

# Applied Physics - I

Con. 3129-08.

(REVISED COURSE)  
(2 Hours)

CO-5155

MASTER

[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.

*F.E. Sem I All Br. (Rev) Applied Physics I 24/5/08*

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  $\text{Na}^+$  is  $0.98 \text{ \AA}$  and radius of  $\text{Cl}^-$  is  $1.81 \text{ \AA}$ . 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  $20^\circ\text{C}$  and salinity is  $10 \text{ gm/lit}$ .
  
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  $600 \text{ m}^3$ . The wall area of the room is  $220 \text{ m}^2$ , the floor area is  $120 \text{ m}^2$  and the ceiling area is  $120 \text{ m}^2$ . 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 Plank's constant  $h = 6.63 \times 10^{-34} \text{ J.sec}$ .)
  
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  $30^\circ$  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  $2 \text{ \AA}$  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  $1.28 \text{ \AA}$ . Calculate its density if its atomic weight is 63.5. 7  
     (Given Avogadro's number =  $6.023 \times 10^{23}$  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 =  $2650 \text{ kg/m}^3$  Young's modulus =  $8 \times 10^{10} \text{ N/m}^2$ ).