JAYPEE UNIVERSITY OF INFORMATION TECHNOLOGY, WAKNAGHAT

TEST -1 EXAMINATION- 2016

B.Tech. VI Semester

COURSE CODE: 10B11PH611   MAX. MARKS: 15

COURSE NAME: MATERIALS SCIENCE

COURSE CREDITS: 04   MAX. TIME: 1 HR

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

Q1. (a) Obtain an expression for electronic polarizability in terms of radius of the atom.   **[2 marks]**

(b) Show that the energy stored in the polarized atom of a dielectric is $(\frac{1}{2})\alpha E^2$, where α is the polarizability and E is the applied field.   **[2 marks]**

Q2. (a) Show that the dielectric loss is proportional to the imaginary part of the dielectric constant.   **[2 marks]**

(b) The polarizability of ammonia molecule is 2.42×10^{-39} F-m^2 at 309 K, and 1.74×10^{-39} F-m^2 at 448 K. Calculate for each temperature the polarizability due to deformation of molecules.   **[2 marks]**

Q3. (a) Show that the electric field due to a dipole is inversely proportional to the third power of the magnitude of the position vector.   **[2 marks]**

(b) Calculate total polarizability of CO_2 if its susceptibility is 0.985×10^{-3} and density is 1.977 kg/m^3. Given $N = 2.7 \times 10^{25}$ m^{-3}.

Two parallel plates have equal and opposite charges and the plates are separated by a 5 mm thick dielectric with dielectric constant 3. Calculate the polarization in the dielectric for an applied field intensity of 10^6 V/m.   **[2 marks]**

Q4. Discuss the mechanical behaviour of ceramics on the basis of following parameters:

(i) Porosity (ii) rigidity (iii) crystallinity   **[3 marks]**