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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:

- (a) What is unit cell?
- (b) What is Compton Effect?
- (c) What is polarization in dielectrics?
- (d) Define magnetic susceptibility.
- (e) What is displacement current?
- (f) What is effective mass?
- (g) What do you mean by Meissner effect?

SECTION – B

2. Attempt any three parts of the following question:

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

SECTION – C

Attempt all of the following questions:

3 Attempt any two parts.

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

4 Attempt any two parts.

- (i) Discuss the effects of alternating electric fields on the dielectric constant.
- (ii) If a NaCl crystal is subjected to an electric field to 1000 V/m and the resulting polarization is 4.3 x 10^{-8} C/m², calculate the relative permittivity of NaCl. ε_0 = 8.85 x 10^{-12} F-m⁻¹.
- (iii) 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.

- (i) What is the equation of continuity? Obtain the required expression for it. Also give its physical significance.
- (ii) State and explain Poynting theorem for the flow of energy in electromagnetic waves.
- (iii) For silver, $\mu = \mu_0$ and $\sigma = 3x \ 10^7$ mhos/m. Calculate the skin depth at 10^8 Hz frequency. Given, $\mu_0 = 4\pi x 10^{-7}$ N/A².

7 x 2 = 14

 $3 \ge 7 = 21$

5 x 7 = 35



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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 m²/ (V-s) and 0.17m²/(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 3.3×10^4 A/m. Find the maximum value of magnetic field which allow the metal to retain its superconductivity at 0K.

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