

Con. 3129-08.

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(REVISED COURSE)

(2 Hours)

[Total Marks : 75]

N.B. (1) Question No. 1 is compulsory.

(2) Attempt any **four** questions from Question Nos. 2 to 7.(3) Assume any **suitable** data wherever **required**.(4) **Figures** to the **right** indicate **full** marks.(5) Illustrate your answer with sketches wherever **necessary**.

1. (a) Explain various axes of quartz crystal. 3
- (b) Define reverberation time. Write Sabine's Formula and explain the terms used in it. 3
- (c) Explain Schottky defect and Frenkel defect in ionic crystal. 3
- (d) Find the resistivity of intrinsic Ge at 300°K. Given the density of carriers as $2.5 \times 10^{-19} \text{ m}^{-3}$. 3
(Given $\mu_e = 0.39 \text{ m}^2/\text{volt-sec}$
 $\mu_h = 0.19 \text{ m}^2/\text{volt-sec}$.)
- (e) Define superconductivity, critical temperature and critical magnetic field H_c . 3
2. (a) Describe NaCl structure and calculate the number of molecules per unit cell and packing factor assuming radius of Na^+ is 0.98 \AA and radius of Cl^- is 1.81 \AA . 8
- (b) What is SONAR? Find the depth of sea water from a ship on the sea surface if the time interval of two seconds is required to receive the signal back. 7
Given that temperature of sea water is 20°C and salinity is 10 gm/lit .
3. (a) What is Hall effect? Derive the expression for Hall coefficient (R_H) and Hall voltage (V_H) with proper diagram. 8
- (b) The volume of room is 600 m^3 . The wall area of the room is 220 m^2 , the floor area is 120 m^2 and the ceiling area is 120 m^2 . The average sound absorption coefficient— 7
(i) For the wall is 0.03
(ii) For the ceiling is 0.8
(iii) The floor it is 0.06.
Calculate the average sound absorption coefficient and the reverberation time.
4. (a) What is Meissner effect? Explain the concept of MAGLEV trains. 8
- (b) An X-ray machine has an accelerating potential of 25000 V . Find the shortest wavelength in the X-ray spectrum. Also evaluate its frequency as well as the energy of the photon. 7
(Given Planck's constant $h = 6.63 \times 10^{-34} \text{ J}\cdot\text{sec}$.)
5. (a) Explain the basic principle of magnetostatic focussing. An electron travels with a velocity of $2.5 \times 10^6 \text{ m/s}$ in vacuum in a uniform magnetic field strength of $0.94 \times 10^{-4} \text{ wb/m}^2$, such that velocity vector makes an angle of 30° with the field direction. Determine the distance covered along the magnetic induction lines in five such revolution. 8
- (b) What are continuous X-rays? The interplanar spacing of (110) plane is 2 \AA for a FCC crystal. Find the atomic radius. 7
6. (a) Explain functions of various important parts of a CRT with diagram. 8
- (b) Derive packing factor for FCC: Cu has FCC structure and atomic radius 1.28 \AA . Calculate its density if its atomic weight is 63.5. 7
(Given Avogadro's number = 6.023×10^{23} in CGS).
7. (a) How does the Fermi level change with increasing temperature in the extrinsic semiconductors (n-type and p-type)? Sketch the diagram. 8
- (b) Find the thickness of quartz plate needed to produce ultrasonic waves of frequency 7
(i) 3.8 MHz (ii) 300 KHz
(Density of quartz = 2650 kg/m^3 Young's modulus = $8 \times 10^{10} \text{ N/m}^2$).