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18EE56

Fifth Semester B.E. Degree Examination, Dec.2023/Jan.2024
High Voltage Engineering

Time: 3 hrs.   Max. Marks: 100

Note: Answer any FIVE full questions, choosing ONE full question from each module.

Module-1

1   a. What is Paschen's law? How do you account for the minimum voltage for breakdown under a give "ρxd" condition. **(08 Marks)**
    b. What will be the breakdown strength of air for small gaps 1mm and large gaps under uniform field conditions and standard atmospheric conditions. **(04 Marks)**
    c. Explain the bubbles theory and suspended particle theory of break down in liquid. **(08 Marks)**

OR

2   a. Define Townsend's first and second ionization and mechanism co-efficient. Derive an expression for the growth in a gas discharge due to secondary emission. **(10 Marks)**
    b. Explain the following breakdown mechanism in solid.
        i)   Thermal breakdown
        ii) Electro mechanical breakdown. **(10 Marks)**

Module-2

3   a. Explain the cascade connection of transformer for producing very high AC voltage. **(07 Marks)**
    b. With a neat sketch explain the working of 4 stage cock craft Walton DC generator. **(10 Marks)**
    c. Write a short note on Wave front and Wave tail. **(03 Marks)**

OR

4   a. A 100kVA, 400V/250KV testing transformer has 8% leakage reactance and 2% resistance on 100kVA base. A cable has to be tested at 500kV using the above transformer as a resonant transformer at 50Hz. If the charging current of the cable at 500kV is 0.4A, find the series inductance required. Assume 2% resistance for the inductor to be used and the connecting leads. Neglect dielectric loss of the cable. What will be the input voltage to the transformer? **(10 Marks)**
    b. Explain the construction and working of a three electrode gap tripping circuit used for the impulse generator. **(10 Marks)**

Module-3

5   a. With the help of neat sketch, explain the construction and working principle of generating voltmeter and bring out the advantages and disadvantages. **(10 Marks)**
    b. With a neat sketch, explain principle working and construction of electrostatic voltmeter. **(10 Marks)**

OR

6   a. A Rogowski coil is to be designed to measure impulse currents of 10KA having a rate of change of current of $10''$ A/S. The current is read by a TVM as a potential drop across the integrating circuit connected to the secondary. Estimate the value of mutual inductance, resistance and capacitance to be connected. If the meter reading is to be 10V for full scale deflection. **(08 Marks)**

b. Explain the chubb-fortscue method for measurement of peak value of an ac voltage waveform. **(07 Marks)**

c. What are the various factors influencing the spark over voltage of sphere gaps and explain any 2 factors. **(05 Marks)**

Module-4

7 a. Explain the surge arrestor with neat diagram. **(10 Marks)**

b. Explain the principle of insulations coordination on HV and EHV power systems. **(10 Marks)**

OR

8 a. Explain the charge formation in the clouds and also explain rate of charging of thunder clouds. **(08 Marks)**

b. Write short notes on:
   i) Expulsion gaps
   ii) Protector tubes
   iii) Rod gaps. **(12 Marks)**

Module-5

9 a. With the help of a diagram of Schering bridge explain how capacitance and $\tan\delta$ can be measured. **(10 Marks)**

b. Explain in brief the method of discharge detection using straight detector. **(10 Marks)**

OR

10 a. What are the tests on transformers and explain in detail the impulse testing of transformer. **(10 Marks)**

b. Explain in details the testing of circuit breakers and isolators. **(10 Marks)**

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