

JAYPEE UNIVERSITY OF INFORMATION TECHNOLOGY, WAKNAGHAT

TEST -3 EXAMINATION- 2023

B.Tech-V Semester (ECE/ECM)

COURSE CODE (CREDITS): 18B1WPH531 (3)

MAX. MARKS: 35

COURSE NAME: Science and Technology of Materials

COURSE INSTRUCTORS: Dr. Santu Baidya

MAX. TIME: 2 Hours

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*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*

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Q1. What is the relation between polarization vector, electric field and displacement vector? Two parallel plates having equal and opposite charges are separated by a 2 cm thick slab that has dielectric constant 3. If the electric field inside is  $10^6$  V/m, calculate the polarization and displacement vector. [CO-3] [2+3]

Q2. Prove the Clausius-Mossotti relation. A solid dielectric material (having cubic symmetry) has  $4 \times 10^8$  atoms per unit volume. If it shows an electronic polarizability of  $1.5 \times 10^{-40}$  Fm<sup>2</sup>, then calculate the dielectric constant of material. [CO-2] [3+2]

Q3. Describe the principle of light communication through optical fiber with diagram. What is critical angle? How many types of optical fibers are present and describe working principle of a step index optical fiber? [CO-1] [2+1+2]

Q4. What is Seebeck effect and define formula for Seebeck coefficient? What is a figure of merit for any thermoelectric material and describe each term? What is an efficiency of a thermoelectric device? [CO-5] [2+1+2]

Q5. Prove the Langevin theory of paramagnetism. Define the magnetic Curie temperature. [CO-1] [3+2]

Q6. What is Curie-Weiss theory of ferromagnetism? Plot the phase diagram of Magnetization vs temperature for a ferromagnetic material. Define molecular exchange field. [CO-3] [2+2+1]

Q7. What is superconductivity? Plot the comparison between electrical resistivity vs temperature for a normal metal and a superconductor. Define critical magnetic field of a superconductor and plot the temperature variation of critical magnetic field. [CO-2] [1+1+3]