

# CBCS SCHEME



18EE56

## Fifth Semester B.E. Degree Examination, July/August 2022 High Voltage Engineering

Max. Marks: 100

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

### Module-1

- 1 a. What is Paschens law? Discuss to measure the minimum voltage for breakdown under a given " $p \times d$ " condition. (08 Marks)
- b. Explain the bubble theory and suspended particle theory of breakdown in liquid. (08 Marks)
- c. What will the breakdown strength of air be for small gaps (1mm) and large gaps (20cm) under uniform field conditions and standard atmospheric conditions? (04 Marks)

OR

- 2 a. Define Toronsend's first and second Ionization mechanism co-efficient. Derive an expression for the current in the air gap considering Toronsend secondary ionization coefficient. (10 Marks)
- b. Explain the following breakdown mechanism in solid:
  - i) Electromechanical breakdown
  - ii) Thermal breakdown. (10 Marks)

### Module-2

- 3 a. With a neat sketch, explain the working of four stage Cockcroft Walton D.C generator with waveform. (10 Marks)
- b. Explain the cascade connection of transformer for producing very high A.C voltage. (07 Marks)
- c. Describe wave front and wave tail time of an impulse voltage wave with sketch. (03 Marks)

OR

- 4 a. Explain the construction and working of a three electrode gap tripping circuit used for the impulse generator. (10 Marks)
- b. 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 500KVA 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)

### Module-3

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

OR

- 6 a. Explain the Chubb-Frotschue method for measurement of peak value of an A.C. voltage waveform. (08 Marks)
- b. What are the various factors influencing the spark over voltage of sphere gaps and explain any two factors. (05 Marks)
- c. A Rogowski coil is to be designed to measure impulse currents of 10kA having a rate of change of current of  $10^{11}$  A/S. The current is read by a TVM as a potential drop across the integrating circuit connected to the secondary. Estimate the values of mutual inductance, resistance and capacitance to be connected, if the meter reacting is to be 10V for full-scale deflection. (07 Marks)

Module-4

- 7 a. Explain the working principle of surge arrester with neat diagram. (10 Marks)
- b. Explain the principle of insulation coordination on HV and EHV power systems and criterion to be adopted. (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 a short notes on:  
i) Expulsion gaps  
ii) Protector tubes. (06 Marks)
- c. 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)

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Module-5

- 9 a. Explain in brief the method of discharge detection using straight detector. (10 Marks)
- b. With the help of a Schering bridge diagram explain how capacitance and  $\tan\delta$  can be measured. (10 Marks)

OR

- 10 a. Explain in detail the testing of isolators and circuit breakers with neat diagram. (10 Marks)
- b. Explain the types of testing on transformers and explain in detail with neat circuit diagram of impulse testing. (10 Marks)

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