

Roll No.

Total Pages : 2

PC 8705-MH

BS/2057
CONDENSED MATTER PHYSICS-II
Paper-A
Semester-VI

Time Allowed : 3 Hours]

[Maximum Marks : 30

Note :- The candidates are required to attempt two questions each from Sections A and B carrying 5 marks each and any five from Section C consisting of seven short answer type questions carrying 2 marks each.

SECTION-A

1. What do you understand by Phonons ? Express laws of conservation of energy and momentum in case of inelastic scattering of phonons by photon. 5
2. Discuss Einstein's model of specific heat of solids. What are its major drawbacks ? 5
3. Derive expressions for fermi energy and density of states for a free electron gas in one dimension. 5
4. Obtain an expression for the dispersion relation for lattice vibrations of monoatomic linear lattice. 5

SECTION-B

5. Discuss the Kronig-Penny model and show that how it explains the forbidden gap. 5
6. What do you understand by intrinsic and extrinsic semiconductors ? Discuss the variation of the fermi level with temperature for an n-type semiconductor. 5

7. What are essential characteristics of a semiconductor ? Obtain and discuss the expression for electrical conductivity for an intrinsic semiconductor. 5
8. (a) What do you understand by superconductivity ? Explain the term critical magnetic field in superconductor. How does the critical magnetic field vary with temperature in type I and type II superconductors ? 2½
- (b) What is minimum frequency of the radiation which could break apart cooper-pairs in lead at 0 K, if the band gap of lead is 2.76×10^{-3} eV at 0 K. 2½
9. Attempt any five :
- (i) Give the failure of Dulong and Petit's law at low temperature.
- (ii) What do you mean by high temperature superconductivity ?
- (iii) Give the difference between the free electron mass and the effective mass of an electron.
- (iv) Give the physical significance of Debye's temperature.
- (v) What is donor concentration in n-type Ge is $2 \times 10^{-2} \Omega\text{m}$ resistivity at room temperature ? Give the mobility of electron $\mu_e = 0.10 \text{ m}^2\text{v}^{-1}\text{s}^{-1}$.
- (vi) Why n-type and p-type semiconductors are electrically neutral ?
- (vii) Give the two basic difference between elastic vibrations and e.m.waves. 5x2=10