USN | | | | | | | | | |

10EE73

Seventh Semester B.E. Degree Examination, June/July 2019
High Voltage Engineering

Time: 3 hrs. Max. Marks:100

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

PART – A

1 a. What are the advantages of transmitting a certain amount of electrical power at a high voltage? Assume the power factor, current density and reactance of the line to remain unchanged. **(09 Marks)**

b. Explain the need for generating high voltages in laboratory. **(04 Marks)**

c. What is the use of an electrostatic precipitator? With a neat schematic diagram describe in short principle of its operation. **(07 Marks)**

2 a. Define Townsend's first and second ionization coefficients. **(04 Marks)**

b. Derive Paschen's law and draw Paschen's curve in respect of a gas subjected to a uniform static electric field. **(08 Marks)**

c. In a Townsend experiment conducted on a certain gas it was found that the steady state current (the secondary ionization can be ignored) is 6×10^{-8} A at 10 kV at a gap spacing of 0.4 cm between electrodes. Keeping the field constant and reducing the distance to 0.2 cm a current of 10×10^{-9} A was obtained. Calculate Townsend's first ionization coefficient, α. However, the gas broke down when the gap distance was increased to 1.0 cm. What is the second ionizing coefficient, γ? **(08 Marks)**

3 a. Describe the mechanism of breakdown of a commercial liquid dielectric due to gaseous bubbles. **(06 Marks)**

b. Explain the mechanism of thermal breakdown in solid insulating materials. **(06 Marks)**

c. Discuss in brief the streamer mechanism of breakdown of a gaseous insulation. **(08 Marks)**

4 a. Explain with a neat diagram the cascade connection to obtain 750 kV, 50 Hz using three winding testing transformers, each rated at 230V/250kV/230V. **(10 Marks)**

b. An eight stage Cockroft-Walton type cascade circuit with capacitances all equal to 0.05 μF is fed from 150 kV, 150 Hz. If 3.5 mA current is to be supplied to the load, determine:
i) The ripple
ii) Voltage drop and regulation
iii) Optimum number of stages for maximum output voltage. **(10 Marks)**

PART – B

5 a. With a neat diagram, explain what is meant by a 1500 kV, 1.2/50 voltage. **(04 Marks)**

b. Derive an expression for the output voltage of the single stage impulse generator shown in Fig.Q5(b). The spark gap G breaks down the moment C_1 is charges to V_0.

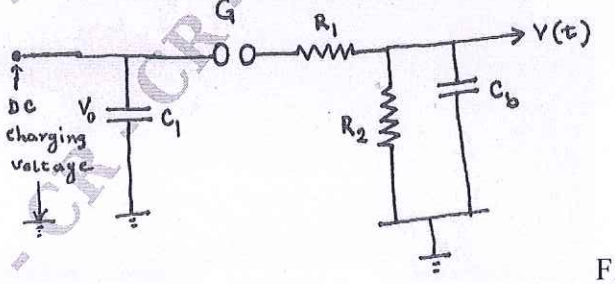

Fig.Q5(b) **(10 Marks)**

c. An 8 stage impulse voltage generator has 0.12 μF capacitors rated at 167 kV. What is the maximum discharge energy? It has to produce s 1/50 wave form across a load capacitor of 15000 pf. Find a rough estimate of WFR and WTR. **(06 Marks)**

6 a. Describe Chubb-Fortescue method for measurement of peak value of ac voltage. **(08 Marks)**

b. Explain the principle of an electrostatic voltmeter. Show that it measures d.c. voltage and rms value of ac voltage. **(08 Marks)**

c. An absolute electrostatic voltmeter has a movable circulate plate of 8 cm diameter. If the spacing between the plates is 4 mm and the applied voltage is 1 kV d.c. Calculate the force on the plate. $\epsilon_0 = 8.854 \times 10^{-12}$ F/m, $\epsilon_r = 1$. **(04 Marks)**

7 a. Show the two circuit models to represent a lossy capacitor. What is tans? Explain its significance? **(04 Marks)**

b. With a neat diagram describe a high voltage Schering bridge to measure the capacitance and dissipation factor of a sample of a dielectric. **(10 Marks)**

c. A 33 kV, 50 Hz, H.V. Schering bridge is used to test a sample of insulation. The various arms have the following parameters at balance. The standard air capacitor is 500 pF and the resistive branch is 8000 Ω. The branch with parallel combination of resistance and capacitance have the values of 180 Ω and 0.15 μF. Determine the parameters of the sample, the loss angle and power factor under these conditions. **(06 Marks)**

8 a. Describe the high voltage tests conducted on a suspension insulator string touching on the following points:

i) Experimental arrangement
ii) High voltage tests of different types
iii) Salt fog test **(10 Marks)**

b. Describe the lightning impulse tests conducted on a power transformer in the laboratory. **(10 Marks)**

* * * * *