and/ or Chemistry**
**Course Level:** PHY-301
**Syllabus showing each unit against class number and marks**

| Unit no. | Unit content | No. of classes | Marks/Credit |
|---|---|---|---|
| **Theory** | | | |
| Unit I: Atom Model: | The Bohr model of the hydrogen-like atom, Sommerfeld Relativistic Atom Model: Elliptical orbits, explanation of fine structure of H alpha line in Balmer series of hydrogen atom. Limitation of Sommerfeld atom model.<br>Orbital magnetic dipole moment: Bohr Magneton, Gyromagnetic Ratio, Larmor precession, Space Quantization, Electron Spin, quantum numbers associated with vector atom model, spin-orbit interaction, Coupling Schemes: L-S Coupling and j-j Coupling, Spectroscopic term and their notation, Stern-Gerlach experiment and its conclusion.<br>Normal and Anomalous Zeeman Effect.<br>Paschen Back and Stark Effect (Qualitative Discussion only). | 20 | Credit - 4 |
| Unit II: X-rays: | Ionizing Power, X-ray Diffraction, Bragg's Law, X-ray Spectra: Continuous and characteristic X-rays Mosley's law, Compton effect. | 8 | |
| Unit III: Multi electron atoms: | Hund's rule, Periodic table: Pauli's exclusion principle, explanation of the periodic classification of the elements, Building up or Aufbau Principle, Broad features of Alkali atom (Na etc.) spectra and its explanation | 10 | |
| Unit IV: Molecular Spectra | Rotational Energy levels, Selection Rules and Pure Rotational Spectra of a diatomic Molecule. Vibrational Energy Levels, Selection Rules and Vibration Spectra of a diatomic Molecule. Rotation-Vibration Energy Levels, Selection Rules and Rotation-Vibration Spectra. Determination of Internuclear Distance. | 15 | |
| Unit V: Raman Effect | Quantum Theory of Raman Effect. Characteristics of Raman Lines. Stoke's and Anti-Stoke's Lines. Complimentary Character of Raman and infrared Spectra. | 7 | |

**Reading list**


1. Introduction to Atomic spectra, H. E. White, Tata McGraw Hill (1934)
2. Atomic and Molecular Spectra, Raj Kumar
3. Concepts of Modern Physics, Arthur Beiser (McGraw-Hill Book Company, 1987)
4. Atomic physics, J. B. Rajam & foreword by Louis De Broglie (S. Chand & Co., 2007)
5. Physics of Atoms and Molecules, B. H. Bransden and C. J. Joachein.
   Fundamentals of Molecular Spectroscopy, C. N. Banwell and E. M. McCash


**Graduate Attributes**

**i. Course Objective**

- To learn the development of atom models.
- To learn the origin of atomic spectra and their modifications under different physical conditions.
- To learn the basics of molecular spectra for diatomic molecule and a few applications.

**ii. Learning outcome**

Students will be ability to describe the atomic spectra of one and two valance electron atoms and will also understand the change in behavior of atoms and corresponding modification of their spectra in external applied electric and magnetic field. They will understand the basic principle of pure rotational, vibrational, Rotation-Vibration and Raman spectra of molecules and their few applications.

**Theory Credit: 04 (Four)**

**Practical Credit: 0 (Zero)**

**No. of Required Classes: 60**

**No. of Contact Classes: 60**

**No. of Non-Contact Classes:**

**Particulars of Course Designer (Name, Institution, email id):**


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