

Roll Number:

JAYPEE UNIVERSITY OF INFORMATION TECHNOLOGY, WAKNAGHAT

TEST -3 EXAMINATION- 2023

B.Tech-V Semester (ECE)

COURSE CODE (CREDITS): 18B1WPH531(03)

MAX. MARKS: 35

COURSE NAME: Science and Technology of Materials

COURSE INSTRUCTORS: Dr. Ragini Raj Singh

MAX. TIME: 2 Hours

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

Q.1.(a) Discuss theories of magnetism (i) Weber's theory; and (ii) Domain theory [CO:1, Marks:2]

(b) Discuss magnetic moments and angular momentum and deduce the relation between μ and J . [CO:2, Marks:2]

Q.2.(a) Discuss classical Langevin's theory of diamagnetism. [CO:2, Marks:2]

(b) Derive Curie-Wiess law of magnetism. [CO:2, Marks:2]

Q.3.(a) In detail explain the full process to prepare modern ceramic materials and the properties of these ceramics. [CO:3, Marks:3]

(b) How ceramics can be used as semiconductors, gas sensors and as superconductors. Also discuss at least three other applications of ceramics. [CO:3, Marks:3]

Q.4.(a) Define (i) Smart gels; (ii) Rheological materials; and (iii) magnetostrictive materials, with their applications. [CO:4, Marks:3]

(b) What are unusual properties of Nanomaterials? How you can describe nanostructures of different dimensions? [CO:4, Marks:3]

Q. 5. Solve the following: [CO:5, Marks:5 X 3=15]

(a) Find the capacitance of a layer of Al_2O_3 that is 0.5 m thick and 2000 mm² of square area ($\epsilon_r = 8.854 \times 10^{-12} \text{ Fm}^{-1}$).

(b) The dielectric constant of a helium gas at NTP is 1.0000684. Calculate the electron polarizability of helium atoms if the gas contains 2.7×10^{26} atoms/m³ and hence calculate the radius of helium atom ($\epsilon_r = 8.854 \times 10^{-12} \text{ Fm}^{-1}$)

(c) Compute the saturation magnetization and saturation flux density for iron (atomic weight: 55.8) which has a net magnetic moment per atom of 2.2 Bohr magnetons and a density of 7.87 g/cm³.

(d) A magnetic material has a magnetization of 2300 A m and produces a flux density of 0.00314 Wb m. Calculate the magnetizing force and the relative permeability of the material.

(e) The saturation magnetic induction of Nickel is 0.65 Wb m. If the density of Nickel is 8906 kg m and its atomic weight is 58, calculate the magnetic moment of the Nickel atom in Bohr magnetron.