

Ref. No.: Ex/FET/OE/MET/T/220/2023(S)

**B.E. Electrical Engineering 4th Year 2nd Semester Supplementary Exam -
2023**

Subject: Testing and Characterization of Materials

Time: 3 hours

Full Marks = 100

(Answer Question No: 10 and any eight from the rest)

1. **5 + 5 = 10**
 - a. Describe the relevance of hardness testing for assessing the mechanical integrity of electrical contacts and terminals.
 - b. Compare the benefits of using different hardness testing methods (e.g., Rockwell, Brinell, Vickers) on various electrical components.

2. **6 + 4 = 10**
 - a. Draw a schematic of load vs. displacement, engineering stress vs. engineering strain, and true stress vs. true strain curves on the same diagram for low-carbon steel tested under uniaxial tension. Compare the nature of these curves assigning reasons for differences.
 - b. Explain the importance of measuring yield strength, ultimate tensile strength, and elongation in tensile testing of electrical wires.

3. **6 + 4 = 10**
 - a. Draw a schematic of the load vs. displacement curve for low-carbon steel tested under uniaxial compression and discuss the nature of the curve.
 - b. Discuss the factors influencing the compression strength of electrical insulators and their significance in high-voltage applications.

4. **4 + 6 = 10**
 - a. How does impact testing help in evaluating the mechanical behavior of electrical enclosures subjected to external forces?
 - b. Define DBTT. State the standard procedure for estimating the DBTT of a material.

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5. 5 + 5 = 10
- a. Define fatigue testing and its role in determining the endurance limit of electrical components subjected to cyclic loading.
 - b. Discuss the relevance of the stress-life (S-N) curve in fatigue testing of electrical conductors.
6. 5 + 5 = 10
- a. What is creep testing, and how does it help understand the time-dependent deformation of electrical materials under constant stress and elevated temperatures?
 - b. Explain the implications of creep behavior in electrical connectors used in high-temperature environments.
7. 10
- How can comprehensive characterization techniques aid in the failure analysis of electrical components to identify the root causes?
8. 10
- Discuss the mechanisms of electrochemical corrosion in electrical components, emphasizing how it affects the longevity and performance of connectors and terminals.
9. 10
- Describe the role of potentiostatic and galvanostatic tests in evaluating the corrosion resistance of electrical contact materials.
10. **Write a short note on (Answer any four):** (4 × 5) = 20
- a. Possible ways to improve the fatigue strength of materials.
 - b. Intergranular fracture vs. Transgranular fracture.
 - c. Die penetration testing method and its range of applications.
 - d. Advantages and limitations of using ultrasonic testing for flaw detection and thickness measurement in electrical insulation materials and printed circuit boards.
 - e. Principles behind eddy current testing and its applications.