[This question paper contains 4 printed pages.]

Your Roll No.....

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Sr. No. of Question Paper : 2610

Unique Paper Code : 42227637

Name of the Paper : Solid State Physics

Name of the Course : B.Sc. (Prog.) : DSE-3B

Semester : VI

Duration : 3 Hours Maximum Marks : 75

Instructions for Candidates

1. Write your Roll No. on the top immediately on receipt of this question paper.
2. Attempt any five questions.
3. Question No. 1 is compulsory.

1. Attempt any five of the following : (5×3=15)

(a) List three differences between amorphous and crystalline solids with one example of each.

(b) Show that reciprocal lattice vector $\vec{G}_{hkl}$ is normal to the plane (hkl).

(c) Calculate Einstein's frequency for copper having Einstein's temperature θ_E = 230K.

P.T.O.

(d) What are phonons? Differentiate between acoustical and optical phonons.

(e) Explain Meissner effect with the help of a diagram.

(f) What do you understand by the term 'Domains'? Why do large number of domains exist in a ferromagnetic material?

(g) Distinguish between Conductors, Semiconductors and Metals on the basis of E-K curve.

(h) What are plasmons?

2. (a) What are Miller Indices? How are they defined for a plane? Name the six faces of a unit cube in terms of Miller Indices. (3)

(b) Derive Bragg's Law and express it in terms of Reciprocal lattice vector $\vec{G}$. (7)

(c) Show that Reciprocal Lattice of a bcc is fcc. (5)

3. (a) Derive the dispersion relation for a linear monoatomic lattice and discuss under what conditions it can act as a 'low pass filter'. (10)

(b) Why did the classical theory of specific heat fail to explain the behaviour of solids at low temperature? How did Einstein overcome this difficulty? (5)

4. (a) What are the characteristics of Diamagnetic materials? Derive an expression for diamagnetic susceptibility on the basis of classical theory. (3,5)

(b) Show that the area enclosed by B-H curve represents the energy loss per cycle. (5)

(c) A magnetic substance has 10^{28} atoms/m^3. The magnetic moment of each atom is 1.8×10^{-23} Am^2. Calculate the paramagnetic susceptibility at 300 K. (2)

5. (a) Explain the three types of polarizabilities. (5)

(b) Derive an expression for electronic polarizability in a time varying field. (10)

6. (a) Give a detailed account of Kronig-Penny Model. How did it lead to formation of energy bands in solids? (10)

P.T.O.

(b) Discuss three types of E-K zone-schemes and representing them diagrammatically. (5)

7. (a) What is Superconductivity? Give 4 applications of superconductors. (6)

(b) With the help of diagram discuss Type I and Type II superconductor. (5)

(c) What is the effect of magnetic field on critical temperature of a superconductor? (4)

Values of constants

$h = 6.6 \times 10^{-34}$ J-s

$k = 1.38 \times 10^{-23}$ J/K

(2000)