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10EE73

Seventh Semester B.E. Degree Examination, Aug./Sept.2020
High Voltage Engineering

Time: 3 hrs.

Max. Marks:100

Note: Answer any FIVE full questions, selecting atleast TWO questions from each part.

PART – A

1.
 - a. Explain in brief the need for generating high voltages in the laboratory. (04 Marks)
 - b. With a neat sketch, explain the working principle of electrostatic precipitator. (08 Marks)
 - c. With a neat figure, describe the working of electrostatic separator based on charging by ion bombardment. (08 Marks)
2.
 - a. Explain the process of ionization by collision and hence derive the “Townsend’s current growth equation”. (10 Marks)
 - b. What is meant by time lag of breakdown? Explain briefly formative time lag and statistical time lag. (06 Marks)
 - c. In an experiment in a certain gas it was found that the steady state current is 5.5×10^{-8} A at 8KV at a distance of 0.4cm between the plane electrodes. Keeping the field constant and reducing the distance to 0.1cm results in a current of 5.5×10^{-9} A. Calculate Townsend’s primary ionization co-efficient α . (04 Marks)
3.
 - a. What are the limitations of Townsend theory and explain the Streamer’s theory? (08 Marks)
 - b. Explain suspended particle theory as applied to liquids. (06 Marks)
 - c. Explain the thermal breakdown of solid dielectrics. (06 Marks)
4.
 - a. Explain with the help of a neat sketch, the construction and working principle of cascading of transformers for three units. (10 Marks)
 - b. A Cockcroft – Walton type voltage multiplier has eight stages with capacitances, all equal to $0.05\mu\text{F}$. The supply transformer secondary voltage is 125 KV at a frequency of 150 Hz. If the load current to be supplied is 5mA, find i) the percentage ripple ii) the regulation iii) the optimum number of stages for minimum regulation or voltage drop. (10 Marks)

PART – B

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5.
 - a. With the help of the neat diagram, explain how lightning impulse voltage can be developed in the laboratory by Marx circuit. (08 Marks)
 - b. Explain with a neat circuit diagram, the tripping of an impulse generator with a three electrode gap method. (08 Marks)
 - c. A 12 stage impulse generator has $0.126 \mu\text{F}$ capacitors. The wave - front and the Wave – tail resistances connected at 800 ohms and 5000 ohms respectively. If the load capacitor is 1000 PF, find the front and tail times of the impulse wave produced. (04 Marks)
6.
 - a. Explain the series resistance microammeter used in HVDC measurement. Write the limitations of the method. (08 Marks)
 - b. Explain the principle and construction of an electrostatic voltmeter for the measurement of high voltages. (08 Marks)



- c. A generating voltmeter has to be designed, so that it can have a range from 20 to 200 KV dc. If the indicating meter reads a minimum current of $2\mu\text{A}$ and maximum current of $25\mu\text{A}$, what should capacitance of the generating voltmeter be? Assume that the driving motor speed is 1500 r.p.m. (04 Marks)
- 7 a. Discuss the method of straight detection for locating partial discharges in electrical equipment. Show the partial discharge pattern. (10 Marks)
- b. A 33 KV, 50Hz high voltage Schering bridge is used to test a sample of insulation. The various arms of the bridge at balance are : Standard capacitor of 500 pF ; Resistive branch is 800 ohm ; Branch with parallel combination of resistor and capacitor has values 180 ohms and 0.15 μF . Determine the value of the capacitance (sample) , its parallel equivalent loss resistance , the power factor and the power loss under the test conditions. (10 Marks)
- 8 a. Explain with a neat schematic diagram, the synthetic testing of circuit breakers. Show the current and recovery voltage waveforms across the test circuit breaker. (10 Marks)
- b. Discuss the dry and wet flashover tests on an insulator. (10 Marks)
