

International Islamic University Chittagong
 Department of Electrical and Electronic Engineering
 B. Sc. Engineering in EEE
 Special Semester End Exam, Spring 2023

Course Code: **EEE 3515**
 Time: 2 hours 30 minutes

Course Title: **Electrical Properties of Materials**
 Full Marks: 50

- (i) The figures in the right-hand margin indicate full marks
 (ii) Course Outcomes and Bloom's Levels are mentioned in additional Columns

Course Outcomes (COs), Program Outcomes (POs) and Bloom's Levels (BL) of the Questions			
CO	CO Statements	PO	BL
CO1	Reflect a basic understanding of crystal structure, lattice geometry, quantum mechanical behavior of electrons, molecular orbital theories.	POa	C2
CO2	i) Determine Miller indices, Crystal directions and planner concentration of crystals. ii) Apply the concept of dielectric and magnetic material properties and their applications to determine various dielectric constants.	POb	C3
CO3	Demonstrate the working principle of superconductor and their applications.	POa	C5

Bloom's Levels (BL) of the Questions						
Letter Symbols	C1	C2	C3	C4	C5	C6
Meaning	Remember	Understand	Apply	Analyze	Evaluate	Create

Part A

[Answer the questions from the followings]

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|-----|--|-----|----|---|
| 1. | a) Describe the terms and conditions to make a molecular bonding between two He atoms. | CO1 | C2 | 5 |
| 1. | b) How band of energy is formed in a solid? Explain it using an example with figures. | CO2 | C1 | 5 |
| 2. | a) In a crystal, how can we determine the electron acceleration, taking into account the potential energy variation of the electron with distance inside the crystal? | CO2 | C2 | 5 |
| 2. | b) What do you understand the work function and fermi energy of a material? Explain using suitable schematic diagram. | CO2 | C1 | 5 |
| Or, | | | | |
| 2. | a) Differentiate between Fermi- Dirac and Boltzmann classical statistics. Pauli exclusion principle does not be considered in Boltzmann classical statistics. Why? Explain with necessary figures. | CO2 | C2 | 5 |
| 2. | b) Explain the concept of electron state distribution in an energy band with relevant sketch. | CO2 | C1 | 5 |

Part B

[Answer the questions from the followings]

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|-----|---|-----|----|---|
| 3. | a) "When a dielectric material is placed between two plates, surface polarization charges would not be cancelled each other"- Is it right or wrong? Write down your logical arguments with necessary figures. | CO2 | C4 | 5 |
| 3. | b) "The valence electrons are loosely bounded with the parent atoms of Ar is higher than the Si atoms"- Justify. | CO2 | C5 | 5 |
| 4. | a) Define magnetic dipole moment. What is magnetization vector M? Explain it using suitable example. | CO2 | C2 | 5 |
| 4. | b) Calculate the magnetization of a material with susceptibility of 60 and field intensity of 0.40 units. | CO3 | C5 | 5 |
| Or, | | | | |
| 4. | a) What is atomic magnetic moment? Find the atomic magnetic momentum in terms of orbital angular momentum. | CO2 | C2 | 5 |
| 4. | b) Differentiate between diamagnetic and ferrimagnetic materials. | CO3 | C5 | 5 |
| 5. | a) Explain the transition from Meissner state to normal state for different types of superconductors. | CO2 | C5 | 5 |
| 5. | b) How and why levitate a magnet on top of a superconductor's surface? | CO2 | C2 | 5 |