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No. of Printed Pages—3

EE-403

B. TECH.
FOURTH SEMESTER EXAMINATION, 2002-2003
ELECTRICAL ENGINEERING MATERIAL

LIBRARY
Govt. Sector Goal Institute of Technology
GHAZIABAD

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 \AA .

- (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 0.3 and 0.1 m²/volt-sec. respectively. Calculate the carrier density. Given $e = 1.6 \times 10^{-19}$ Coulomb.
- (f) Differentiate between intrinsic and extrinsic semiconductors.
3. Attempt any TWO of the following :— (6×2=13)
- (a) Show that the internal field due to polarization inside the dielectric is given by

$$E' = \frac{\rho}{3\epsilon_0}.$$

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

$$4\pi\epsilon_0 a^3.$$

(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.