

Time: 2 Hours

Marks: 60

- N:B**
1. Question No.1 is compulsory.
 2. Attempt any **Three** questions from the remaining questions Nos.2 to 6.
 3. Assume suitable data wherever required.
 4. Figures to the right indicate marks.
- Q.1** Attempt **Any Five**
- a) Define the following terms 1) Space lattice 2) Unit cell 3) lattice point **03**
 - b) Distinguish between insulators, conductors and semi-conductors in terms of their energy bands. **03**
 - c) What are liquid crystals? List the various types of liquid crystals. **03**
 - d) What are polar and non-polar dielectrics? **03**
 - e) Define relative permeability and susceptibility. Write the relation between them. **03**
 - f) A classroom has dimensions $20 \times 15 \times 5 \text{ m}^3$, the reverberation time is 3.5sec. Calculate the total absorption of its surfaces and the average absorption coefficient. **03**
 - g) What are ultrasonic waves? State the direct piezoelectric effect. **03**
- Q.2**
- a) Show that Fermi level in intrinsic semiconductor lies at the centre of the forbidden band. $E_F = E_C + E_V/2$ **08**
 - b) Draw the following: (i) (2 3 1) (ii) [2 0 1] (iii) $(\bar{1} \ 2 \ \bar{1})$ Calculate the packing efficiency for Body centered cubic cell? **07**
- Q.3**
- a) Explain various stages of hysteresis and give the significance of hysteresis **08**
 - b) Deduce the Bragg's law for the diffraction of X- rays in crystals. **07**
- Q.4**
- a) For a cubic structure in a crystal, derive an expression for interplanar spacing between the planes with miller indices (hkl) **05**
 - b) What is potential barrier? How is it formed in a p-n junction? **05**
 - c) Derive Clausius –Masotti relation for non-polar dielectrics. **05**
- Q.5**
- a) Copper has F.C.C. structure and the atomic radius is 1.28 \AA . Calculate its density. (At wt = 63.54, $N_A = 6.023 \times 10^{23}$) **05**
 - b) A copper strip 2cm wide and 1mm thick is placed in a magnetic field with $B=1.5 \text{ Wb/m}^2$. If current of 200 A is set up in the strip, calculate Hall voltage that appears across the trip. Given $R_H = 6 \times 10^{-7} \text{ m}^3/\text{C}$. **05**
 - c) Explain in detail the conditions necessary for good acoustical design of an auditorium **05**
- Q.6**
- a) What are real crystals? Differentiate between Frenkel and Schottky defect **05**
 - b) Define the terms: i) mobility ii) conductivity. Find the resistivity of intrinsic germanium at 300K. Given the density of carriers as $2.5 \times 10^{19} / \text{m}^3$, $\mu_e = 0.39 \text{ m}^2/\text{V-sec}$ and $\mu_h = 0.19 \text{ m}^2 / \text{V-sec}$. **05**
 - c) Find the natural frequency of vibration of quartz plate of thickness 1.8mm. Given Young's modulus for quartz is $8 \times 10^{10} \text{ N/m}^2$, Density of quartz is 2650 kg/m^3 . **05**
