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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 $T_c=7.26K$. If the constant characteristics of the lead material at $0K$ is $H_0=8 \times 10^5 A/m$. 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:

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

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.