CBCS SCHEME

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15EE73

Seventh Semester B.E. Degree Examination, Aug./Sept.2020
High Voltage Engineering

Time: 3 hrs. Max. Marks: 80

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

Module-1

1 a. Define Townsends ionization coefficients and derive the combined current growth equations. **(07 Marks)**

b. With the aid of Paschen's curve and law explain its significance. **(06 Marks)**

c. Mention the desirable properties of a gaseous dielectric. **(03 Marks)**

OR

2 a. Explain how breakdown occurs in liquid dielectrics due to cavitation and bubble theory. **(04 Marks)**

b. Pertaining to breakdown in solid dielectrics explain:
i) Electromechanical Mechanism
ii) Thermal Mechanism. **(08 Marks)**

c. Determine the electromechanical breakdown voltage of a PMMC sheet of 4mm thick, relative permittivity 4, Youngs modulus of elasticity 1000kg/m^2 and permittivity of free space 8.85×10^{-12}F/m. The PMMC sheet is subjected to an impulse voltage. **(04 Marks)**

Module-2

3 a. With a neat sketch, explain the 3 stage cascade connection of transformers for generation of AC high voltages. **(06 Marks)**

b. Enumerate the advantages of series resonant circuit over cascade connection. **(06 Marks)**

c. An Eight stage; 1400KV impulse generator has a energy rating of 12kJ. Calculate:
i) DC charging voltage per stage
ii) Generator capacitance
iii) Stage capacitance. **(04 Marks)**

OR

4 a. Derive an expression for output voltage of a single stage impulse generator with basic circuit diagram and wave shape. **(05 Marks)**

b. Describe C-W type voltage doubler circuit operation under loading condition. **(05 Marks)**

c. A C-W type voltage multiplier has 10 stages with capacitances all equal to 0.1μF. The supply transformer secondary voltage is 100KV (RMS) and frequency is 50HZ. For a load current of 5mA, calculate:
i) Ripple voltage
ii) Voltage drop
iii) Maximum DC output voltage. **(06 Marks)**

Module-3

5 a. Describe Chubb and Fortescue method of measuring peak value of AC high voltages. **(06 Marks)**

b. With the help of a neat sketch, explain the construction and working principle of generating voltmeter. **(06 Marks)**

c. The following details refers to measurement of AC voltages by chubb and Fortescue method:
HV capacitance = 10pF
Frequency = 50Hz
DC current indicated by microammeter in one half of a cycle = 50μA
What is the rms value of a measured voltage? **(04 Marks)**

OR

6 a. Briefly explain the factors affecting the measurement of voltages using standard sphere gaps. **(08 Marks)**

b. Explain the series resistance micro ammeter method used in HVDC measurements. **(04 Marks)**

c. An electrostatic voltmeter has two parallel plates. The movable plate is 10cm in diameter with 10kV between the plates and the pull is 5×10^{-3}N. Determine the change in capacitance for a movement of 1mm due to movable plate. **(04 Marks)**

Module-4

7 a. Discuss the different theories of charge formation in cloud. **(08 Marks)**

b. How over voltages are being controlled due to switching at power frequency? Explain in brief. **(08 Marks)**

OR

8 a. Explain the principle of insulation co-ordination on HV and EHV power system. **(08 Marks)**

b. With a neat schematic diagram, explain a typical valve type lightening arrestor. **(08 Marks)**

Module-5

9 a. Describe the method of measuring capacitance and tan δ using HV schering bridge. **(08 Marks)**

b. What are partial discharges? And how they are defected under power frequency operating conditions. **(08 Marks)**

OR

10 a. Explain clearly the step by step procedure of testing: i) Insulators and ii) Cables. **(10 Marks)**

b. A 20KV, 50HZ schering bridge has a standard capacitance of 106μF. In a test on a Bakelite sheet the balance was obtained with a capacitance of 0.35μF in parallel with a non-inductive resistor of 318Ω. The non-inductive resistance in the remaining arm of the bridge being 130Ω. Determine the equivalent
i) Series resistance
ii) Capacitance and
iii) The power factor of the test specimen. **(06 Marks)**

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