

PHYSICS Paper-A

(Condensed Matter Physics-II)

Time Allowed : Three Hours

Maximum Marks : 22

- Note : (i) Attempt five questions in all by selecting two questions from each of Unit-I, II and III is compulsory.
(ii) Use of non-programmable calculator is allowed.

UNIT-I

- (a) Obtain an expression for the dispersion relation in case of monoatomic linear chain of atoms.
(b) Find the cut off frequency for a one dimensional monoatomic chain, given that the interatomic spacing is 3\AA and velocity of sound is 3000 m/sec . 2.5, 1.5
- (a) Discuss Debye model of specific heat.
(b) Find the value of debye temperature for gold. The density of gold is 19000 kg/m^3 and velocity of sound is 2100 m/s . Take atomic mass of gold 197. 2.5, 1.5
- Explain Weiss theory of ferromagnetism. Also discuss the variation of saturation magnetisation with temperature. 4

UNIT-II

- (a) What are liquid crystals ? How can they be classified ? Give two important properties and applications of liquid crystals.
(b) The dielectric constant of sulphur is 4. Sulphur has cubic structure and its density is 2080 kg m^{-3} . Calculate the atomic polarizability of sulphur. Give that its atomic mass is 32. 2.5, 1.5

5. Discuss the BCS theory of superconductors.

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6. (a) Name the various methods to fabricate the nanomaterials. Discuss how lithography helps us to design the nanostructures.

(b) What is the size of the human hair on nanometer scale? 2.5, 1.5

UNIT-III

7. Attempt any six of the following :

(i) What are the assumptions made in discussing the one dimensional mono-atomic lattice.

(ii) Why does Dolone-Petitis law fail at low temperatures ?

(iii) Define magnetic susceptibility. What is its Physical significance ?

(iv) What are domain walls ?

(v) What are liquid crystals ?

(vi) Name the two types of nanotubes.

(vii) What is Meissner effect ?

6×1=6