

PC-1255/MH

CS-2058
CONDENSED MATTER PHYSICS-II
Paper-A
(Semester-VI)

Time Allowed : 3 Hours]

[Maximum Marks : 30

Note :- Attempt two questions each from Sections A and B carrying 5 marks each, and any five from Section C consisting of 7 short answer type questions carrying 2 marks each.

SECTION-A

- I. What do you understand by Phonon ? Describe inelastic scattering of photons by phonons. Obtain an expression for the frequency of phonons generated when a photon is scattered inelastically at an angle θ . 5
- II. Give the assumptions of Einstein's theory of specific heat and discuss its behaviour at very high and very low temperature and compare its prediction with actual results. 5

- III. Derive expressions for fermi energy and density of state for free electron gas in one dimension. 5
- IV. (a) Consider silver in metallic state with one free electron per atom. If the density of Ag = 10.5 gm/cm^3 and atomic weight = 108 gm atom. Find the fermi energy.
- (b) Find the Debye's temperature, if the Debye frequency for a vibration mode in certain solid is 9.0×10^{10} Hertz.

SECTION-B

- V. What do you understand by extrinsic semiconductor. Find the density of electron in conduction in the case of intrinsic semiconductor. 5
- VI. What is meant by Fermi level. Discuss the variation of the Fermi level with temperature for an n-type semiconductor. 5
- VII. (a) Give qualitative description of BCS theory. How does it account for the superconductivity state. 2.5
- (b) Explain various types of thermodynamic effects of superconductors. 2.5
- VII. Discuss Kronig-Penney model for the energy band, structure of solid. Show that band can accommodate $2N$ electrons, where N is total number of atoms in the crystal. 5

SECTION-C

IX. Attempt any five :

- (a) What do you understand by valence band, conduction band and band gap ?
- (b) Give the cause of failure of free electron theory.
- (c) Why does Dulong and Petit law fails at low temperature ?
- (d) Give basic difference between e.m. waves and elastic vibrations.
- (e) Give the properties of metals, which explained by free electron theory.
- (f) What is Seebeck effect ?
- (g) What do you mean by critical temperature of a superconductor ?

5x2=10