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B. TECH.

THEORY EXAMINATION (SEM-II) 2016-17

ENGINEERING PHYSICS - II

Time : 3 Hours

Max. Marks : 70

Note : Be precise in your answer. In case of numerical problem assume data wherever not provided.

SECTION - A

1. Attempt all parts of the following question:

7 x 2 = 14

- What is unit cell?
- What is Compton Effect?
- What is polarization in dielectrics?
- Define magnetic susceptibility.
- What is displacement current?
- What is effective mass?
- What do you mean by Meissner effect?

SECTION - B

2. Attempt any three parts of the following question:

3 x 7 = 21

- Describe Bragg's X-ray spectrometer. Explain how it is used to study structure of the crystals.
- Describe Langevin's theory of dia-magnetism. Show that the magnetic susceptibility is negative and independent of temperature for diamagnetic materials.
- Write down Maxwell's equations in free space and show that E, H and direction of propagation form a set of orthogonal vectors.
- Discuss the formation of bands in solids. Differentiate semiconductors, conductors and insulators on the basis of band gap.
- What are Bucky balls? Discuss their preparation techniques, properties and applications.

SECTION - C

Attempt all of the following questions:

5 x 7 = 35

3 Attempt any two parts.

- Describe the crystal structure of sodium chloride (NaCl).
- What are Miller indices of a given plane? How are they obtained?
- The lattice constant for a cubic lattice is 'a'. Deduce the spacing between (101) and (112) planes.

4 Attempt any two parts.

- Discuss the effects of alternating electric fields on the dielectric constant.
- If a NaCl crystal is subjected to an electric field to 1000 V/m and the resulting polarization is $4.3 \times 10^{-8} \text{ C/m}^2$, calculate the relative permittivity of NaCl. $\epsilon_0 = 8.85 \times 10^{-12} \text{ F-m}^{-1}$.
- What do you mean by hysteresis? Prove that the energy dissipated per cycle per c.c. of magnetization is μ_0 times the area of B-H curve (or I-H curve).

5 Attempt any two parts.

- What is the equation of continuity? Obtain the required expression for it. Also give its physical significance.
- State and explain Poynting theorem for the flow of energy in electromagnetic waves.
- For silver, $\mu = \mu_0$ and $\sigma = 3 \times 10^7 \text{ mhos/m}$. Calculate the skin depth at 10^8 Hz frequency. Given, $\mu_0 = 4\pi \times 10^{-7} \text{ N/A}^2$.

P.T.O.

6 Attempt any two parts.

- (i) Derive an expression for the electrical conductivity of intrinsic and extrinsic semiconductors? Explain effect of temperature on the conductivity of semiconductors.
- (ii) What is Fermi-Dirac probability distribution function $F(E)$? Plot the graph $F(E)$ versus energy E at 0K and 2000K.
- (iii) Calculate the current produced in a small germanium plate of area 10^{-4} m^2 and of thickness 0.3mm, when a potential difference of 2 volt is applied across the faces. Given, concentration of free electrons in germanium as $2 \times 10^{19} \text{ m}^{-3}$ and mobilities of electrons and holes are $0.36 \text{ m}^2/(\text{V-s})$ and $0.17 \text{ m}^2/(\text{V-s})$ respectively.

7 Attempt any two parts.

- (i) Define transition temperature. Discuss the effect of external magnetic field on superconductors.
- (ii) Distinguish Type-I and Type -II superconductors. How does the magnetization vary with applied magnetic field in type I and type II superconductors?
- (iii) The transition temperature for Pb is 7.2K. However, at 5K it loses the superconducting property subjected to a magnetic field of $3.3 \times 10^4 \text{ A/m}$. Find the maximum value of magnetic field which allow the metal to retain its superconductivity at 0K.