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 20x15x5 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) $(1\ \bar{2}\ \bar{1})$ 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 Braggs 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 Å. 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 Wb/m^2.If current of 200 A is set up in the strip, calculate Hall voltage that appears across the trip. Given $R_H = 6 \times 10^{-7}\ m^3/C$.	**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 $2.5 \times 10^{19}\ /m^3$, $\mu_e = 0.39\ m^2/V\text{-sec}$ and $\mu_h = 0.19 m^2\ /V\text{-sec}$.	**05**
	c)	Find the natural frequency of vibration of quartz plate of thickness 1.8mm.Given Young's modulus for quartz is $8 \times 10^{10}\ N/m^2$, Density of quartz is $2650\ kg/m^3$.	**05**

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