

Integrated Ph.D. course Batch 2022

Syllabus for special paper - III

Max. marks: 100

Min. marks: 50

Title of the paper: **Optoelectronic Properties of Solids**

Unit 1: Crystallography

Basics of crystallography, Bravais lattice and crystal systems, Miller indices, reciprocal lattice, concept of Brillouin zone, Bragg's law condition in reciprocal lattice, crystal defects, x-ray diffraction.

Unit 2: Band structure of crystals

Crystal binding (ionic, covalent, hydrogen), Bloch's theorem and Bloch functions, Kronig Penney model, band theory of solids, overview of semiconductors and introduction to extrinsic and intrinsic semiconductors.

Unit 3: Optical and magnetic properties of solids

Optical properties of materials, absorption, reflection, transmission, refractive index, dispersion of light, electrical conductivity, dielectric constant, permittivity and polarizability, ferroelectricity and piezoelectricity, types of magnetism (ferromagnetism, anti-ferromagnetism, etc).

Unit 4: Optoelectronic devices and their applications

Electronic devices (transistors, diodes), optoelectronic devices (light emitting diodes, photodetectors, solar cells, Ruby laser), materials for Optoelectronics (semiconductors, organic materials, photonic crystals), applications of optoelectronic materials (communication systems, medical imaging).

References:

1. Kittel's introduction to solid state physics (Charles Kittel)
2. Introduction to solid state physics (M. A. Wahab)