

# 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  $1000\text{kg/m}^2$  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)

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**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  $0.1\mu\text{F}$ . 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)

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.  
2. Any revealing of identification, appeal to evaluator and /or equations written eg,  $42+8=50$ , will be treated as malpractice.

**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 = 50 $\mu$ 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 lightning arrester. (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 detected 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 318 $\Omega$ . The non-inductive resistance in the remaining arm of the bridge being 130 $\Omega$ . Determine the equivalent  
 i) Series resistance  
 ii) Capacitance and  
 iii) The power factor of the test specimen. (06 Marks)

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