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10EE73

Seventh Semester B.E. Degree Examination, Jan./Feb. 2021
High Voltage Engineering

Time: 3 hrs.

Max. Marks:100

- Note:** 1. Answer FIVE full questions, selecting atleast TWO questions from each part.
 2. Missing data, if any, may be suitably assumed.
 3. Draw neat sketches wherever necessary.

PART – A

- 1 a. Explain the need for generating high voltages. (08 Marks)
 b. What are the various classes of high voltages to be generated in HV laboratory? (06 Marks)
 c. What are the industrial applications of high voltages? (06 Marks)
- 2 a. Define Townsend's first and second ionization coefficients and hence derive expressions for current growth in a gas subject to uniform electric fields due to primary and secondary processes. (12 Marks)
 b. State and explain Paschen's law. (04 Marks)
 c. A steady current of $600\mu\text{A}$ flows through the plane electrodes separated by a distance of 0.5cm when a voltage of 10KV is applied. Determine Townsends first ionization coefficient if a current of $60\mu\text{A}$ flows when the distance of separation is reduced to 0.1cm and the field is kept constant at the previous value. (04 Marks)
- 3 a. Explain the following mechanisms in the breakdown of solid dielectrics
 i) Electromechanical breakdown
 ii) Thermal breakdown. (10 Marks)
 b. Explain suspended particle mechanism in the breakdown phenomenon of liquid dielectrics. (06 Marks)
 c. A solid specimen of dielectric has a dielectric constant of 4.2 and $\tan \delta = 0.001$ at a frequency of 50Hz. If it is subjected to an alternating field of 50KV/cm, calculate the heat generated in the specimen due to dielectric loss. (04 Marks)
- 4 a. List the advantages of series resonant circuit. (06 Marks)
 b. A Cockroft Walton type voltage multiplier has eight stages with capacitances all equal to $0.05\mu\text{F}$. the supply transformer secondary voltage is 125KV at a frequency of 150Hz. If the load current to be supplied is 5mA, calculate :
 i) Percentage ripple and ii) Percentage regulation. (08 Marks)
 c. With the help of a schematic and waveform describe the working principle of Tesla coil. (06 Marks)

PART – B

- 5 a. With a suitable schematic explain the working principle of multistage impulse generator circuit. (08 Marks)
 b. A 12 stage impulse generator has $0.126\mu\text{F}$ condensers. The wavefront and wavetail resistances connected are 800Ω and 500Ω respectively. If the load condenser is 1000pF , find front and tail times of the impulse wave generated. (06 Marks)
 c. Explain one method of controlled tripping of impulse generators. Why is controlled tripping necessary? (06 Marks)

- 6 a. Explain the method of using series resistance with micro ammeter for measuring high dc voltages. List the drawbacks of this method. (08 Marks)
- b. Explain Chubb and fortescue method for measurement of high peak AC voltages. (06 Marks)
- c. Describe the factors affecting breakdown voltage of sphere gaps. (06 Marks)
- 7 a. Describe the Schering bridge method for determining the capacitance and loss angle of a dielectric material. (10 Marks)
- b. What are partial discharges? Explain the method of balanced detection for locating partial discharges in electrical equipment. (10 Marks)
- 8 a. Explain the method of impulse testing of high voltage transformers. (10 Marks)
- b. Explain the procedure of testing of cables. (10 Marks)
