CBCS SCHEME

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18EE56

Fifth Semester B.E. Degree Examination, June/July 2023
High Voltage Engineering

Time: 3 hrs. Max. Marks: 100

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

Module-1

1 a. Derive an expression for the current in the air gap, that is $I = I_0 e^{\alpha d}$, considering Townsend's first ionization coefficient. **(08 Marks)**

b. Mention the desired properties of gaseous dielectric for HV applications. Given any three examples of gaseous dielectric. **(06 Marks)**

c. In an experiment in a certain gas, it was found that the steady state current is 5.5×10^{-8}A at 8KV at a distance of 0.4cm between the plane electrodes, keeping the field constant ad reducing the distance to 0.1cm results in a current of 5.5×10^{-9}A. Calculate Townsend's primary ionization coefficient α. If the break down occurred when the gap distance was increased to 0.9cm, what is the value of Townsend's secondary ionization coefficient γ. **(06 Marks)**

OR

2 a. Explain the following breakdown mechanism in solid :
i) Electromechanical breakdown
ii) Thermal breakdown. **(08 Marks)**

b. State and explain Paschen's law. **(06 Marks)**

c. A solid dielectric specimen of dielectric constant of 4.0 shown in Fig.Q2(c) has an internal void of thickness 1mm. The specimen is 1cm thick and is subjected to a voltage of 80KV(RMS). If the void is filled with air and if the breakdown strength of air can be taken as 30KV(Peak)/cm, find the voltage at which an internal discharge can occur.

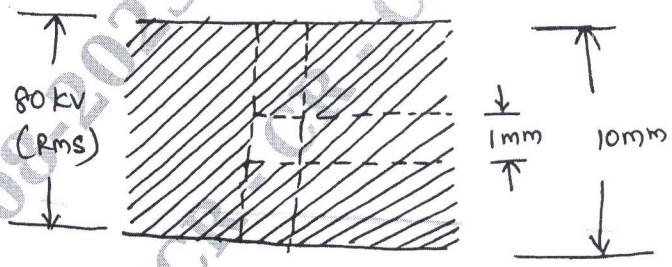

Fig.Q2(c) **(06 Marks)**

Module-2

3 a. Explain with a neat sketch, how 3-stage cascaded transformer generates HVAC. **(08 Marks)**

b. Explain the principle of operation of a resonant transformer. **(06 Marks)**

c. A Cock croft Walton type voltage multiplier has eight stages with capacitance, all equal to 0.05μF. The supply transformer secondary voltage is 125KV at a frequency of 150Hz. If the load current to be supplied is 5mA, Find :
i) percentage ripple ii) the regulation. **(06 Marks)**

OR

4 a. With a circuit diagram, explain the tripping of an impulse generation with three electrode gap arrangement. **(08 Marks)**

b. With a neat sketch, explain the Marx circuit arrangement for multistage impulse generator. **(06 Marks)**

c. What is Tesla Coil? How are damped high frequency oscillations can be obtained using the Tesla Coil? **(06 Marks)**

Module-3

5 a. With a schematic diagram, explain the principle of operation of a generating voltmeter. What are its advantages and limitations? **(10 Marks)**

b. Explain the principle of operation of an electrostatic voltmeter for measurement of very high dc and ac voltages. **(10 Marks)**

OR

6 a. Explain how Chubb and Frotscue circuit can be used to measure the peak value of ac voltages. **(08 Marks)**

b. What are the various factors influencing the spark over voltage of sphere gaps and explain any two factors. **(06 Marks)**

c. A generating voltmeter has to be designed so that it can have a range from 20 to 200KV dc. If the indicating meter reads a minimum current of 2μA and maximum current of 25μA, what should the capacitance of the generating voltmeter be? Assume the speed of the driving synchronous motor is 1500 RPM. **(06 Marks)**

Module-4

7 a. Explain different theories of charge formation in cloud. **(10 Marks)**

b. What is direct and indirect lightning stroke? Give reasons for induced voltage on the power line due to indirect stroke. **(10 Marks)**

OR

8 a. List the parameters to be considered for the selection of surge arrester voltage rating for EHV and UHV and also the types of surge arresters used. Explain function of surge arrestor as a shunt protective device with a neat sketch. **(10 Marks)**

b. A transmission line has the following line constants R = 0.1Ω/km, L = 1.26mH/km, c = 0.009μF/km and G = 0. If the line is a 3ϕ line and is charged form one end at a line voltage of 230KV, find the rise in voltage at the other end, if the line length is 400km. **(10 Marks)**

Module-5

9 a. With a necessary circuit diagram and pattern, explain discharge detection using straight detector for partial discharge measurement. **(10 Marks)**

b. Explain the method of measuring capacitance and tan delta using shearing bridge. **(10 Marks)**

OR

10 a. What are the various tests done on transformers? Explain in detail impulse testing of transformer. **(10 Marks)**

b. Explain in detail the testing of : i) Circuit breaker ii) Insulators. **(10 Marks)**

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