

JAYPEE UNIVERSITY OF INFORMATION TECHNOLOGY, WAKNAGHAT

TEST -1 EXAMINATION- FEBRUARY 2018

B.Tech. VI Semester

COURSE CODE: 10B11PH611

MAX. MARKS:15

COURSE NAME: MATERIALS SCIENCE

COURSE CREDITS: 4

MAX. TIME: 1 Hr

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

Q1 (a) Derive an expression for Claussius - Mossotti equation in the optical frequency region. [3]

(CO-1)

(b) Calculate the polarization density of He gas when it is placed in a field of $6 \times 10^5 \text{ V/m}$. The atomic polarizability of He is $1.8 \times 10^{-41} \text{ Fm}^2$ at NTP. Also calculate the separation of positive and negative charges in each atom. [2]

(CO-3)

Q2 (a) What is dielectric loss? Show that dielectric loss depends on the imaginary part of the dielectric constant. [3]

(CO-2)

(b) The polarizability of a dielectric material is $2.42 \times 10^{-39} \text{ Fm}^2$ at 36°C and $1.74 \times 10^{-39} \text{ Fm}^2$ at 175°C . Calculate the induced dipole moment for the material. [2]

(CO-3)

Q3 (a). Which polymer is required anti-static coating applications? Describe how to develop this polymer. [2]

(CO-5)

(b) Cross-linked polymer consisting of 70 wt. % C_2H_4 and 30 wt. % C_3H_6 may have elastic properties similar to those for natural rubber. For this copolymer determine the fraction of both repeat unit types. Also calculate the number average molecular weight if the degree of polymerization is 3000. [3]

(CO-3)

Constants: $\mu_0 = 4\pi \times 10^{-7} \text{ Hm}^{-1}$; Avogadro number = 6.023×10^{23} , $m_e = 9.1 \times 10^{-31} \text{ kg}$; $e = 1.6 \times 10^{-19} \text{ C}$; $\epsilon_0 = 8.85 \times 10^{-12} \text{ C}^2\text{N}^{-1}\text{m}^{-2}$, $k_B = 1.38 \times 10^{-23} \text{ J/K}$.