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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**

(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: **3 x 7 = 21**

(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: **5 x 7 = 35**

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/m^2, 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_o 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, $\mu = \mu_o$ and $\sigma = 3x\ 10^7$ mhos/m. Calculate the skin depth at 10^8 Hz frequency. Given, $\mu_o = 4\pi x10^{-7}$ 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 2×10^{19} m^{-3} and mobilities of electrons and holes are 0.36 m^2/ (V-s) and 0.17m^2/(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 x 10^4A/m. Find the maximum value of magnetic field which allow the metal to retain its superconductivity at 0K.