

F.E. (REV) (CBGS) Sem I.

3/6/15

## Applied Physics-I

Q.P. Code : 1027

**(REVISED COURSE)**

(2 Hours)

[ Total Marks : 60

- N.B. : (1) Question No. 1 is compulsory.  
 (2) Attempt any three questions from question no. 2 to 6.  
 (3) Use suitable data wherever required.  
 (4) Figures to the right indicate full marks.

1. Attempt any five from the following : 15
- Draw the following in a cubic unit cell  
 $(0\ 1\ 2)$ ,  $(\bar{1}\ \bar{2}\ 3)$ ,  $[1\ 2\ 1]$
  - Define the term space lattice, unit cell and lattice parameter.
  - Determine the lattice constant for FCC lead crystal of radius  $1.746\ \text{\AA}$  and also find the spacing of  $(2\ 2\ 0)$  plane.
  - Define : drift current, diffusion current and mobility of charge carriers.
  - What is the probability of an electron being thermally promoted to conduction band in diamond at  $27^\circ\text{C}$ , if bandgap is  $5.6\ \text{eV}$  wide.
  - Why soft magnetic materials are used in core of transformers ?
  - Calculate the electronic polarizability of Ar. Given number of Ar atoms at NTP =  $2.7 \times 10^{25}/\text{m}^3$  and dielectric constant of Ar = 1.0024.
2. (a) Show that for intrinsic semiconductors the Fermi level lies midway between the conduction band and the valence band. Draw the energy level diagram as a function of temperature for n-type of semi-conductor. 8
- (b) Cu has FCC structure. If the interplanar spacing  $d$  is  $2.08\ \text{\AA}$  for the set of  $(111)$  planes. Find the density and diameter of Cu atom. Given atomic weight of Cu is 63.54. 7
3. (a) What is hysteresis ? Draw a hysteresis loop for ferromagnetic material and explain the various important points on it. For a transformer which kind of material will you prefer-the one with small hysteresis area or the big one ? 8
- (b) Derive Bragg's law. X-rays of unknown wavelength give first order Bragg's reflection at glancing angle of  $20^\circ$  with  $(2\ 1\ 2)$  planes of copper having FCC structure. Find the wavelength of X-rays, if the lattice constant for copper is  $3.615\ \text{\AA}$ . 7
4. (a) Discuss Diamond structure with neat diagram and also determine the effective number of atoms/unit cell, co-ordination number and atomic radius in terms of lattice constant. 5
- (b) Classify solids on the basis of energy band diagram. 5
- (c) Explain orientational polarization with suitable diagram and write the mathematical expression of orientational polarizability. 5

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5. (a) Calculate the number of atoms per unit cell of a metal having the lattice parameter  $2.9 \text{ \AA}$  and density  $7.87 \text{ gm/cm}^3$ . Atomic weight of metal is 55.85. Avogadro number is  $6.023 \times 10^{23}/\text{gm mole}$ . 5
- (b) What is Hall effect? Mention its significance. How mobility can be determined by using Hall effect? 5
- (c) The reverberation time is found to be 1.5 second for an empty Hall and it is found to be 1.0 second when a curtain cloth of  $20\text{m}^2$  is suspended at the centre of the Hall. If the dimensions of the hall are  $10 \times 8 \times 6\text{m}^3$ , calculate the coefficient of absorption of curtain cloth. 5
6. (a) Describe principle, construction and working of magnetostriction oscillator to produce ultrasonic waves. 5
- (b) Explain various point defects in crystals. 5
- (c) Explain how a voltage difference is generated in a p-n junction when it is used in a photovoltaic solar cell. 5
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