JAYPEE UNIVERSITY OF INFORMATION TECHNOLOGY, WAKNAGHAT
SUMMER MID SEMESTER EXAMINATION- June 2018
B.Tech VI Semester

COURSE CODE: 10B11PH611   MAX. MARKS: 50

COURSE NAME: Materials Science

COURSE CREDITS: 04   MAX. TIME: Two Hours

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

Q1. (a) Obtain Clausius-Mossotti equation. How can it be used to determine the dipole moment of a polar molecule from the dielectric constant measurements? **[5-marks]**

(b) In a drop of water of radius 10^{-3} m, the molecular dipoles are pointed in the same direction. If the dipole moment of the water molecule is 6×10^{-30} C-m, calculate the polarization. **[3-marks]**

Q2. (a) What is relaxation time? Discussion the decay and growth of polarization in a dielectric material for a steady electric d.c. electric field. **[5-marks]**

(b) If the relaxation time is given as 18×10^{-6} s at 22°C, then calculate the frequency when the real and imaginary parts of the complex dielectric constant become equal. Find out the phase difference between the current and the voltage at this frequency. **[3-marks]**

Q3. A step index fibre has core and cladding refractive indices as **1.466** and **1.460**, respectively. Calculate the maximum radius allowed for the fibre, if it is supporting only one mode at a wavelength of **1200 nm**. Also, calculate the numerical aperture, the critical angle, and the maximum acceptance angle of the fibre. **[6-marks]**

Q4. (a) Discuss the physical significance of numerical aperture. How does it depend on refractive indices of core and cladding. Also, discuss attenuation and dispersion of signals in optical fibre. **[5-marks]**

(b) A communication system uses a **10 km** fibre having loss of **2.3 dB**. Calculate the output power if the input power is **900 μW**. **[3-marks]**

Q5. Discuss in detail the stress-strain diagram with respect to the concept of strain hardening. How does the relation between stress and strain change while going from the elastic to the plastic regime? **[5-marks]**

Q6. Describe ferroelectric hysteresis. Discuss the behavior of ferroelectric materials with respect to their curie temperature. **[5-marks]**

Q7. Compare the different segment displays. What light source would be convenient for such displays. Explain your answer. **[5-marks]**

Q8. Discuss briefly the working of a LCD display. What is the advantage of using a back lighting system in LCD devices? **[5-marks]**

Constants: $\mu_0 = 4\pi \times 10^{-7}$ Hm^{-1}; Avogadro number = 6.023×10^{23}; $m_e = 9.1 \times 10^{-31}$ kg; e = 1.6×10^{-19} C; $\varepsilon_0 = 8.85 \times 10^{-12}$ C^{2}N^{-1}m^{-2}; density of water = 1 g/cc