Syllabus of Ph. D. Entrance For Physics

Part A (Compulsory-Total 20 Marks)

1. Condensed Matter Physics-Crystal classes and system, 2d and 3d lattices, bonding of common crystal structure; reciprocal lattice, diffraction and structure factor, elementary ideas about point defect and dislocations, short and long range order in liquids and solids, liquid crystals, quasicrystals and glasses. Lattice vibrations, phonons, specific heat of solids. Free electron theory. Fermi statistics, heat capacity and Pauli paramagnetic susceptibility. Electron motion in periodic potentials energy bands in metals, insulators and semiconductors, tight binding approximation, impurity levels in doped semiconductors. Dielectrics-Polarization mechanisms, Clausius-Mossotti equation, piezo, pyro and ferroelectricity. Dia and Para magnetism, exchange interactions, magnetic order, ferro, anti ferro and ferromagnetism, ferrites.

Part B (Total 80 Marks)

1. Mathematical Methods of Physics -Dimensional analysis. Vector algebra and vector calculus. Linear algebra, matrices. Eigenvalues and eigenvectors. Linear ordinary differential equations of first & second order.

2.Quantum Physics and Applications - Wave-particle duality. Heisenberg's Uncertainty Principle. Schrodinger equation. Particle moving in a one-dimensional potential. Orbital angular momentum. Motion in a central potential symmetry conservation laws. Schrodinger equation in a periodic potential, Tunnelling through a potential barrier. Identical particles, spin statitics connection.

3. Electrostatics-Laplace and Poission equations, boundary value problems, multiple expansion, dielectrics. Magnetostatics - Ampere's theorem, Biot-Savart Law, electromagnetic induction. Electromagnetic waves-reflection and refraction, dispersion, Rectangular wave guides. Interference, coherence, visibility of fringes. Diffraction, Polarization, Electrodynamics motion of a charged particle in electric and magnetic fields.

4. Electronics- Semiconductor discrete devices (characteristic curves and physics of p-n junction)- pn junction diode, Bipolar junction transistor, Opto electronic devices (Photo-diode, solar cell, LED, LCD and photo transistor), Diffusion of impurities in sillicon, growth of oxide. Applications of semiconductor devices in linear and digital circuits-Zener regulated power supply, Transistor (bipolar, MOSFFT, JFET) as amplifier.

Dr. N. V. Pradnyakar   Dr. S. R. Chaudhari
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