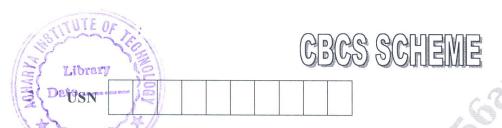
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15EE73

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

- 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.
 - c. Mention the desirable properties of a gaseous dielectric.

(06 Marks) (03 Marks)

OR

- 2 a. Explain how breakdown occurs in liquid dielectrics due to cavitation and bubble theory.
 - 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 $8.85 \times 10^{-12} \text{F/m}$. 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 $0.1\mu F$. The supply transformer secondary voltage is 100 KV (RMS) and frequency is 50 HZ. For a load current of 5 mA, 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 = 50μ A

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 $5 \times 10^{-3}N$. 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 $\tan \delta$ 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 $106\mu F$. In a test on a Bakelite sheet the balance was obtained with a capacitance of $0.35\mu F$ 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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