

JAYPEE UNIVERSITY OF INFORMATION TECHNOLOGY, WAKNAGHAT

TEST -1 EXAMINATIONS-2022

B.Tech-V Semester (CS/IT)

COURSE CODE (CREDITS): 18B1WPH532

MAX. MARKS: 15

COURSE NAME: APPLIED MATERIALS SCIENCE

COURSE INSTRUCTORS: VINEET SHARMA, SURAJIT K. HAZRA, MAX. TIME: 1 Hour

SANJIV K. TIWARI

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*Note: All questions are compulsory. Marks are indicated against each question in square brackets.*

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Q1. For a capacitor having area magnitude equal to the plate separation magnitude show that loss energy is independent of the applied signal frequency. [2 marks] [CO-1]

Q2. For an isotropic dielectric obtain an expression of Lorentz field using cavity model. [2 marks] [CO-2]

Q3. Discuss the frequency response of total polarizability for a dielectric material across the electromagnetic spectrum. [2 marks] [CO-5]

Q4. Write short notes on the following

- (a) Ferroelectric phase transition
- (b) Strain Hardening
- (c) Poling

[1 mark each=3] [CO-2]

Q5. The dielectric constant of He measured at 0°C and 1 atm pressure is 1.000684. Under these conditions the gas contains  $2.7 \times 10^{25}$  atoms/m<sup>3</sup>. Calculate the radius of the electron cloud. Also calculate the displacement when a He atom is subjected to a field of  $10^6$  V/m.

[2 marks] [CO-3]

Q6. One gram molecule of a certain polar substance is dissolved into 1000 cm<sup>3</sup> of a non polar liquid. The liquid itself has a dielectric constant of 3 at 27°C, whereas the solution has a dielectric constant of 3.2 at that temperature. Calculate the dipole moment of the polar molecules. [2 marks] [CO-3]

Q7. A solid dielectric material has  $5 \times 10^{28}$  identical atoms/m<sup>3</sup>. If the polarizability is  $3.6 \times 10^{-40}$  Fm<sup>2</sup>, calculate the Lorentz field normalized w.r.t. the external electric field.

[2 marks] [CO-3]

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$\epsilon_0 = 8.85 \times 10^{-12}$  F/m,  $e = 1.6 \times 10^{-19}$  C,  $k_B = 1.38 \times 10^{-23}$  J/K,  $N_A = 6.023 \times 10^{23}$