Supplementary Examination- 2026
B.Tech-I Semester (CSE/IT/ECE/CE/BT/BI)

COURSE CODE(CREDITS): 18B1WPH532 (03) MAX. MARKS: 75
COURSE NAME: Applied Materials Science
COURSE INSTRUCTORS: PBB, VSA, SKT, SBD, HAZ MAX. TIME: 2 Hours

Note: *(a) All questions are compulsory. Scientific calculators are allowed.*

Q.No	Question	CO	Marks
Q1	a) Derive the expression for electric field due to dipole of dipole moment μ at distance 'r'. 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 water molecule is 6×10^{-30} C-m, calculate the polarization.	1	7.5
Q2	a) Derive the Clausius-Mossotti equation in dielectrics. b) Sulphur has atomic weight 32 and its density is 2.08 g/cc. The electronic polarizability of sulphur is 3.5×10^{-40} Fm^2. Consider the cubic symmetry in sulphur solid, calculate its relative dielectric constant.	2 3	7.5
Q3	a) What is polarizability? Derive the expression for static electronic polarizability for atom of radius 'r'. b) The polarizability of oxygen atom in the air molecule is 9.7×10^{-41} Cm^2/V. Calculate the average distance of centre of negative charge cloud from the nucleus.	2 3	7.5
Q4	a) Explain the classical theory of diamagnetism and derive the expression for Larmor frequency. b) A iron rod 0.5 m long and 2 mm^2 cross section is placed in a long solenoid of 25 turns per cm carrying a current of 2 A. Assuming the relative permeability of iron to be 400, determine the magnetic moment of the bar magnet.	1 3	7.5
Q5	a) Discuss Meissner effect and its contradiction to classical electromagnetic theory. Graphically explain type-1 and type-II superconductors. b) The density and atomic mass of Niobium are 8.57×10^3 kg/m^3 and 93 respectively. It has one conduction electron per atom. Calculate London penetration depth of Niobium.	1 3	7.5
Q6	a) Discuss the glass transition temperature in polymers with respect to its application. b) The density of amorphous polyethylene is 920 kg/m^3 and that of crystalline polythene is 961.97 kg/m^3. Calculate the % crystallinity of a high density polyethylene whose density is 938 kg/m^3.	5 3	7.5
Q7	Briefly discuss the following terms in the processing of ceramics: (i) Slurry (ii) Green body (iii) Poling (iv) Sintering (v) Metal-organic decomposition (MOD)	5	7.5
Q8	a) Derive an expression to show that the paramagnetic susceptibility is inversely proportional to temperature. b) A paramagnetic substance contains 6.5×10^{25} atoms/m^3 and the magnetic moment of each atom is 1 Bohr magneton. Find the paramagnetic susceptibility at 300 K.	1 3	7.5
Q9	a) Derive an expression to find the numerical aperture of an optical fiber. b) The refractive indices of core and cladding for a step index fiber of diameter 0.064 mm are 1.53 and 1.39 respectively. Calculate (i) numerical aperture of the fibre (ii) acceptance angle (iii) the number of reflections in 90 cm of fibre for a ray at the maximum incidence angle and for one-half of this angle.	2 5	7.5
Q10	a) A graded index fiber having quadratic refractive index profile has a core diameter of 0.05 mm and numerical aperture of 0.22 at a wavelength of 850 nm. What is the V-parameter and the number of modes guided in the core. b) Discuss the working of twisted nematic liquid crystal molecules in LCD displays.	5 4	7.5

Constants: $m_e = 9.11 \times 10^{-31}$ kg; $e = 1.6 \times 10^{-19}$ C; $N_A = 6.023 \times 10^{23}$; $k_B = 1.38 \times 10^{-23}$ J/K; $\varepsilon_o = 8.85 \times 10^{-12}$ F/m; $\mu_B = 9.27 \times 10^{-24}$ Am^2; $\mu_o = 4\pi \times 10^{-7}$ H/m;