# Pt. CLS Govt. P. G. College, Karnal

## Lesson Plan 2023-2024 (Even Semester)

**Name of Teacher:** Dr. Sunil Kumar (Department of Physics)
**Class:** B.Sc. (Sem-6$^{th}$) Section B
**Days:** (4-6)
**Subject: Physics** (Paper II: Atomic & Molecular Physics)

| S.No. | Week | Topics |
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| 1. | Weak 1 | **Unit – I: Historical background of atomic spectroscopy**<br>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) |
| 2. | Weak 2 | 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 |
| 3. | Weak 3 | 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 |
| 4. | Weak 4 | Short comings of Bohr-Sommerfeld theory, Vector atom model; space quantization, electron spin, coupling of orbital and spin angular momentum |
| 5. | Weak 5 | Spectroscopic terms and their notation, quantum numbers associated with vector atom model, transition probability and selection rules. |
| 6. | Weak 6 | **Unit –II: Vector Atom Model (single valance electron)**<br>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 |
| 7. | Weak 7 | 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 |
| 8. | Weak 8 | Rydeburg-Ritze combination principle, Absorption spectra of Alkali atoms. observed doublet fine structure in the spectra of alkali metals and its Interpretation |
| 9. | Weak 9 | Intensity rules for doublets, comparison of Alkali spectra and Hydrogen spectrum.<br>**UNIT-III: Vector Atom model (two valance electrons)**<br>Essential features of spectra of Alkaline-earth elements, Vector model for two valance electron atom: application of spectra. |
| 10. | Weak 10 | 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. |
| 11. | Weak 11 | 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, |
| ***HOLI Vacations*** | | |
| 12. | Weak 12 | Comparison of spectral terms in L-S And J-J coupling, Hyperfine structure of spectral lines and its origin; isotope effect, nuclear spin |

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| | | **Unit –IV: Atom in External Field** Zeeman Effect (normal and Anomalous), |
| 13. | Weak 13 | Experimental set-up for studying Zeeman effect, Explanation of normal Zeeman effect(classical and quantum mechanical) |
| 14. | Weak 14 | Explanation of anomalous Zeeman effect( Lande g-factor), Zeeman pattern of D1 and D2 lines of Na<br>Atom, Paschen-Back effect of a single valence electron system.<br>**Class Test** |
| 15. | Weak 15 | Weak field Stark effect of Hydrogen atom. Molecular Physics General Considerations, Electronic States of Diatomic Molecules, Rotational Spectra (Far IR and Microwave Region)<br>Vibrational Spectra (IR Region), Rotator Model of Diatomic Molecule, Raman Effect, Electronic Spectra. |