Internal Assessment

Bsc (H) Physics-VI SEM

Solid-State Physics 2023-24

UPC: 32221502

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Date: 06.11.23

Instructions:

1. Attempt **3** questions in all.
2. Question Number **1** is compulsory.

Q.1 Attempt any four of the following: (2.5x4=10)

(a) The Debye temperature for diamond is 2230K. Calculate the highest possible vibration frequency.

(b) Calculate the electronic polarizability of Neon. The radius of neon atom is 0.158 nm.

(c) What is the most important feature of dispersion curve that distinguishes diatomic lattice from a monoatomic lattice.

(d) Calculate the Hall coefficient of Na based on free electron model. Na has b.c.c structure and side of the cube is 4.28 Å.

(e) What is reciprocal lattice. Explain the properties and importance of reciprocal lattice.

(f) What do you understand by direct and indirect band gap semiconductors. Give an example of each.

(g) Differentiate between normal and anomalous dispersion.

Q2. (a) How does the Einstein assumptions lead to an improvement in the specific heat of a solid over the classical theory? Explain its demerits.

(b) What is geometrical structure factor. Calculate it for FCC/BCC structure in which all atoms are identical. (9,6)

Q3. (a) Explain with the help of diagrams how the concept of effective mass is inherent to band theory. If energy of an electron in a crystal is given by E = 7 h2k2/m. Calculate its effective mass.

(b) Distinguish between conductors, semiconductors and insulators on the basis of E-K curve. (9,6)

Q4. (a) Sketch the dependence of polarization in dielectrics on the frequency of the applied electric field clearly indicating frequency ranges for the electronic, ionic and dipolar polarization.

(b) Discuss Ewald Construction and Deduce Bragg's law in vector form. (8,7)

Neeti