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BIEE-013

B.Tech. – VIEP – ELECTRICAL ENGINEERING (BTELVI)

Term-End Examination

00418

December, 2015

BIEE-013 : ELECTRICAL AND ELECTRONICS ENGINEERING MATERIALS

Time : 3 hours *Maximum Marks : 70*

Note :

(i) *Attempt any **seven** questions.*

(ii) *All questions carry equal marks.*

(iii) *Symbols used have their usual meanings.*

(iv) *Use of scientific calculator is allowed.*

1. (a) What are Miller indices ? Name at least six features of Miller indices. *5*

(b) Find the Miller indices of a plane that makes intercepts 1 on x-axis, 2 on y-axis and is parallel to z-axis. Also sketch the plane in a simple cubic cell. *5*

2. (a) Explain Bragg's law of X-ray diffraction. Show that the condition for reflection is given by $2d \sin \theta = n\lambda$. 5

(b) The Bragg's angle for first order deflection from (111) plane in a crystal is 30°, when the wavelength of X-ray is 1·75 Å. Calculate the lattice parameter 'a' . Given (hkl) = (111). 5

3. Give a brief account of the band theory of solids. Explain the classification of solids into conductors, semiconductors and insulators on the basis of band theory. 10

4. (a) Define the terms : mean free path (λ), mobility (μ) and collision time (τ). 5

(b) On the basis of electron theory, show that the expression of conductivity is given by

$$\sigma = \frac{ne^2\tau}{m}.$$ 5

5. (a) Explain the Hall effect in semiconductor material. 5

(b) Discuss the Type I and Type II super conductors with relevant diagrams. 5

6. (a) As the concentration of electrons in a semi-conductor is changed by changing the impurity level, the conductivity also changes. Show that it passes through a minimum, when $n_e = n_i \sqrt{\frac{\mu_h}{\mu_e}}$ and find the minimum value. n_1 is the intrinsic concentration. 5

(b) The resistivity of pure germanium at room temperature is 0·47 Ω-m. Find the carrier density of Germanium at the room temperature for the electron mobility (μ_e) of 0·42m^2/volt-sec and hole mobility (μ_h) of 0·20m^2/volt-sec. *5*

7. What are drift current and diffusion current ? Find the expression for each of them. Also derive the expression of the continuity equation. *10*

8. (a) Explain the origins of permanent magnet dipoles in matters. *5*

(b) The saturation induction of Nickel is 0·65 Tesla. If the density of Nickel is 8906 kg/m^3 and the atomic weight is 58·7, calculate the magnetic moment of Nickel atom. Avogadro number is 6·23 × 10^{26}/mole. *5*

9. (a) Distinguish between ferromagnetism and antiferromagnetism. *5*

(b) Explain domain theory for ferromagnetic materials. *5*

10. Write short notes on any ***two*** of the following : *2×5=10*

(a) Crystal growth

(b) Low resistivity materials versus High resistivity materials

(c) IGFET

(d) Permanent magnet materials