

Seventh Semester B.E. Degree Examination, Dec.08/Jan.09

High Voltage Engineering

3 hrs.

Max. Marks:100

Note: Answer any FIVE full questions.

1.
 - a. Explain need for generation of high voltages in laboratory. (04 Marks)
 - b. Mention important applications of high voltages. (02 Marks)
 - c. What are limitations of Townsend's theory of breakdown in gases? Explain Streamer theory of breakdown. (10 Marks)
 - d. In an experiment to determine α value in a gas, the measured values of currents under uniform electric field and constant E/P (E=Electric field; P=gas pressure) conditions were, 5×10^{-10} Amp and 3×10^{-9} Amp for gap distances of 4mm and 10mm respectively. Calculate value of α . Neglect secondary ionization effects. (04 Marks)
2.
 - a. State important properties of insulating liquids. (04 Marks)
 - b. Describe suspended particle theory of breakdown in liquids. (06 Marks)
 - c. Define 'Intrinsic Breakdown strength' of solid insulating materials. Explain thermal breakdown phenomena in solids. (10 Marks)
3.
 - a. Describe resonant transforms for generation of high AC voltages. What are their advantages and disadvantages? (08 Marks)
 - b. With neat sketches describe Cockroft Walton voltage doubler circuit. (06 Marks)
 - c. A Cockroft Walton type voltage multiplier has 10 stages with capacitances all equal to 0.1 μ f. The supply transformer secondary voltage is 100kV (rms) and frequency is 50 Hz. For a load current of 5 mA, calculate ripple voltage and maximum output DC voltage. (06 Marks)
4.
 - a. Define : (i) Standard lightning impulse voltage wave. (ii) Standard lightning impulse current wave. (04 Marks)
 - b. Describe the method of generation of impulse currents. Derive the related mathematical formulae. How are capacitors arranged in such circuits? (10 Marks)
 - c. An impulse voltage generator consists of 15 stages and capacitance (C_2) is 2000Pf. Calculate the values of series and shunt resistances required to generate a voltage waveshape $t_r=1.0\mu$ s and $t_f=40.0\mu$ s. (06 Marks)
5.
 - a. Describe Chubb and Fortescue method of measurement of high AC voltages. Discuss accuracy involved in the measurements. (10 Marks)
 - b. Briefly explain the factors affecting measurement of voltages using standard sphere gaps. (06 Marks)
 - c. The following are details referring to measurement of AC voltages by Chubb and Fortescue method.
HV capacitance = 10 Pf; Frequency = 50 Hz; DC current indicated by microammeter in one half cycle = 50 micro-amp. What is rms value of measured voltage? (04 Marks)
6.
 - a. Describe method of measurement of impulse voltages using potential dividers. What errors can enter into the measurements? (10 Marks)
 - b. Explain method of measurement of capacitance and $\tan \delta$ using H.V. Schering bridge. (10 Marks)
7.
 - a. Name and explain in brief different tests that are carried out on high voltage insulators. (12 Marks)
 - b. Why partial discharge tests are performed on H.V cables? Describe partial discharge testing of cables. (08 Marks)
8. Write short notes on any FOUR of the following: (20 Marks)
 - a. Corona and its effects on HV transmission lines.
 - b. Generation of switching impulse voltages.
 - c. Trigatron spark gap for triggering of impulse generators.
 - d. Electrostatic voltmeter.
 - e. Transformer ratio arm bridge.