



CBCS SCHEME

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Seventh Semester B.E. Degree Examination, Jan./Feb. 2023 High Voltage Engineering

Time: 3 hrs.

Max. Marks: 80

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

Module-1

- 1 a. Derive an expression for the current in the airgap that is $i = i_0 e^{\alpha d}$ considering Townsend first ionization co-efficient. (06 Marks)
- b. Explain briefly suspended particle theory of breakdown in liquid dielectric. (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 of 0.1cm results in a current of 5.5×10^{-9} A. Calculate Townsend's primary ionization coefficient ' α '. (04 Marks)

OR

- 2 a. Explain the following mechanism in solid:
i) Electromechanical breakdown
ii) Thermal breakdown. (08 Marks)
- b. What is Paschen's law? How do you account for the minimum voltage for break down under a given "P × D" condition? (08 Marks)

Module-2

- 3 a. Explain the working of Cockcraft-Walton voltage multiplier circuit schematic diagram. (08 Marks)
- b. Explain the 3-stage cascaded transformers for generation of HVAC. List the advantages of high frequency transformers. (08 Marks)

OR

- 4 a. Explain the Mark's circuit arrangement for multistage impulse generator with a neat diagram. (08 Marks)
- b. An impulse generator has eight stages with each condenser rated for 0.16μF and 125kV. The load capacitor is of 1000pF. Find the series and damping resistance needed to produce 1.2/50μs impulse wave. What is the maximum output voltage of the generator if the charging voltage is 120kV? (08 Marks)

Module-3

- 5 a. Describe Chubb and Eortescue method for measurement of peak value of an AC voltage. (08 Marks)
- b. Explain principle, working and construction of electrostatic voltmeter. (08 Marks)

OR

- 6 a. Explain the cathode ray oscilloscope for impulse measurement. (10 Marks)
- b. Explain with schematic diagrams how DC current can be measured using DC current transformers. (06 Marks)

Module-4

- 7 a. Explain the different theories of charge formation in clouds. (08 Marks)
b. Explain the different methods employed for lightning protection of overhead lines. Explain them. (08 Marks)

OR

- 8 a. Explain with suitable figures the principles and functioning of i) Expulsion gaps (10 Marks)
ii) Protector tubes.
b. A 3-phase single circuit transmission line is 400km long. If the line is rated for 220kV and has the parameters $R = 0.1\Omega/\text{km}$, $L = 1.26\text{mH}/\text{km}$, $C = 0.009\mu\text{F}/\text{km}$ and $G = 0$. Find: i) The surge impedance ii) The velocity of propagation neglecting the resistance of the line. If a surge of 150kV and infinitely long tail strikes at one end of the line, what is the time taken for the surge to travel to the other end of the line? (06 Marks)

Module-5

- 9 a. Discuss the method of discharge detection using straight detector. (08 Marks)
b. Describe a high voltage Schering bridge to measure the capacitance and dissipation factor of sample of dielectric with neat diagram. (08 Marks)

OR

- 10 a. Explain in detail the testing of circuit breaker and insulators. (08 Marks)
b. Explain with a schematic diagram, the synthetic testing procedure on valve units in HVDC systems. (08 Marks)
