



CBCS SCHEME

18EE56

Fifth Semester B.E. Degree Examination, July/August 2021 High Voltage Engineering

Time: 3 hrs.

Max. Marks: 100

Note: Answer any FIVE full questions.

1. a. What is Paschen's law? How do you account for the minimum voltage for breakdown under a given "p × d" condition? (06 Marks)
b. Derive an expression for the current in the air gap that is $i = i_0 e^{\alpha d}$ considering Townsend's first ionization co-efficient. (07 Marks)
c. In an experiment in a certain gas it was found that the steady state current is 5.5×10^{-8} A at 8 KV at a distance of 0.4 cm between the plane electrodes. Keeping the field constant and reducing the distance to 0.1 cm results in a current of 5.5×10^{-9} A. Calculate Townsend's primary ionization coefficient α . (07 Marks)
2. a. Explain briefly Bubble theory of breakdown in liquid dielectrics. (05 Marks)
b. Explain suspended particle theory of breakdown in liquid dielectric. (05 Marks)
c. Explain the following breakdown mechanism in solid dielectrics, (10 Marks)
 - (i) Electro Mechanical breakdown.
 - (ii) Thermal breakdown.
3. a. Explain with a neat diagram and waveforms the voltage multiplier circuit using Cockcraft-Walton principle. (07 Marks)
b. A Cockcraft-Walton type voltage multiplier has 10 stages with capacitance all equal to 0.08 μ F. The supply transforms secondary voltage is 115 KV at a frequency of 150 Hz. If the load current to be supplied is 10 mA, find: (08 Marks)
 - (i) Average ripple.
 - (ii) The regulation.
 - (iii) The optimum number of capacitors for minimum regulation or voltage drop.
- c. Explain the necessary of using isolating transformers for excitation with cascade transformer units, if the power requirement is large? (05 Marks)
4. a. With neat sketch, explain the Mark's circuit arrangement for multistage impulse generator. (07 Marks)
b. Define the wave front and wave tail times of an impulse voltage wave. What are the percentage tolerances for a standard lighting impulse wave? (06 Marks)
c. Calculate the front and tail resistance for 5 stages. 1000 KV with capacitance of each stage is 5 μ F and a load capacitance of 10000 pF for 1 μ s front and 50 μ s tail wave. (07 Marks)
5. a. Explain the working principle of generating voltmeter with a diagram. (08 Marks)
b. A generating voltmeter is required to measure voltage between 15 KV to 250 KV. If the indicating meter reads a minimum current of 2 μ A and a maximum of 35 μ A, determine the capacitance of the generating voltmeter. The speed of the drive motor is 1500 rpm. (04 Marks)
c. What is Rogowski coil? Explain with a neat diagram its principle of operation for measurement of high impulse currents. (08 Marks)

- 6 a. Explain the factors that influence the measurement of high voltage using sphere gaps. (08 Marks)
b. Write a note on Cathode-Ray oscillographs for impulse measurements. (08 Marks)
c. How is a compensated dc potential divider used to measure the dc voltage in HVDC systems? (04 Marks)
- 7 a. Explain the different theories of charge formation in clouds. (08 Marks)
b. With suitable figs explain the principles and functioning of,
(i) Expulsion gaps (ii) Protector tubes (08 Marks)
c. Write a note on characteristics of lightning strokes. (04 Marks)
- 8 a. Write a note on surge arresters. (08 Marks)
b. Explain the principles of insulation coordination on HV and EHV power system. (08 Marks)
c. Write a note on insulation levels at substations with protective zones. (04 Marks)
- 9 a. Explain the operation of Schering bridge for three terminal measurements. (10 Marks)
b. Explain discharge detection using straight detector for partial discharge measurement. (10 Marks)
- 10 a. A 33 KV, 50 Hz, high voltage Schering Bridge is used to test a sample of insulation. The various arms have the following parameters on balance. The standard capacitance 500 pF, the resistive branch 500 ohms and branch with parallel combination R and C, has 180 Ω and 0.15 μ F. Determine the value of capacitance of this sample, its parallel equivalent loss resistance, the PF and power loss under these conditions. (08 Marks)
b. Write a short note on testing of cables. (05 Marks)
c. Explain the methods to test the insulators and bushings. (07 Marks)

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