

PHYSICS –II (Non E) (F. Y. B. Tech.)
Solid State Physics and Statistical thermodynamics

Teaching Scheme

Lectures : 3hrs/week

Practical : 2hrs/week

Examination Scheme

T1 - 20, T2 - 20

End-Sem Exam - 60.

Sem: Spring

1. Structure of Solids and its Characterization (6)

Crystalline state, space lattice, lattice, basis and crystal structure, unit cell and primitive cell, lattice parameters, crystal systems in brief (cubic, monoclinic ...Triclinic), Miller indices, inter planer distance of lattice plane, atomic radius (simple cubic, fcc, bcc), no. of atoms in unit cell, coordination number, packing fraction, X-ray diffraction: Bragg spectrometer, analysis of XRD spectra for cubic system

2. Solid State Physics (8)

Sommerfeld's free electron theory, Density of states (1D, 2D, 3D), Nearly free electron theory, origin of band gap, magnitude of band gap, classification of solids on the basis of band theory, Fermi energy level, Fermi-Dirac probability function, position of Fermi level in intrinsic (with derivation), carrier concentration: intrinsic and Extrinsic, semiconductor conductivity: intrinsic and Extrinsic

3. Statistical Mechanics

Micro and macro states, basic postulate of statistical mechanics, concept and types of ensembles, partition function, Maxwell Boltzmann statistics (MBS), Bose Einstein (BES) and Fermi Dirac statistics (FDS)

4. Statistical Thermodynamics

Laws of thermodynamics; zeroth, first, second and third, statistical interpretation of basis thermodynamic variables; pressure, work, energy, entropy, Helmholtz free energy, Gibb's free energy

5. Thermal properties of solids

Thermal vibrations, specific heat of solids, Dulong Petit law, Einstein's theory of specific heat, Debye's theory of specific heat: vibrational modes, density of vibrational mode, Debye's approximation

6. Magnetism and Superconductivity

Origin of magnetic moment, magnetization, Langevin's Theory of Diamagnetism and Paramagnetism, Ferromagnetism, Curie Wiess law, Antiferromagnetism and Ferrimagnetism

Introduction to superconductivity, Meissner effect, concepts of Cooper pair, Type-I and Type-II superconductors, Josephson junction

References:

- Elements of X-ray Diffraction, B. D. Cullity, Addison-Wesley Publishing Company, Inc.
- Introduction to Solid State Physics, Charles Kittel, Wiley
- Solid State Physics, S. O. Pillai, New Age International Publishers.
- Solid state electronic devices, Ben G. Streetman, Sanjay Banerjee Pearson Prentice-Hall
- Fundamentals of statistical Mechanics, B. B. Laud, New Age International Publishers
- Fundamentals of Statistical and Thermal Physics by F. Reif Levant Pub
- Text Book of Engineering Physics by Avadhanulu & Kshirsagar, S. Chand Pub.

- Introduction to Magnetic Materials, B. D. Cullity, Wiley