

JAYPEE UNIVERSITY OF INFORMATION TECHNOLOGY, WAKNAGHAT

TEST -2 EXAMINATIONS- 2026

B.Tech-VI Semester (CSE/IT)

COURSE CODE (CREDITS): 18B1WPH532 (03)

MAX MARKS: 25

COURSE NAME: Applied Materials Science

COURSE INSTRUCTOR: VSA

MAX. TIME: 1 Hour 30 Min

Note: (a) All questions are compulsory.

(b) The candidate is allowed to make suitable numeric assumptions wherever required for solving problems

(c) Use of calculator is allowed

Q.No	Question	CO	Marks
Q1	(a) Plot the real and imaginary parts of the electronic polarizability with frequency for a dielectric on subjecting it to an alternating external field $E_0 e^{i\omega t}$ and give their physical significance.	2	5
	(b) If the radius of a hydrogen atom is 0.05 nm, then calculate the electronic polarizability and the relative permittivity. Given: number of atoms in hydrogen gas is $9.8 \times 10^{26}$ atoms/m <sup>3</sup>	3	
Q2	(a) Derive an expression to show that temperature affects the polarizability of a polar dielectric material.	1	5
	(b) The total polarizability of a particular dielectric material, when used in a gaseous state, varies from $2.40 \times 10^{-39}$ Fm <sup>2</sup> to $1.70 \times 10^{-39}$ Fm <sup>2</sup> , when its temperature changes from 310 K to 450 K. Calculate at each temperature, the value of deformation polarizability and orientational polarizability	3	
Q3	(a) Derive the dielectric loss in a dielectric material and illustrate the loss tangent using a diagram.	2	5
	(b) Calculate the frequency at which the real and imaginary parts of the complex dielectric constant become equal for a dielectric having a relaxation time of $10^{-6}$ sec at 300 K. Also, calculate the phase difference at this frequency between the current and voltage.	3	
Q4	(a) Using a diagram, show the 0.002 strain offset method to determine the mechanical properties of a ceramic material.	2	4
	(b) How are the ceramic materials used for surge-protection applications?	5	
Q5	(a) Obtain the precessional frequency for an electron revolving around the nucleus in an orbit of radius $r$ in a magnetic field $B$ applied perpendicular to the plane of the orbit.	1	6
	(b) The molecular weight and density of a paramagnetic substance are 168.5 and 4370 kg/m <sup>3</sup> at room temperature 300K. Considering the contribution to paramagnetism as one Bohr magneton per molecule, calculate its susceptibility and magnetism produced in it in a field of $5 \times 10^5$ Am <sup>-1</sup> .	3	

Constants:  $\mu_0 = 4\pi \times 10^{-7}$  H-m<sup>-1</sup>; Charge on electron =  $1.6 \times 10^{-19}$  C; mass of electron =  $9.1 \times 10^{-31}$  kg;  $\epsilon_0 = 8.85 \times 10^{-12}$  C<sup>2</sup>/N/m<sup>2</sup>;  $\mu_B = 9.24 \times 10^{-24}$  Am<sup>2</sup>;  $N_A = 6.02 \times 10^{23}$