M. E. ELECTRICAL ENGINEERING EXAMINATION, 2024

(1st Year, 1st Semester)

MATERIALS TECHNOLOGY

Time: Three Hours | Full Marks: 100

Answer any five questions

1. a) Briefly describe the following two electrical properties of insulating material: i) Dielectric constant and ii) Dielectric dissipation factor. 4+4

   b) Explain the significance of tensile, compressive, and bending strength in the selection of insulating materials supported by relevant examples. 3+3+3

   c) Critically analyze the importance of brittleness concerning the properties of insulating materials. 3

2. a) Describe thermal gradation of insulating materials with examples. Briefly explain 'thermal expansion' and 'cold endurance' related to thermal properties of insulating materials 7+4

   b) A customer brings 25m of a cable from a roll of 100m in the shop. It was specified that the insulation resistance of the roll of cable was 350MΩ at 25°C. The insulating material of the cable is such that an increase in 10°C is required for reducing the insulation resistance to half the value at 25°C. What will be the insulation resistance of the 25m piece if the customer measures it at 45°C? 5

   c) Explain the significance of surface resistivity of insulating material. 4

3. a) Define the flash point and pour point of transformer oil as per the Indian Standard IS 335. Specify these values. What impurities are typically present in transformer oil? Briefly explain the reprocessing of transformer oil. Also, mention the applications of synthetic liquid dielectrics. 2+2+2+3+3+2

   b) Draw and explain the nature of dielectric strength vs. pressure relationship for gaseous dielectric. Why compressed gas is used as insulation in many high voltage applications? 4+2

4. a) Discuss the mechanisms of different dielectric polarizations 6

   b) Discuss how the relative permittivity of a dielectric is related to the number of dipoles induced in the dielectric. 8

   c) Classify dielectric materials based on the polarization process. 6

5. a) With the help of a schematic diagram, explain the process of producing porcelain insulators. 10

   b) Write briefly about the properties and uses of the following materials from the perspective of electrical applications: Asbestos, Paper, Mica, and Micanites. 10

6. a) Define magnetostriction. Mention different types of magnetostriction. Write about the applications of magnetostriction. 2+3+3

   b) Briefly explain hysteresis loss and eddy current loss associated with magnetic materials. 6+6

7. a) Define magnetic moment, magnetization, and magnetic susceptibility, and represent each with a suitable mathematical expression. 10

   b) Classify and explain different types of magnetic materials. 10

8. Write short notes on any two of the following: 2×10=20

a) Cross-linked Polyethylene and Polytetrafluoroethylene

b) Compounds and Varnishes

c) Liquid impregnated insulation