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B. TECH.

FOURTH SEMESTER EXAMINATION, 2002-2003

ELECTRICAL ENGINEERING MATERIAL

Time : 2 Hours   Total Marks : 50

Note : Answer **ALL** the questions.

1.   Attempt any FOUR of the following :—   (3×4=12)

   (a)   Explain the terms :

      (i)   space lattice

      (ii) effective number of lattice points

      (iii) crystal structure

   (b)   (i)   Name and draw seven basic crystal systems.

      (ii) Calculate the number of atoms possessed by a unit cell for three types of cubic crystals.

   (c)   (i)   Give the steps for determining the Miller Indices of a crystal plane.

      (ii) Find the Miller Indices of a plane that makes intercept 1 on a-axis, 2 on b-axis and is parallel to c-axis.

   (d)   A BCC crystal is used to determine the wave-length of X-rays. The Bragg angle for reflection from (110) plane is 20·2°. What is the wavelength ? The lattice parameter of the crystal is 3·15 Å.

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(e) What is Ionic Bonding ? Take the example of NaCl and write down the steps of formation of ionic bond between Na and Cl.

(f) Explain edge and screw dislocations in crystals.

2. Attempt any FOUR of the following :— (3×4=12)

(a) Discuss the motion of electrons in electric field and derive expressions for mobility and conductivity.

(b) State the law of emission of electrons from heated metals. How would you determine the emission equation constants ?

(c) Explain the terms : Thomson effect, Seebeck Effect and Peltier Effect.

(d) Apply the principles of Thermodynamics to a thermoelectric circuit and derive expression for Peltier coefficient.

(e) The resistivity of Ga-Sb at 300°K is found to be 2×10^{-3} ohm m. The electron and hole mobilities are $0 \cdot 3$ and $0 \cdot 1$ m²/volt-sec. respectively. Calculate the carrier density. Given $e = 1 \cdot 6 \times 10^{-19}$ Coulomb.

(f) Differentiate between intrinsic and extrinsic semiconductors.

3. Attempt any TWO of the following :— (6·5×2=13)

(a) Show that the internal field due to polarization inside the dielectric is given by

$$E' = \frac{\rho}{3\in_0}.$$

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(b) Define polarizability. Show that the polarizability of an atom of

$$4\pi \in_0 a^3.$$

(c) (i) Discuss different kinds of breakdown in solid dielectric. (3½)

(ii) Explain the terms, dielectric loss and loss angle by a phasor diagram. (3)

4. Attempt any TWO of the following :— (6·5×2=13)

(a) Distinguish between soft and hard magnetic materials. Give few examples of each type. Draw and explain typical B-H curve for soft magnetic material.

(b) What are Ferrites ? Give the general formula for single ferrite and mixed ferrite. What are their advantages over other magnetic materials ?

(c) Explain Superconductivity. What is the effect of magnetic field on it ? Give few applications of superconductivity.

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