

B.E. ELECTRICAL ENGINEERING SECOND YEAR FIRST SEMESTER SUPPLEMENTARY  
EXAM - 2023  
ELECTRICAL ENGINEERING MATERIALS

Time : 3 Hours

Full Marks : 100 (50 for this part)

**Part - I**

Use Separate Answer scripts for each part.

All questions carry (08) marks. Two (02) marks reserved for well organized answers.  
Answer all questions in this part in the same answer script.

**Group A : Answer any three questions (03)**

1. With suitable derivation relate susceptibility to permeability.
2. Explain how ferrite is similar to and different from ferromagnetic materials.
3. Explain the significance of Neel temperature for magnetic materials.
4. What is the source of magnetic dipole moment in materials?
5. Write short note on hard magnetic materials.

**Group B : Answer any two questions (02)**

6. How can you derive temperature coefficient of resistivity at any temperature for a given coefficient at a given temperature?
7. Explain Drude's Model of conductivity
8. Derive Joules law from Drude's model of conductivity.
9. Write short notes on high resistance conducting materials

**Group C : Answer any one (01) question**

10. Discuss BCS theory of superconducting materials
11. Explain Meissner effect for superconducting materials.

[ Turn over

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SUPPLEMENTARY EXAM - 2023**

**SUBJECT: ELECTRICAL ENGINEERING MATERIALS**

Time: Three Hours

Full Marks: 100  
(50 Marks for each part)

**Use a separate Answer-Script for each part**

Two marks for neat and well-organized answers

Question No.	Part-II	Marks
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Answer any three questions

- |    |                                                                                                                                                                                                                                                                                                                 |     |
|----|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|
| 1. | (a) Calculate the frequency and the energy of photons emitted if an electron in a hydrogen atom makes a transition from a quantum state of principle quantum number $n=3$ to the ground state. Given $h = 6.62 \times 10^{-34}$ J. Derive the expression for solving the problem.                               | 10  |
|    | (b) Discuss about the sigma and pi bonding of atoms.                                                                                                                                                                                                                                                            | 6   |
| 2. | (a) Discuss the role of stable inter-atomic distance in the formation of stable molecule. How do you explain ionic bonding considering the stable inter-atomic distance?                                                                                                                                        | 5+5 |
|    | (b) Explain insulators, semiconductors and conductors according to the energy band theory of solids.                                                                                                                                                                                                            | 6   |
| 3. | (a) The insulation resistance of 200m of a cable is $300M\Omega$ at $35^\circ C$ . The insulating material is such that an increase in $10^\circ C$ is required for reducing the insulation resistance to half the value at $35^\circ C$ . Find the insulation resistance of 50m of the cable at $25^\circ C$ . | 7   |
|    | (b) If sodium chloride crystal is subjected to an electric field of 1400 V/m and the resulting polarization is $4.2 \times 10^{-8} C/m^2$ , calculate the relative permittivity of sodium chloride. Derive the formula you have used.                                                                           | 2+7 |
| 4. | (a) Discuss about the properties of transformer oil. What are its major impurities? Discuss about the process by which such impurities could be removed from transformer oil. Name a substitute of transformer oil and explain why such substitutes are not very popular in use.                                | 10  |
|    | (b) With examples, classify insulating materials in the light of thermal gradation.                                                                                                                                                                                                                             | 6   |
| 5. | Write short notes on any two of the following:                                                                                                                                                                                                                                                                  | 2×8 |
|    | (i) Surface resistivity and Dielectric Constant                                                                                                                                                                                                                                                                 |     |
|    | (ii) Different kinds of Dielectric Polarization                                                                                                                                                                                                                                                                 |     |
|    | (iii) Cross-linked polyethylene (XLPE)                                                                                                                                                                                                                                                                          |     |