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B TECH
(SEM-VIII) EVEN SEM.THEORY EXAMINATION, 2017-18
ELECTRICAL AND ELECTRONICS ENGINEERING MATERIAL

*Time: 3 Hours**Max. Marks: 100***Note:** Attempt all sections. Assume missing data suitably, if any.

SECTION – A

1. Attempt all parts of the following: (10*2=20)

- (a) Distinguish between primitive cell and unit cell.
- (b) Define Miller indices of a plane.
- (c) Explain the terms space lattice and coordination number.
- (d) Show that for simple cubic system is $d_{100}:d_{110}:d_{111}::\sqrt{6}:\sqrt{3}:\sqrt{2}$
- (e) Define the terms energy band and forbidden bands.
- (f) Explain the Seebeck effect.
- (g) The lead material works as superconductor at a temperature of $T_c=7.26\text{K}$. If the constant characteristics of the lead material at 0K is $H_0=8\times 10^5\text{A/m}$. calculate the magnetic field in the lead at 5K.
- (h) Explain the Peltier effect.
- (i) What is Magneto-striction?
- (j) Explain the term Drift and continuity equation.

SECTION – B

2. Attempt any three parts of the following: (3*10=30)

- (a) State and explain “Bragg's Law”. X-rays with wavelength of 0.58\AA are used for calculating d_{200} in nickel. The reflection angle is 9.5° . What is the size of unit cell?
- (b) Explain the Langevin's theory of Diamagnetism **or** Para-magnetism.
- (c) Explain the working principle of a MOSFET. Discuss also the types of MOSFET and their working.
- (d) Show that the conductivity of intrinsic semiconductors are given as :
 $\sigma_i = n_i e (\mu_e + \mu_h)$, The symbols having their usual meanings.
- (e) Explain in brief the zone theory of solids.

SECTION – C

Answer all questions in this section.

3. Attempt any one parts of the following: (1*10=10)

- (a) Show that the Hall coefficient is given as for semiconductor materials:

$$R_H = -\frac{1}{ne} \quad \text{and} \quad \theta_H = \tan^{-1}(\mu_e \cdot B_z) \text{ respectively.}$$

the symbols having their usual meanings.

- (b) What is Hall Effect? The resistivity of a doped silicon crystal is $9.23 \times 10^{-3} \Omega\text{-m}$ and the Hall coefficient is $3.84 \times 10^{-4} \text{m}^3 \text{c}^{-1}$. Assuming that the conduction is by a single type of a charge carrier calculate the density and mobility of the carrier.

4. Attempt any one parts of the following: (1*10=10)

- (a) Show that the resistivity of the metal is given by :

$$\rho = \frac{m}{ne^2\tau}$$

the symbols having their usual meanings.

- (b) Sketch the B-H loop of a ferromagnetic material.

5. Attempt any one parts of the following: (1*10=10)

- (a) Explain relative permeability. Show that the relative permeability as $\mu_r = 1 + x$ Where x is the magnetic susceptibility.
- (b) A diffraction pattern of a cubic crystal of lattice parameter $a=3.16\text{\AA}$ is obtained with monochromatic X-ray beam of wavelength 1.54\AA . The first line on this pattern was observed to have $\theta = 20.3^\circ$.

6. Attempt any one parts of the following: (1*10=10)

- (a) What are ferrites? Give some applications where ferromagnetic materials are used. Explain ferrimagnetisms.
- (b) Explain the concept of Hysteresis loss and eddy current loss in ferromagnetic material.

7. Attempt any one parts of the following: (1*10=10)

- (a) Explain the superconductivity with Meissner Effect. Determine the temperature coefficient of resistance of material used in a resistor if the resistance at 25°C is 50Ω and at 70°C is 57.2Ω .
- (b) Explain thermal conductivity and obtain an expression for coefficient of thermal conductivity.