

FE | Sem - J (REV) A. P. I

10/12/12

AGU-2nd half (I) 12-12

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 :-

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- Explain the term lattice parameters of Cubic crystal.
- 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 1.38×10^{-23} J/k.
- Mobility of holes is 0.025 m²/V-sec. What would be the resistivity of P-type silicon if the Hall coefficient of the sample is 2.25×10^{-5} m³/C ?
- Define dielectrics, electric dipole and polarizability.
- Differentiate between soft and hard magnetic materials.
- Define 'Reverberation time'. Write Sabine's formula and explain the terms in it.
- 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 hysteresis 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 ($a = 2.125 \text{ \AA}$). Consider the case of 2nd order maximum and $\lambda = 0.592 \text{ \AA}$. 74. (a) Calculate the number of atoms per unit cell of a metal having lattice parameter 2.9 \AA and density 7.87 gm/cm^3 . Atomic weight of metal is 55.85, Avagadro number is 6.023×10^{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). 5

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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 $Y = 8 \times 10^{10} \text{ N/m}^2$, density of quartz is 2650 kg/m^3 . Calculate the change in thickness required if the same plate is used to produce ultrasonic waves of frequency 3MHz. 5