

CBCS SCHEME

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18EE56

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

Time: 3 hrs.

Max. Marks: 100

*Note: 1. Answer any FIVE full questions, choosing ONE full question from each module.
2. Assume any missing data suitably.*

Module-1

- 1 a. Derive an expression for the current growth in the air gap considering Townsend first ionization coefficient. (08 Marks)
- b. What is Paschen's law? How do you account for the minimum voltage for breakdown under a given PXD condition? (08 Marks)
- c. List the three important properties of liquid dielectrics. (04 Marks)

OR

- 2 a. List the various breakdown mechanisms in solid dielectrics and explain thermal breakdown. (08 Marks)
- b. Explain briefly suspended particle theory of breakdown in liquid dielectric. (06 Marks)
- c. What is meant by time lag of breakdown? Explain statistical and formative time lag. (06 Marks)

Module-2

- 3 a. Explain the working of Cockcroft – Walton type voltage multiplier circuit with schematic diagram. (06 Marks)
- b. Describe with a neat sketch, the working of a Vande Graaff generator. (06 Marks)
- c. With a circuit diagram, explain the tripping of an impulse generation with three electrode gap arrangement. (08 Marks)

OR

- 4 a. What are the advantages of high frequency transformers? Explain the 3-stage cascaded transformer for generation of HVAC. (10 Marks)
- b. Explain with schematic diagram the Marx circuit of multistage impulse generator incorporating the series and wave tail resistances within the generator. (06 Marks)
- c. A 12-stage impulse generator has $0.126 \mu\text{F}$ capacitors. The wave-front and wave-tail resistances connected are 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)

Module-3

- 5 a. Explain the various factors that affect the spark over voltage of sphere gap. (08 Marks)
- b. With a block diagram, explain the cathode ray oscilloscope for impulse measurement. (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 the capacitance of the generating voltmeter be? (04 Marks)

OR

- 6 a. With a schematic diagram, explain the principle of operation of a generating voltmeter. (08 Marks)
- b. With a neat sketch, explain the working of Rogowski coil for high impulse current measurement. (06 Marks)
- c. Explain how peak value of high voltage AC is measured using Chubb-Frotschue method. (06 Marks)

Module-4

- 7 a. Write the classification of transmission lines and explain any one. (06 Marks)
- b. Explain the successive reflections and lattice diagrams. (06 Marks)
- c. What is direct and indirect lightning stroke? Give reasons for induced voltage on the power line due to indirect stroke. (08 Marks)

OR

- 8 a. List the parameters to be considered for the selection of surge arrester voltage rating for EHV and UHV. Also explain the types of surge arresters used. (10 Marks)
- b. Explain with suitable figures the principle and functioning of
(i) Expulsion Gaps (ii) Protector tubes. (10 Marks)

Module-5

- 9 a. With a necessary circuit diagram and pattern explain discharge detection using straight detector for partial discharge measurement. (10 Marks)
- b. Explain the method of measuring dielectric loss at power frequency using high voltage Schering bridge. (10 Marks)

OR

- 10 a. Explain the different methods of conducting short circuit tests on circuit breakers. (10 Marks)
- b. Explain the power frequency tests and impulse tests for
(i) Insulators (ii) Bushings. (10 Marks)
