School of Material Science and Nanotechnology, NIT Kurukshetra
Syllabus of Ph.D Entrance Test Jan.-2016

CRYSTAL STRUCTURE: Space Lattice, unit cell and translation vectors; Miller indices, Simple and closed packed crystal structures, Defects in solids.

FREE ELECTRON THEORY: Elements of classical free electron theory and its limitations, quantum theory of free electrons, Fermi level, Density of states, Fermi-Dirac distribution function, Thermionic emission, Richardson's equation.

BAND THEORY OF SOLIDS: Origin of energy bands, Kronig Penney Model (qualitative), E-K diagram, Brilloun Zones, Concept of effective mass and holes, Classification into metals, Semiconcuctors and insulators, Fermi energy and its variation with temperature.

MAGNETIC PROPERTIES OF SOLIDS: Atomic magnetic moments, orbital diamagnetism, classical theory of paramagnetism, ferro magnetism, molecular field theory and domains.

ELEMENTS OF NANOTECHNOLOGY: Introduction to nanoscience and technology, concept of quantum size effect, quantum dots, Nanomaterials: top down and bottom up techniques, atomic manipulation-nanodots, semi-conductor quantum dots, self-assembly monolayers, Nanowires, Carbon nanotubes, Applications of nanotechnology. Simple details of characterization tools- SEM, TEM, XRD.

DIELECTRICS: Polarization, displacement, susceptibility, dielectric coefficient, permitivity & various relations between them, Energy stored in electric field, Behavior of dielectrics in ac fields-simple concepts, dielectric losses, Applications of dielectrics.

QUANTUM PHYSICS : Introduction to quantum mechanics- simple concepts, discovery of Planck's Constant, Group velocity and phase velocity, Schrodinger wave equation, Postulates of quantum mechanics, Time dependent and time independent Schrodinger wave equation, Uncertainty principle, Eigen values, Elementary ideas of quantum statistics.

Nuclear fission, moderators, nuclear reactors nuclear fusion; Interaction of radiation with matter (basic concepts)

X-RAYS: Production of X-rays, continuous and characteristics X-ray, Mosley Law, absorption and diffraction of X-ray, Bragg's law and its applications, Methods of X-ray diffraction, Compton scattering.

12/01/2016