


# DEVI AHILYA VISHWAVIDYALAYA, INDORE

## Syllabus for Ph.D. Entrance Test

### SUBJECT: APPLIED PHYSICS

#### PART – B

- 1. Electromagnetic Theory:**  
Solution of electrostatic and magnetostatic problems including boundary value problems; Maxwell's equations; Electromagnetic waves and their reflection, refraction, interference, diffraction, and polarization. Poynting vector, Poynting theorem, energy, and momentum of electromagnetic waves. Special theory of relativity – Lorentz transformations, relativistic kinematics, mass-energy equivalence. Compton Effect.
- 2. Optics**  
Ray optics, wave optics, electromagnetic optics, and photon optics, interaction of light and matter. waves in anisotropic media, coherence, image formation and Fourier optics, guided wave optics and holography. Lasers-spontaneous and stimulated emission, optical pumping, population inversion, coherence (temporal and spatial) simple description of Ruby laser, CO<sub>2</sub> and He-Ne Lasers, optical fibers.
- 3. Atomic and Molecular Physics:**  
Spectra of one- and many-electron atoms; Stern-Gerlach experiment, LS and JJ coupling; hyperfine structure; Zeeman and Stark effects; electric dipole transitions and selection rules; rotational and vibrational spectra of diatomic molecules; electronic transition in diatomic molecules, Franck-Condon principle; Raman effect; NMR and ESR;
- 4. Quantum Mechanics:**  
Wave-particle duality; uncertainty principle; Schrodinger equation; one-, two- and three-dimensional potential problems; particle in a box, harmonic oscillator, hydrogen atom; linear vectors and operators in Hilbert space; angular momentum and spin; addition of angular momenta; time independent perturbation theory; elementary scattering theory.
- 5. Solid State Physics:**  
Crystal classes and systems, 2d & 3d lattices, Bonding of common crystal structures, unit cells, Miller indices, reciprocal lattice, diffraction methods for structure determination; Concept of amorphous, single, and polycrystalline structures and their effect on properties of materials. Crystal growth techniques, elastic properties of solids; defects in crystals; lattice vibrations and thermal properties of solids; crystal growth techniques, imperfections in crystalline solids.

  
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