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10EE73

Seventh Semester B.E. Degree Examination, June/July 2017
High Voltage Engineering

Time: 3 hrs. Max. Marks:100

Note: ***Answer any FIVE full questions, selecting atleast TWO questions from each part.***

PART – A

1 a. Explain the need for generation of high voltages in the laboratory. Mention its applications. **(05 Marks)**

b. What are the advantages of transmitting electrical power at high voltage? Mention the industrial applications of high voltage. **(05 Marks)**

c. Describe the working principle of electrostatic precipitator and electrostatic painting. **(10 Marks)**

2 a. Define Townsend's first and second ionization co-efficient. Derive an expression for the current growth in a gas discharge due to secondary mechanism. **(10 Marks)**

b. What are electronegative gases? Why is the breakdown strength of these gases higher compared to that of other gases? **(05 Marks)**

c. A steady current of 600μA flows through the plane electrode separated by a distance of 0.5cm, when a voltage of 10KV is applied. Determine the Townsends's first ionization co-efficient if a current of 60μA flows when the distance of separation is reduced to 0.1cm and the field is kept constant at the previous value. **(05 Marks)**

3 a. What is thermal breakdown in "solid dielectrics" and how it is practically more significant than other mechanisms? **(06 Marks)**

b. Explain briefly suspended particle theory of breakdown in liquid dielectrics. **(06 Marks)**

c. The following observations were made in an experiment for determination of dielectric strength of transformer oil. Determine the power law equation :

Gap spacing (mm)	4	6	8	10
Breakdown voltage (KV)	88	135	165	212

(08 Marks)

4 a. Describe the working of a 3–stage Cockcroft–Walton's cascaded DC–generator. Derive the expressions for ripple and output voltage. **(08 Marks)**

b. With the help of a neat sketch, explain the construction and working principle of cascading of transformers of three units, for producing very high "AC" voltage. **(06 Marks)**

c. A ten-stage Cockcroft–Walton circuit has all capacitors of 0.06μF. The secondary voltage of the supply transformer is 100 KV at a frequency of 150Hz. If the load current is 1 mA determine i) voltage regulation ii) the ripple iii) the optimum number of stages for maximum output voltage. **(06 Marks)**

PART – B

5 a. Describe the method of generation of impulse currents. Derive the related mathematical formulae. How are capacitors arranged in such circuits? **(07 Marks)**

b. Describe the Tesla coil with its equivalent circuit and output waveforms. Give the application of Tesla coil. Show that $v_2 = v_1\sqrt{\frac{c_1}{c_2}\eta}$ with usual notations. **(07 Marks)**

c. An impulse generator has eight stages with each capacitor rated for 0.16 micro-farad and 125 KV the load capacitor available is 1000 Pico-farad. Find the series resistance and the damping resistance needed to produce 1.2/50 micro–second impulse wave. What is the maximum output voltage of the generator if the charging voltage is 120 KV? **(06 Marks)**

6 a. Discuss how resistance potential dividers are used to mesure high voltages. Explain the effect of stray capacitances on such measurements and also suggest suitable remedial measure. **(10 Marks)**

b. Describe with a neat sketch the working of a generating voltmeter used to measure high DC voltages. **(06 Marks)**

c. An absolute electrostatic voltmeter has a moveable circular plate 8cms in diameter. If the distance between the plates during a measurement is 4mm and the applied voltage is 1 KV. Calculate the force on the plate [Assume medium as having $E_r = 1$]. **(04 Marks)**

7 a. What are partial discharges? Explain with a neat diagram the principle of pulse current measurement of partial discharges by straight detection technique. **(07 Marks)**

b. Describe the Schering bridge method of determining the capacitance and loss angle of a dielectric specimen. Derive the relevant formulae. **(07 Marks)**

c. A 33KV, 50Hz high voltage Schering bridge is used to test a sample of insulation. The various arms have the following parameters on balance. The standard capacitance 500pF the resistive branch 800ohm and branch with parallel combination of resistance and capacitance has valued 180 ohms and 0.15μF. Determine the value of the capacitance of this sample its parallel equivalent loss resistance the power factor and the power loss under these test conditions. **(06 Marks)**

8 a. With a neat diagram, explain the impulse testing of transformers. How are the faults detected and located? **(08 Marks)**

b. Mention the different power frequency tests that are carried out in practice on HV insulators. Explain the procedure of conducting each of these tests. **(08 Marks)**

c. Explain any one method of testing cables. **(04 Marks)**

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