

- (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**.

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1. Attempt any **five** :-
 - (a) Find the Miller Indices for a plane with the following set of intercepts $(a/2, b, \infty)$. 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 $5.9 \times 10^3 \text{ m/sec}$ 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 \AA . **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 $10^{21} / \text{m}^3$. Find the Hall voltage developed if the magnetic field used is 0.6 T. 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 $8 \times 10^{10} \text{ N/m}^2$. 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 0.71 \AA is diffracted by a Fcc crystal of density $1.99 \times 10^3 \text{ kg/m}^3$. 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 $6.023 \times 10^{26} / \text{kg mole}$. **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 \AA , atomic wt. of Ni is 58.71. Given Avagadros no. is $6.023 \times 10^{26} / \text{kg mole}$. 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 $1.72 \times 10^{-8} \text{ ohm m}$. Calculate the mobility of electrons in Cu. Given that the number of electrons per unit volume is $10.41 \times 10^{28} / \text{m}^3$. **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**