Con. 5957-11.

MP–2446

(2 Hours)

[**Total Marks : 75**

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** to the **right** indicate the **full** marks.

Q.1   Answer any five questions:

    a)   Draw the following planes (121), (100), (111)   (3)

    b)   State any three applications of superconductivity   (3)

    c)   How Lissajous figures are used to determine phase difference?   (3)

    d)   What are ultrasonic waves? State magnetostriction effect.   (3)

    e)   State Sabine's formula.   (3)

    f)   Calculate atomic packing factor for FCC crystal structure?   (3)

    g)   Show the position of Fermi level in intrinsic semiconductor, p-type   (3)
semiconductor and n-type semiconductor.

Q.2   a)   Explain Diamond crystal structure with proper diagram. Calculate the   (8)
number of atoms per unit cell, atomic radius and atomic packing factor
for diamond unit cell.

    b)   What is cavitation effect? Find the natural frequency of vibration of   (7)
quartz plate of thickness 2 mm. Given: Young's modulus for quartz is 8×10^{10} N/m^2 and density 2650 Kg/m^3. Calculate the change in thickness
required if the same plate is to be used to produce ultrasonic waves of 3
MHz.

Q.3   a)   Explain reverberation and reverberation time. Explain various methods   (8)
for design of good acoustics.

    b)   What are lattice parameters? Aluminium has density 2.7 gm/cm^3. It has   (7)
atomic weight 27 and lattice parameter is 4.05 A^0. Determine the type of
crystal structure followed by Aluminium and calculate the atomic radius.
Given Avogadro's number $N_A = 6.023 \times 10^{23}$ /gm mole.

Q.4   a)   What is superconductivity and critical temperature? Describe type I and   (8)
type II superconductor.

    b)   Define mobility of charge carrier. Find resistivity of germanium at 300   (7)
^{0}K. Given density of carriers is 2.5×10^{19} /m^2. Mobility of electron is 0.39
m^2/V-Sec and mobility of hole is 0.19 m^2/V-Sec. Charge of electron is 1.6
$\times 10^{19}$ C.

[**TURN OVER**

Q.5 a) State Hall effect and what is the significance of hall effect?
n-type Ge sample has donor concentration 10^{21} atoms $/m^3$. What hall voltage would you expect if current $1 \times 10^{-3}A$ and if 0.5 T magnetic field is applied across 2 mm thick sample.

b) What is piezoelectric effect? Explain with neat labeled diagram the construction and working of Piezoelectric oscillator.

Q.6 a) State and explain terms in Bragg's law of X-ray diffraction. Calculate the glancing angle on cube (100) of rock salt having lattice constant 2.814 A^0 corresponding to first order diffraction maximum for X- rays of wavelength 1.541 A^0.

b) Explain construction and working of CRO.

Q.7   Solve/explain any three :

a) A class room has dimension $20 \times 15 \times 10$ m^3, the reverberation time is 3 sec. Calculate total absorption of its surfaces and average absorption coefficient.

b) Liquid crystal and different phases of liquid crystal

c) Point defects in crystal

d) Meissner effect