(2) Attempt any **four** questions from question Nos. **2** to **7**.

(3) Assume any **suitable** data wherever **required**.

(4) **Figures** to **right** indicates **full** marks.

(5) Illustrate your answer with **sketches** wherever **necessary**.

1. Attempt any **five** :–

   (a) Find the Miller Indices for a plane with the following set of intercepts (a/2, b, ∞). Draw the plane for the same.   3

   (b) What is mobility and conductivity of charge carriers ? Which has the greater mobility, electron or hole and why ?   3

   (c) Calculate the change in intensity level when the intensity of sound increases 1000 times its original intensity.   3

   (d) Explain the significance of critical temperature in a superconductor.   3

   (e) Find the echo time of ultrasonic pulse which is traveling with the velocity 5.9×10^3 m/sec in mild steel. The correct thickness measured by gauge meter is 18 mm.   3

   (f) Explain how the phase difference between two frequencies is measured, Using C.R.O.   3

   (g) Calculate the distance between two atoms of a basis of the diamond structure, if the lattice constant of structure is $5\overset{\circ}{A}$.   3

   (h) Explain the different phases of Liquid Crystals.   3

2. (a) What is magnetostriction effect ? Draw the diagram of magnetostriction Oscillator. Explain its working.   8

   (b) What is the importance of Hall Effect in a semiconductor ? In a Hall effect experimental set up, a sample of n type Ge has an donor density of 10^2 $1/m^3$. Find the Hall voltage developed if the magnetic field used is 0.5T. Given J is 500 A/m^2 and the thickness of sample is 5 mm.   7

3. (a) Describe the hcp structure. What is its coordination number, atomic radius and number of atoms owned by the unit cell ? Also find its packing factor.   8

   (b) Find the natural frequency of vibration of a Quartz plate of thickness 1.8 mm. Given Young's modulus for quartz is 8×10^{10} N/m^2. Density of quartz is 2650 kg/m^3. Calculate the change in the thickness required if the same plate is used to produce ultrasonic waves of frequency 2MHz.   7

4. (a) What are Type I and Type II superconductors ? Which type of superconductor does not follow the meissner effect strictly ?   8

   (b) An X-Ray beam of wavelength 0.71Å is diffracted by a Fcc crystal of density 1.99×10^3 kg/m^3. Calculate the interplanar spacing for (2 0 0) planes and the glancing angle for the second order reflection from these planes. Given mol. wt of the crystal is 74.6 and Avagadros no. is 6.023×10^{26}/kg mole.   7

5. (a) Explain in detail the conditions necessary for good acoustical design of an auditorium.   8

   (b) Ni has FCC structure. Its lattice constant is $3.52\overset{\circ}{A}$, atomic wt. of Ni is 58.71. Given Avagadros no. is 6.023×10^{26}/kg mole. Calculate its radius, A P F and density.   7

6. (a) Explain the basic principles of electrostatic and magnetostatic focusing.   8

   (b) The resistivity of Cu is 1.72×10^{-8} ohm m. Calculate the mobility of electrons in Cu. Given that the number of electrons per unit volume is $10.41 \times 10^{28}/m^3$.   7

7. (a) Show that for an intrinsic semiconductor, the Fermi level lies half way between conduction and valence band. With the help of energy band diagram, show the Fermi level positions for n and p type semiconductors at 0K and TK.   8

   (b) State Sabine's Formula explaining the terms involved in it. A hall of length 20m, breadth 15m and ht 10m has a reverberation time of 2 secs. Calculate the average coefficient of absorption.   7