

Con. 3129-08.

(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**.
- Explain various axes of quartz crystal. **3**
 - Define reverberation time. Write Sabine's Formula and explain the terms used in it. **3**
 - Explain Schottky defect and Frenkel defect in ionic crystal. **3**
 - 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 $\mu_e = 0.39 \text{ m}^2/\text{volt-sec}$
 $\mu_h = 0.19 \text{ m}^2/\text{volt-sec}$)
 - Define superconductivity, critical temperature and critical magnetic field H_c . **3**
 - 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**
 - 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 .
 - What is Hall effect? Derive the expression for Hall coefficient (R_H) and Hall voltage (V_H) with proper diagram. **8**
 - 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—
 (i) For the wall is 0.03
 (ii) For the ceiling is 0.8
 (iii) The floor it is 0.06. **7**
 Calculate the average sound absorption coefficient and the reverberation time.
 - What is Meissner effect? Explain the concept of MAGLEV trains. **8**
 - 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. (Given Planck's constant $= 6.63 \times 10^{-34} \text{ J}\cdot\text{sec}$) **7**
 - 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**
 - What are continuous X-rays? The interplanar spacing of (110) plane is 2 \AA for a FCC crystal. Find the atomic radius. **7**
 - Explain functions of various important parts of a CRT with diagram. **8**
 - 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 $= 6.023 \times 10^{23}$ in CGS).
 - How does the Fermi level change with increasing temperature in the extrinsic semiconductors (n-type and p-type)? Sketch the diagram. **8**
 - Find the thickness of quartz plate needed to produce ultrasonic waves of frequency **7**
 (i) 3.8 MHz (ii) 300 KHz
 (Density of quartz $= 2650 \text{ kg/m}^3$ Young's modulus $= 8 \times 10^{10} \text{ N/m}^2$).