

- N.B. :** (1) Question No. 1 is **compulsory**.  
 (2) Attempt any **four** questions from the remaining questions.  
 (3) Assume **suitable** data and symbols if **required**.  
 (4) **Figures** on the **right** indicates **full marks**.

Qu.1 Attempt any five ;

(15)

- Calculate the lattice parameter of FCC lattice with molecular weight 60.2 and density  $6250 \text{ Kg/m}^3$ .
- What is the vortex state of a superconductor?
- The mobility of holes is  $0.025 \text{ m}^2/\text{V sec}$ . What would be the resistivity of p type Silicon if the Hall Coefficient of the sample is  $2.25 \times 10^{-4} \text{ m}^3/\text{C}$ .
- Draw the following.  
(100), (220), [101]
- Name the various ways by which the sound generated in an auditorium is absorbed.
- What will be the young's modulus of quartz plate if 5.5 mm thick quartz plate is used to produce an ultrasonic wave of frequency  $0.4999 \text{ MHz}$ ? The density of quartz is  $2.65 \times 10^3 \text{ Kg/m}^3$ .
- How will you measure the phase angle between two a.c. signals using Lissajous figures?

Qu.2 a) What type of crystal structure does NaCl have? Explain NaCl unit cell with proper diagram. Calculate the number of atoms per unit cell, atomic radius and atomic packing fraction of NaCl unit cell. (8)

b) Show that for the intrinsic semiconductor the Fermi level lies half way between conduction and valence band. Also draw the position of Fermi level for n-type semiconductor at absolute zero and at higher temperatures. (7)

Qu.3 a) What is Magnetostriction effect? Write the construction and working of Magnetostriction oscillator with proper diagram. (8)

b) A sample of a n-type Silicon has a donor density of  $10^{20} / \text{m}^3$ . It is used in the Hall effect experiment. If the sample of width 4.5 mm is kept in a magnetic field of (0.55T) with current density of  $500 \text{ A/m}^2$ . Find ---i) Hall voltage developed in it, ii) Hall coefficient, iii) Hall angle if mobility of electron is  $0.17 \text{ m}^2/\text{V sec}$ . (7)

- Qu.4 a) Calculate the wavelength of X rays reflected the face of FCC crystal with lattice constant of 2.82 nm and if the second order Bragg reflection occurs at a glancing angle of 17.167 deg. (8)
- b) What do you understand by the terms critical temperature and critical magnetic field? How does the critical magnetic field vary with the temperature? "A super conductor is perfectly diamagnetic" Explain. (7)
- Qu.5 a) A hall of dimension  $20 \times 15 \times 10 \text{ m}^3$  has average absorption coefficient 0.1. Find the reverberation time. If a curtain cloth of  $100 \text{ m}^2$  is suspended at the centre of the hall with coefficient of absorption 0.66. What will be the change in reverberation time. (8)
- b) Draw block diagram of CRO. Describe its various parts along with their functions. (7)
- Qu. 6a) What are the types of X rays? Discuss the origin of each type. (5)
- b) Differentiate between type-I and type-II Superconductors. (5)
- c) With the energy band diagram of an unbiased p-n junction, explain the terms: barrier potential and depletion region. (5)
- Qu. 7 a) What is the cavitation effect? Discuss its applications (5)
- b) Silicon has the same crystal structure as of Diamond. Its density is  $2.33 \times 10^3 \text{ Kg m}^{-3}$  and atomic weight is 28.9. Calculate lattice constant and atomic radius of it. (5)
- c) Explain in brief the conditions necessary for good acoustical design of an auditorium. (5)