ST. JOSEPH'S COLLEGE (AUTONOMOUS), BANGALORE-27
M.Sc-III SEMESTER
MID SEMESTER EXAMINATION- AUGUST 2016.
PH 9215: SOLID STATE PHYSICS

Time: 1½ hours   **Max Marks:35**

This paper contains 2 parts and 1 printed page

PART A

Answer any TWO of the following   **[10x2=20]**

1. Explain the concept of reciprocal lattice and show that the reciprocal lattice of BCC is a FCC structure.

2. Derive the dispersion relation for elastic waves in a linear monoatomic chain and using the result show that density of modes $D(\omega) = \dfrac{2N}{\pi} \dfrac{1}{\left(\omega_m^2 - \omega^2\right)^{(1/2)}}$

3. Explain Einstein's theory of specific heat and derive the expression for specific heat at low and high temperatures.

PART B

Answer any THREE of the following   **[5x3=15]**

4. The potential energy of a diatomic molecule in terms of interatomic distance R is given as $U(R) = \dfrac{-a}{R} + \dfrac{b}{R^9}$. Determine a and b assuming equilibrium seperation to be $2.8A^0$ and the dissociation energy 8×10^{-19} J.

5. The diamond structure has cube edge of $356A^0$. Calculate the distance between the nearest neighbhour and the number of atoms per cm^3.

6. Show that the number of Frenkel defects in a crystal $n \approx \left(NN'\right)^{(1/2)} e^{(-E_i/2k_BT)}$ where E_i is the energu required to remove the atom from a lattice site, N: number of lattice points, N' number of interstitial points.

7. The Debye temperature for diamond is 2230K. Calculate the highest possible vibrational frequency and molar heat capacity of diamond at 10K.