FE | Sem-I (Rev) A.P. I 19/12/12

AGJ-2nd half (I)-12-15

Con. 9049–12. **(REVISED COURSE)** **KR-3447**

(2 Hours) **[Total Marks : 60**

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

(2) Attempt any **three** questions from remaining questions No. **2** to **6**.

(3) Assume **suitable** data wherever **required**.

(4) **Figures** to the **right** indicate marks.

1. Attempt any **five** :– **15**
   (a) Explain the term lattice parameters of Cubic crystal.
   (b) What is the probability of an electron being thermally excited to conduction band in silicon at 20°C. The band gap energy is 1·12eV; Boltzmann constant is $1{\cdot}38 \times 10^{-23}$ J/k.
   (c) Mobility of holes is 0·025 m^2/V-sec. What would be the resistivity of P-type silicon if the Hall coefficient of the sample is $2{\cdot}25 \times 10^{-5}$ m^3/C ?
   (d) Define dielectrics, electric dipole and polarizability.
   (e) Differentiate between soft and hard magnetic materials.
   (f) Define 'Reverberation time'. Write sabine's formula and explain the terms in it.
   (g) State the terms : magnetostriction effect; piezo-electric effect.

2. (a) Explain the formation of energy bands in solids. With neat energy band diagrams explain extrinsic semiconductors. **8**
   (b) Draw the unit cell of HCP. What is its co-ordination number, atomic radius, and effective number of atoms per unit cell. Also calculate its packing factor. **7**

3. (a) What is hysteresis ? Draw a hysteris loop for ferromagnetic material and explain the various important points on it. What is the technical significance of the area enclosed under 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. Calculate the glancing angle on the plane (100) for a crystal of rock salt (a = 2·125 A°). Consider the case of 2^{nd} order maximum and λ = 0·592A°. **7**

4. (a) Calculate the number of atoms per unit cell of a metal having lattice parameter 2·9A° and density 7·87 gm/cm^3. Atomic weight of metal is 55·85, Avagadro number is $6{\cdot}023 \times 10^{23}$/gm-mole. **5**
   (b) Prove that the Fermi level lies exactly at the centre of the forbidden energy gap in case of an intrinsic semiconductor. **5**
   (c) Explain ionic polarization and obtain polarizability (α_i). **5**

[TURN OVER

5. (a) With neat diagram of a unit cell, explain the structure of $BaTiO_3$. 5
   (b) What is Hall effect ? Derive expression for Hall voltage. 5
   (c) Explain the absorption coefficient of a hall. Calculate the change in intensity level when the intensity of sound increases 1000 times its original intensity. 5

6. (a) In what sense real crystals differ from ideal crystals ? Explain the point defects in crystals. 5
   (b) Explain construction and working of a solar cell. 5
   (c) Find the natural frequency of vibration of quartz plate of thickness 2mm. Given Young's modulus of quartz $Y = 8 \times 10^{10}$ N/m^2, density of quartz is 2650 kg/m^3. Caculate the change in thickness required if the same plate is used to produce ultrasonic waves of frequency 3MHz. 5