

B.Tech I Year(R05) Supplementary Examinations, May 2010**APPLIED PHYSICS**

(Common to Electrical & Electronic Engineering, Electronics & Communication Engineering, Computer Science & Engineering, Electronics & Instrumentation Engineering, Bio-Medical Engineering, Information Technology, Electronics & Control Engineering, Computer Science & Systems Engineering and Electronics & Computer Engineering)

Time: 3 hours

Max Marks: 80

Answer any FIVE Questions
All Questions carry equal marks

1. (a) Define crystal lattice, unit cell, lattice parameter and coordination number. [8]
(b) Consider a Body Centered Cubic lattice of identical atoms having radius R. Compute
 - i. the number of atoms per unit cell
 - ii. the coordination number and
 - iii. the packing fraction. [8]
2. (a) Draw the (112) and (120) planes, and the [112] and [120] directions of a simple cubic crystal. [4]
(b) Derive an expression for the inter-planar spacing in the case of a cubic structure. [8]
(c) Calculate the glancing angle at (110) plane of a cubic crystal having axial length 0.26 nm corresponding to the second order diffraction maximum for the X-rays of wavelength 0.065 nm. [4]
3. (a) Explain Schottky and Frenkel defects with the help of suitable figures. [10]
(b) Explain the significance of Burgers vector. [6]
4. (a) Explain the origin of energy bands in solids. [6]
(b) Assuming the electron - lattice interaction to be responsible for scattering of conduction electrons in a metal, obtain an expression for conductivity in terms of relaxation time and explain any three drawbacks of classical theory of free electrons. [6]
(c) Find the temperature at which there is 1% probability of a state with an energy 0.5 eV above Fermi energy. [4]
5. (a) What are paramagnetic materials? Explain. [4]
(b) Obtain an expression for paramagnetic susceptibility (χ). How does the paramagnetic susceptibility of a material vary with temperature? [8]
(c) A paramagnetic material has 10^{28} atoms per m^3 . Its susceptibility at 350 K is 2.8×10^{-4} . Calculate the susceptibility at 300 K. [4]
6. (a) State the expression for the density of electrons and holes in an intrinsic semiconductor. [4]
(b) Derive the expression for Fermi level. [6]
(c) Derive the relation between the intrinsic carrier concentration and absolute temperature. [6]
7. (a) Explain the terms:
 - i. temporal coherence
 - ii. population inversion
 - iii. metastable state
 - iv. stimulated emission [10]
(b) Why is the optical resonator required in lasers? Illustrate your answer with neat sketches. [6]
8. (a) What is total internal reflection? Discuss its importance in optical fibres. [6]
(b) Describe the various types of optical fibres, their advantages and limitations. [6]
(c) If the numerical aperture of a fibre is 0.245 with a core refractive index 1.51, calculate the refractive index of cladding as well as acceptance angle. [4]
