

B. E. (ELECTRICAL ENGINEERING) 1ST YR 2ND SEMESTER EXAMINATION, 2023

SUBJECT: - ELECTRICAL ENGINEERING MATERIAL

Time: ~~Two hours~~/Three hours/ ~~Four hours~~/ Six hours

Full Marks 100
(50 marks for each part)

Use a separate Answer-Script for each part

PART I

Answer question 1 and any two from the rest.

1. Answer any four of the following.

- a) Why Ferro-magnetic shows spontaneous magnetism? 4×5
 - b) Why free electrons move with uniform velocity in conductor?
 - c) Why para magnetic Curie temperature is different to ferro-magnetic Curie temperature?
 - d) Why mean free path is related to resistivity of material?
 - e) Why crystallographic axis important for magnetizing material?
 - f) Explain how Meissner effect can be supported by Maxwell's equation.
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2. a) Explain how external magnetic field can alter the angular frequency of rotating electron around the nucleus. 5+4+6
b) Referring to domain theory explain the phenomenon of anisotropy with characteristic plots and examples.
c) Referring to domain theory explain the phenomenon of anisotropy with characteristic plots and examples.
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3. a) State the significance of Neel temperature in antiferromagnetic material and derive the expression of it. 5+4+6
d) Explain how mean free path of electrons in conductor is related to scattering of electrons with ion core. State the significance of Fermi velocity of free electron in conductor.
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4. a) Suggest suitable atomic model to prove that the velocity of free electrons in conductors is uniform when the conduction is subjected to uniform electric field. 7+8
b) Derive the expression of penetration depth over which external magnetic field will decay inside the superconductor.

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Ref No: EX/EE/5/T/122/2023

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SUBJECT: - ELECTRICAL ENGINEERING MATERIAL

Time: ~~Two hours~~/Three hours/ ~~Four hours~~/ ~~Six hours~~

Full Marks 100
(50 marks for each part)

5. **Write short notes on any three of the following:** 3×5
- a) Magnetstriction;
 - b) Type-I & II superconductor;
 - c) Relaxation time;
 - d) Superconducting magnetic;
 - e) Orbital magnetic dipole moment & angular momentum.

**BACHELOR OF ENGINEERING (ELECTRICAL ENGINEERING) FIRST YEAR
SECOND SEMESTER - 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

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|----|---|-----|
| 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 $n=4$ to the ground state. Given $h = 6.62e-34$ J. Derive the expression for solving the problem. | 10 |
| | (b) Discuss about the sigma and pi bonding of atoms. | 6 |
| 2. | (a) Classify the materials according to the energy band theory of solids. Give proper examples of each class of materials. | 9 |
| | (b) What do you mean by Van der Waals and Hydrogen Bonding? Explain these bonding with suitable example. | 4 |
| | (c) Discuss about the differences between ionic bonding and metallic bonding. | 3 |
| 3. | (a) The insulation resistance of a 100m long cable is $10\text{ M}\Omega$ at 27°C . At 60°C the insulation resistance value decreases to 1% of that at 27°C . Find the insulation resistance at 40°C for a length of 50m of the same cable. | 7 |
| | (b) If sodium chloride crystal is subjected to an electric field of 1400 V/m and the resulting polarization is $4.2 \times 10^{-8}\text{ C/m}^2$, calculate the relative permittivity of sodium chloride. Derive the formula you have used. | 2+7 |

[Turn over

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4. (a) Discuss in brief the mechanism behind the breakdown of gas insulation. Does pressure affect the breakdown voltage of gas insulation? 5+4
- (b) What are the major properties of transformer oil? Discuss how the impurities are removed from transformer oil. Name a substitute of transformer oil and explain why such substitutes are not very popular in use. 3+2+2
5. Write short notes on any two of the following: 2×8
- (i) Bonding and antibonding
 - (ii) Polyethylene
 - (iii) Teflon
 - (iv) Varnishes.