

BHARATI VIDYAPEETH DEEMED UNIVERSITY
SYLLABUS FOR Ph.D. ENTRANCE IN PHYSICS

Unit I: Classical mechanics

Newton's laws, central force motion, two body collision, scattering in laboratory and center of mass frames, rigid body dynamics, moment of inertia, non-inertial frames, pseudo-force, conservation laws, periodic motion, special theory of relativity, mass energy equivalence

Unit II: Quantum mechanics

Wave particle duality, wave functions in coordinate, Heisenberg uncertainty principle, Schrödinger's equation (time dependent and time independent), eigenvalues problems such as particle in a box, harmonic oscillator etc. motion in a central potential, orbital angular momentum, angular momentum, hydrogen atom, spin orbit coupling, fine structure, selection rule, elementary theory of scattering, Pauli's exclusion principle. Quantum size effect:- electron confinement in infinitely deep square well, quantum well structure, quantum dots and quantum wires

Unit III: Electromagnetic theory

Electrostatics: Gauss's law and its application,
Magnetostatics: Biot-Savart Law, Amperes theorem, electromagnetic induction, Maxwell's equations in free space, boundary conditions on fields at interfaces, scalar and vector potentials, electromagnetic waves in free space, dielectrics and conductors, reflection and refractions, polarization, transmission lines, dynamics of charged particles in static and electromagnetic fields, radiation from moving charges, dipoles

Unit IV: Electronics

Semiconductor devices including diodes, transistors, field effect transistors, Optoelectronic devices including solar cells, photo-detectors and LEDs, Solar energy and its conversion, Basic principle of solar cell, photovoltaic conversion, types of solar cell materials and characteristic, operational amplifiers and their applications, digital techniques and applications (registers, counter, comparators etc.), A/D and D/A converters, Two probe method, Four probe method, thermoelectric power (TEP)

Unit V: Atomic and molecular physics

Quantum states of an electron in an atom, electron spin, spectrum of hydrogen, energy levels of hydrogen, hyperfine structure, LS and JJ coupling, Zeeman effect, electron spin resonance, nuclear magnetic resonance, Raman spectra, spontaneous and stimulated emission of radiation, laser, optical pumping, population inversion.

Books Recommended:

1. Classical Mechanics – Herbert Goldstein
2. Principles of Quantum Mechanics – R. Shankar
3. Introduction to Electrodynamics – David J. Griffiths
4. Electronic Devices and Circuit Theory – Robert L. Boylestad & Louis Nashelsky
5. Optoelectronics and Photonics – Safa O. Kasap
6. Experimental Methods for Engineers – J.P. Holman
7. Physics of Atoms and Molecules – B.H. Bransden & C.J. Joachain
8. Modern Physics – Arthur Beiser
9. Basic Principles of Spectroscopy – Raymond Chang
10. Mathematical Methods for Physicists – George B. Arfken & Hans J. Weber