

BIRLA INSTITUTE OF TECHNOLOGY, MESRA, RANCHI  
(END SEMESTER EXAMINATION MO/2022)

CLASS: B.TECH.  
BRANCH: EEE

SEMESTER: VII  
SESSION: MO/2022

SUBJECT: EE593 HIGH VOLTAGE ENGINEERING  
TIME: 03 HOURS FULL MARKS: 50

**INSTRUCTIONS:**

1. The question paper contains 5 questions each of 10 marks and total 50 marks.
2. Attempt all questions.
3. The missing data, if any, may be assumed suitably.
4. Tables/Data handbook/Graph paper etc., if applicable, will be supplied to the candidates

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- Q.1(a) What is meant by Electrical Breakdown? [2]  
Q.1(b) How is the electric stress/ electric field intensity controlled? [3]  
Q.1(c) Describe the current growth phenomenon in a gas subjected to a uniform electric field. [5]

- Q.2(a) State and explain Paschen's law. [2]  
Q.2(b) Describe the current growth phenomenon in a gas subjected to a uniform electric field. [3]  
Q.2(c) The following table gives experimental results for studying Townsend's mechanism. The field is kept constant. [5]

Gap Distance (mm)	Observed Current
0.5	$1.5 \times 10^{-13}$
1.0	$5.0 \times 10^{-13}$
1.5	$8.5 \times 10^{-13}$
2.0	$1.5 \times 10^{-12}$
2.5	$5.6 \times 10^{-12}$
3.0	$1.4 \times 10^{-10}$
3.5	$1.4 \times 10^{-10}$
4.0	$1.5 \times 10^{-9}$
5.0	$7.0 \times 10^{-7}$

The minimum current observed is  $6 \times 10^{-14}$  A. Determine the values of Townsend's first and second ionization coefficients.

- Q.3(a) What are commercial liquid dielectrics? How are they different from pure liquids? [2]  
Q.3(b) Explain how internal discharges through solid dielectrics lead to a breakdown. [3]  
Q.3(c) What is the effect of solid impurities in the oil on the breakdown strength of liquids? Why are electrical and thermal properties important for the liquid used in an apparatus like a transformer? [5]

- Q.4(a) What do you mean by a 2000kV, 1.2/50 impulse voltage? [2]  
Q.4(b) Discusses the different methods of measuring high dc voltages. What are the limitations of each method? [3]  
Q.4(c) A voltage multiplier has ten stages with capacitances, all equal to 0.05microfarad. The supply transformer secondary voltage is 100kV at a frequency of 100Hz. If the load current to be supplied is 5mA, find the regulation and percentage ripple. [5]

- Q.5(a) List the common test facilities available in high-voltage laboratories. [2]  
Q.5(b) Why is grounding essential in an HV laboratory? Describe a typical grounding system used. [3]  
Q.5(c) A generating voltmeter is required to measure voltage between 15kV to 250kV. If the indicating meter reads a minimum current of  $2 \mu\text{A}$  and a maximum current of  $35 \mu\text{A}$ , determine the capacitance of the generating voltmeter. [5]

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