PH002 Foundation Course in Physics for PhD Candidates P/F

(Non-credit course)

UNIT-I Classical Mechanics

Dimensional analysis, problem solving methods, Symmetry and conservation laws, Newton's laws. Central force motions. Two body Collisions - scattering in laboratory and Centre of mass frames. Rigid body dynamics- moment of inertia tensor. Generalized coordinates. Lagrangian and Hamiltonian formalism and equations of motion.

UNIT-II Quantum Mechanics

Uncertainty principle-Wave-particle duality. Schrödinger equation (time-dependent and time-independent). Eigenvalue problems (particle in a box). Tunnelling through a barrier. Dirac notation for state vectors, Time-independent perturbation theory and applications.

UNIT-III Atomic & Molecular Physics

Hydrogen atom-Quantum states of an electron in an atom. Electron spin. Spectrum of helium. Zeeman, Paschen-Bach & Stark effects. rotational, vibrational and Raman spectra of diatomic molecules, selection rules

UNIT-IV Condensed Matter Physics

Bravais lattices. Reciprocal lattice. Diffraction and the structure factor. Bonding of solids. Elastic properties, phonons, electronic specific heat. Hall effect and thermoelectric power. Electron motion in a periodic potential, band theory of solids: metals, insulators and semiconductors. Defects and dislocations.

UNIT-V Optics

Phase and group velocity, superposition principle, Maxwell equations, EM waves, photons, Propagation of light in matter, Rayleigh scattering, origin of refractive index, diffraction by single, double and multiple slits, diffraction grating, resolving power, Fraunhoffer and Fresnel diffraction; interference, interferometers, applications.

TEXT BOOKS/ REFERENCES:

1. *Introduction to Quantum Mechanics* by David J Griffiths, Pearson, India-2nd Ed. 2005. Various free online versions available. For example at: *http://www.fisica.net/mecanica-quantica/Griffiths - Introduction to quantum mechanics.pdf* or *http://syedzia.yolasite.com/resources/introduction_to_quantum_mechanics_D._J._Griffiths.pdf*
2. H. Goldstein, *Classical Mechanics*, Addison-Wesly, 2E, 1980
3. *E. Hecht and A.R. Ganesan, Optics, 4E, Pearson, 2008*

4. *Ajoy Ghatak, Optics, 5E, Tata-McGraw Hill, 2012*
5. *N.W. Ashcroft and N.D. Mermin, Solid State Physics, Cengage Learning, 2003.*
6. *C.Kittel, Introduction to Solid State Physics, Wiley India, 7E, 2007.*
7. David Halliday, Robert Resnick, and Jearl Walker*, Fundamentals of Physics,* 6th Ed, John-Wiley, 2000.

Additional References:

8. *Principles of Quantum Mechanics* by Ramamurti Shankar**,** Pearson, India-2nd Ed. 2005.
9. Hecht, Eugene, *Optics,* 2nd Ed, Addison Wesley, 1987
10. *A.K. Ghatak, Introduction to Modern optics, Tata McGraw Hill, 1972.*
11. *Bahaa E. A. Salesh, Fundamentals of photonics,* 2nd Ed., Wiley Interscience, 2007
12. Kenneth Krane*, Modern Physics,* Wiley-India, 2E 2006
13. Bemstein, Fishbane and Gasiorowic*, Modern Physics, 1E,* Pearson-India, 2003
14. *Eisberg and Resnick, Quantum Physics of Atoms, molecules, solids, Nuclei and particles, Wiley-India,2E, 2006*
15. Arther Beiser*, Concepts of Modern Physics,* TMH, 6E, 2006
16. *J. Peatross & M. Ware, Physics of Light and Optics (Available online at:http://optics.byu.edu/BYUOpticsBook_2013.pdf)*
17. *G.R. Fowles, Introduction to Modern Optics, 2E, Dover, 1989*
18. *M. Born M & E. Wolf, Principles of Optics, 7th Expanded Ed., CUP, 1999 (Reference)*
19. *Ibach and Luth, Soil State Physics, Springer India, 3E, 2002.*
20. *M.Marder, Condensed Matter Physics, Wiley Inter sciences, 1E, 2000.*