

JAYPEE UNIVERSITY OF INFORMATION TECHNOLOGY, WAKNA GHAT
TEST -2 EXAMINATION- 2023

BTech-V Semester (CSE/IT)

COURSE CODE (CREDITS): 18BIWPH532 (3)

MAX. MARKS: 25

COURSE NAME: Applied Materials Science

MAX. TIME: 1.5 H

COURSE INSTRUCTORS: PBB, VSA, SKT, HAZ

Note: (a) All questions are compulsory.

(b) Marks are indicated against each question in square brackets.

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

- Q1. (a) Discuss the phenomenon of poling in ceramic processing. [2-marks] [CO-5]
- (b) For an atom subjected to externally applied magnetic field, derive an expression for Larmour precession frequency and discuss the result. [3-marks] [CO-2]
- (c) A paramagnetic material has 10^{28} atoms/m³. The magnetic moment of each atom is 1.8×10^{-23} Am². Calculate the paramagnetic susceptibility at room temperature (~300 K). [2-marks] [CO-2]
- Q2. (a) Write a short note on ferroelectric domains. [2-marks] [CO-5]
- (b) Plot the graphs for Curie's law and Curie-Weiss law for a paramagnetic sample and discuss the differences. [3-marks] [CO-2]
- (c) Consider a helium atom in its ground state (1s). The mean radius in the Langevin formula may be approximated by Bohr radius 0.529Å. The density of helium is 0.178 kg/m³. Calculate the diamagnetic susceptibility of a helium atom. [3-marks] [CO-2]
- Q3. (a) Discuss the stress-strain diagram for a metal. Also explain strain-hardening. [3-marks] [CO-5]
- (b) If a dielectric sample has its dielectric constant 4 and refractive index 1.5, then calculate the ratio of ionic to electronic polarizabilities. [3-marks] [CO-3]
- Q4. (a) Sulphur has atomic weight 32 and its density is 2.08 g/cc. The electronic polarizability of sulphur is 3.5×10^{-40} Fm². Considering the cubic symmetry in sulphur solid, calculate its relative dielectric constant. [2-marks] [CO-3]
- (b) Using atomic theory, discuss the origin of magnetic moment and the subsequent quantization. [2-marks] [CO-1]

$k_B = 1.38 \times 10^{-23}$ J/K; $m_e = 9.11 \times 10^{-31}$ kg; $\mu_0 = 4\pi \times 10^{-7}$ H/m; $e = 1.6 \times 10^{-19}$ C; $\epsilon_0 = 8.85 \times 10^{-12}$ F/m; $\mu_B = 9.27 \times 10^{-24}$ Am²