

MASTER OF ENGINEERING IN ELECTRICAL ENGINEERING EXAMINATION, 2018

(1st Year, 2nd Semester)

CONDITION MONITORING OF HIGH VOLTAGE EQUIPMENT

Time: Three Hours

Full Marks: 100

Answer *any six* questions*Four Marks are reserved for neat and well organized answers*

1. a) Briefly discuss how (i) volume resistivity and (ii) surface resistivity can be measured for an insulating material. Give suitable illustrations of the experimental setup. 8
- b) Write down the expression for variation of insulation resistance with temperature. The insulation resistance of a 100m long cable is $20 \text{ M}\Omega$ at 25°C . At 45°C the insulation resistance value decreases by 1% of that at 25°C . Find the insulation resistance at 35°C for a length of 50m of the same cable. 8
2. What do you understand by the term "Good Insulation"? With a schematic, show how the insulation resistance can be measured. With the help of proper axes, draw the curves showing components of current measured during DC testing of insulation. How does humidity affect the insulation resistance? 16
3. Write notes on (i) Polarization Index (PI), (ii) Dielectric Absorption (DA), (iii) Hipot and (iv) Step Voltage Tests. 16
4. a) Write a note on "Duval's Triangle" highlighting some typical fault classification. 8
- b) Explain the advantages and limitations of Degree of Polymerization (DP) measurement by collecting paper samples from an oil-filled transformer. 8
5. Briefly state the basic theory of Frequency Domain Spectroscopy (FDS). Starting from the measured parameters, derive the expression of dielectric dissipation factor. 16

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6. Why cannot the condition of MOV surge arresters be predicted by simply measuring the total leakage current? Describe the methodology of condition monitoring of MOV surge arresters. Explain how surge counters operate in metal oxide surge arresters. 16

7. Give some areas where fiber optic sensors can be used for monitoring high voltage systems. Discuss briefly about various parameters that are monitored in power system equipments using fiber optics. 16

8. How monitoring is done in SF6 switchgears? What are the monitored values in the case of SF6 circuit breakers? Explain how the condition of SF6 circuit breaker can be monitored using a reference "coil current" curve. Briefly state the parameters that are monitored in SF6 disconnectors and earthing switches. 16