Credit Course

Physics

MATERIAL SCIENCE FOR PHYSICISTS

UNIT-I : Dielectrics and Ferroelectrics

Macroscopic description of the static dielectric constant, the electronic and ionic polarization of molecules, orientational polarization, measurement or dielectric constant of a solid, the internal field of Lorentz, Clausus – Mosott relation- elementary ideas on dipole relaxations.

Classification of ferroelectric crystals-BaTiO, and KDP, dielectric theory of ferro electricity, spontaneous polarization and ferro electric hysteresis.

UNIT – 2 : Magnetic properties

Quantum theory of diamagnetism, origin of permanent magnetic moment, theories of paramagnetism, paramagnetic cooling, spontaneous magnetization, weiss theory of spontaneous magnetization, nature and origin of the weiss molecular field. Heisenberg exchange interaction, hysteresis. The block wall, Neel's theory of antiferromagnetism. Ferromagnetism, ferrite's and their applications (basic concepts only)

UNIT -3 : Superconductivity

Occurance of superconductivity, experimental observations, persistent currents. Effect of magnetic fields, meissner effect, Type-I and Type – II superconductors, intermediate states, entropy and heat capacity, energy gap. Isotope effect, thermal conductivity. Theoretical explanations, London's equation. Penetration depth, coherence length cooper pairs, elements of BCS theory, giaver tunneling josphson effects (basic ideas)

UNIT – 4 : Fiber optics and Lasers

Introduction, ray theory Transmission, Types of fibers, Photo conductor, fiber optic sensors.

Lasers, basic concepts, condition for lasing action, ruby laser, helium-neon laser, semi-conductor lasers, applications.

BOOKS:

1. Introduction to solid state physics by C.Kittel
2. Materials science by M.Arumugam
3. Materials science & Engineering by WD Callister (Jr)