JAYPEE UNIVERSITY OF INFORMATION TECHNOLOGY, WAKNAGHAT

TEST -2 EXAMINATION- 2025

B.Tech-I Semester (ECE)

COURSE CODE (CREDITS): 3 MAX. MARKS: 25

COURSE NAME: SCIENCE AND TECHNOLOGY OF MATERIALS (18B1WPH531)

COURSE INSTRUCTORS: Haresh Raval 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

Q.No	Question	CO	Marks
Q1	a. Explain why not all materials are magnetic materials. b. Using Atomic theory, discuss the origin of magnetic moment and subsequent quantizations including space quantization.	CO [3]	2 4
Q2	a. A paramagnetic material has 10^{28} atoms/m^3 .The magnetic moment of each atom is $1.8 \times 10^{-23} Am^2$. Calculate the paramagnetic susceptibility at room temperature (300 K). b. Consider a helium atom in its ground state (1 s). The mean radius in the Langevin formula may be approximated by Bohr radius 0.529$\dot{A}$. The density of helium is 0.178 kg/m^3. Calculate the diamagnetic susceptibility of a helium atom.	CO[4]	2 3
Q3	In how many components does the energy level of an unpaired electron with orbital angular momentum quantum number $l = 1$ splits into, in the presence of an external magnetic field. Show proof.	CO [4]	5
Q4	a. Derive the expression of internal electric field due to long one dimensional array of atomic dipoles at the location an atom in the array. 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 $6.1 \times 10^{-30}\ Cm$. Calculate the polarization. (molar mass of water M=18.015 g/mol)	CO [3]	3 3
Q5	State the Curie's law and Curie-Weiss law for magnetic materials. What are the key differences between these laws.	CO [2]	3
	$k_B = 1.38 \times 10^{-23}\ J/K$, $e = 1.6 \times 10^{-19}\ C$, $m_e = 9.1 \times 10^{-31}\ kg$, $\mu_0 = 4\pi \times 10^{-7} H/m, \epsilon_0 = 8.85 \times 10^{-12} F/m$, $\mu_B = 9.27 \times 10^{-24} Am^2$		