**CURRICULUM DEVELOPMENT PLAN: Dr. Savita Sharma**

**B.Sc. (H) Physics IVth Semester (Even Semester, 2024-2025)**

**Paper: Modern Physics; UPC:2222012401; Credit: 04 (Lecture-03, Practical-01)**

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| **Topics** | **Allocation of Lectures**  **(hrs)** | **Month**  **Wise schedule** | **Tutorial/assignment/**  **Presentation etc.** |
| Unit – I  Origin of Quantum Theory: Black body radiation and failure of classical theory, Planck’s quantum hypothesis, Planck’s radiation law, quantitative treatment of photo-electric effect and Compton scattering, Heisenberg’s uncertainty principle, Gamma ray microscope thought experiment, position - momentum uncertainty, consequences of uncertainty principle. | 09 | 08-28th January 2025 | * Syllabus Overview * Reference Books * Derivations * Problem-solving * Students’ difficulties |
| Unit – II  The Schrodinger Equation: The Schrodinger equation in one-dimension, statistical interpretation of wave function, probability and probability current densities. Normalization, conditions for physical acceptability of wave functions with examples, position and momentum operators and their expectation values. Commutator of position and momentum operators | 09 | 29th January-10th February 2025 | * Derivations * Problem-solving * Students’ difficulties |
| Unit – III  Time Independent Schrodinger Equation: Demonstration of separation of variable method for time independent Schrodinger equation: Free particle wave function, wave packets, application to energy eigen values and stationary states for particle in a box problem.  Reflection and transmission across a step and rectangular potential barrier | 09 | 11th February- 3rd March 2025 | * Derivations * Problem-solving * Students’ difficulties |
| Unit - IV  Atomic Physics: Beyond the Bohr’s Quantum Model: Sommerfeld theory of elliptical orbits; Hydrogen atom energy levels and spectra, emission and absorption spectra; Correspondence principle; X-rays: Method of production, Continuous and Characteristic X-rays, Moseley’s law.  Lasers: Lifetime of excited states, natural and Doppler width of spectral lines, emission (spontaneous and stimulated) and absorption processes, Einstein’s A and B coefficients, principle of detailed balancing, metastable states, components of a laser and lasing action, working principle of a 4 level laser, e.g. He-Ne lasers; qualitative idea of X-ray free electron lasers. | 09 | 4th March-31st March 2025 | * Derivations * Problem-solving * Students’ difficulties * Assignments |
| Unit - V  Basic Properties of Nuclei: Introduction (notation, a basic idea about nuclear size, mass, angular momentum, spin, parity, isospin), N-Z graph, nuclear binding energy, semi-empirical mass formula, and basic idea about the nuclear force and meson theory.  Radioactivity: Law of radioactivity and secular equilibrium.  Accelerators: Accelerator facility available in India: Van-de Graaff generator (Tandem accelerator), linear accelerator, cyclotron (principle, construction, working, advantages and disadvantages), discovery of new elements of the periodic table. | 09 | 1st April-21st April 2025 | * Derivations * Problem-solving * Students’ difficulties * Class Test * Previous year's Question Papers |