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JAYPEE UNIVERSITY OF INFORMATION TECHNOLOGY, WAKNAGHAT
TEST -3 EXAMINATION- 2021
B.Tech VI Semester (CSE-IT)

COURSE CODE: 18B1WPH532 MAX. MARKS: 35
COURSE NAME: Applied Materials Science
COURSE CREDITS: 03 MAX. TIME: 2 Hours

Note: All questions are compulsory. Carrying of mobile phone during examinations will be treated as case of unfair means. Scientific calculators are allowed.

(**Q1**) Calculate the induced dipole moment per unit volume for He-gas subjected to 6×10^5 V/m. The atomic polarizability of He is 0.18×10^{-40} F-m^2 and the concentration of He-atoms is 2.6×10^{25} m^{-3}. Also calculate separation of positive and negative charges in each atom. [3]

(**Q2**) What is poling? Elaborate on its application? [2]

(**Q3**) (a) Cross linked copolymers consisting of 60 wt % ethylene (C_2H_4) and 40 wt % propylene (C_3H_6) may have elastic properties similar to those for natural rubber. For this copolymer, determine the fraction of both mer types. [2]

(b) What is the difference between naturally occurring and synthetic polymers? On the basis of thermal response of polymers, discuss their various types. [3]

(**Q4**) (a) A material core has 10 turns per centimeter of a wire wound uniformly upon it which carries a current of 2 Amperes. The flux density in the material is 1 T. Calculate the magnetic field and magnetization of the material. Also calculate the relative permeability of the core. [2]

(b) Derive an expression for the larmour precession frequency for an atom subjected to external applied magnetic field. [3]

(**Q5**) (a) For an optical fibre (core diameter ***d***) having core refractive indices n_1 and surrounding medium refractive index n_o, derive an expression for the number of reflections per meter suffered by the guided ray if the acceptance angle is θ_A. [3]

(b) How much will a light pulse spread after travelling along 6-km of a step index fiber whose numerical aperture is 0.280 and n_1 is 1.48. Also, calculate the maximum bit rate that may be obtained assuming only intermodal dispersion. [2]

(c) The optical power after propagating through a fiber of 1.5 km length is reduced to 25% of its original value. Compute the fiber loss in dB/km. [2]

(**Q6**) (a) Derive the London equations and give their physical significance. [4]

(b) Calculate the value of London penetration depth at 0 K for lead whose density is $11.3\text{x}10^3$ kg/m^3 and atomic weight is 207.19. Its T_c is 7.22 K. Calculate the increase in penetration depth at 3.61 K from its value at 0 K. [3]

(c) Calculate the critical current density for 1-mm diameter of lead at 4.2 K. A parabolic dependence of H_c upon T may be assumed. Given T_c for lead is 7.18 K and H_o for lead is $6.5\text{x}10^4$ A/m. [3]

(**Q7**) What is working principle of LED? How many shades of colour will be displayed by a 16-bit LED panel. [3]

$\mu_o = 4\pi \text{ x } 10^{-7}$ Hm^{-1}; $m_e = 9.1 \text{ x } 10^{-31}$ kg; $e = 1.6 \text{ x } 10^{-19}$ C; $\varepsilon_o = 8.85 \text{ x } 10^{-12}$ C^{2}N^{-1}m^{-2}