

(Following Paper ID and Roll No. to be filled in your Answer Book)

PAPER ID : 2053

Roll No.

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B.Tech.

(SEM IV) EVEN SEMESTER THEORY EXAMINATION,
2009-2010

**ELECTRICAL AND ELECTRONICS
ENGINEERING MATERIALS**

Time : 3 Hours

Total Marks : 100

Note : (i) Answer *all* the questions.

(ii) All the questions carry *equal* marks.

1. Answer **any four** parts of the following : (4x5=20)

(a) What do you mean by bonding in solids ?
Why are some solids strongly bonded than
the others ?

(b) Explain briefly the following :

(i) Space lattice.

(ii) Body centred cubic structure.

(iii) Face centred cubic structure.

(c) What is Atomic Packing Factor ? Calculate
its value for

(i) Body centred cube

(ii) Face centred cube

- (d) Obtain the Miller indices of a plane whose intercepts are $2a/3$, $2b/5$ and $c/3$ on x, y and z axes respectively in a simple cubic unit cell.
- (e) Derive Bragg's equation. Explain the meaning of first order, second order and third order reflections.
- (f) What is meant by crystal growth? Explain mechanism of crystal growth. Discuss effect of cooling.
2. Answer **any four** parts of the following : (4x5=20)
- (a) Define thermal conductivity and derive an expression for thermal conductivity.
- (b) Classify materials on the basis of energy band theory.
- (c) Discuss the factors which affect electrical resistivity of materials.
- (d) Explain Superconductivity. Describe briefly the properties of Superconducting materials.
- (e) Using electron theory of metals, derive ohms Law in the form $\sigma = \frac{ne^2\tau}{m}$ where the symbols have their usual meanings.
- (f) Explain thermoelectric effect. Mention its applications.
3. Answer **any two** parts of the following : (2x10=20)
- (a) Explain phenomenon of polarization in dielectric materials. Discuss electronic polarization, Ionic polarization and orientation polarization.

- (b) Prove that the internal field due to polarization inside the dielectric is given by

$$E_i = E + \frac{P}{3\epsilon_0}$$

- (c) (i) Explain spontaneous polarization and give its salient features.
(ii) Explain Piezoelectricity.

4. Answer any four parts of the following : (4x5=20)

- (a) Differentiate between Intrinsic and Extrinsic semiconductors.
- (b) Differentiate between n-type and p-type semiconductors and how are they produced ?
- (c) What is Hall Effect ? Derive relation between Hall coefficient and carrier density.
- (d) Explain voltage - current characteristics of a P-N diode under forward and reverse biasing. What type of breakdown occurs under reverse bias and why ?
- (e) Mobilities of electrons and holes in a sample of intrinsic Germanium at room temperature are $3600 \text{ cm}^2/\text{v-s}$ and $1700 \text{ cm}^2/\text{v-s}$ respectively. If the electron and hole densities are each equal to $2.2 \times 10^{13}/\text{cm}^3$, calculate the conductivity.
- (f) Explain drift and diffusion currents and give an expression for total current of semiconductor.

5. Answer any two parts of the following : (2x10=20)

- (a) (i) How do you classify the materials as dia, para or ferromagnetic ?
- (ii) Explain the phenomenon of magnetostriction and give its salient features.
- (b) (i) Compare properties of low resistivity and high resistivity materials.
- (ii) Explain briefly the following mechanical properties of metals. Elasticity, Plasticity, Ductility and Malleability.
- (c) Explain difference between hard and soft magnetic materials. How do their B-H curve differ ? Mention three permanent magnetic materials giving their applications.

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