

GUJARAT TECHNOLOGICAL UNIVERSITY

BE- SEMESTER-VII EXAMINATION – WINTER 2025

Subject Code:3170917

Date:20-11-2025

Subject Name:High Voltage Engineering

Time:10:30 AM TO 01:00 PM

Total Marks:70

Instructions:

1. Attempt all questions.
2. Make suitable assumptions wherever necessary.
3. Figures to the right indicate full marks.
4. Simple and non-programmable scientific calculators are allowed.

MARKS

- Q.1 (a) Give comparison between uniform and non-uniform Field. 03
(b) Explain the time lags for breakdown. 04
(c) Give methods for electric field computation and explain anyone. 07

- Q.2 (a) Differentiate between Commercial Liquid and pure Liquid. 03
(b) Explain treeing and tracking related to solid breakdown. 04
(c) Define Electric stress. Explain Electric field stress in homogeneous isotropic materials. 07

OR

- (c) Define Townsend's first and second ionization coefficients. Obtain Current growth equation due to first and second ionization. 07

- Q.3 (a) Draw & Discuss Equivalent circuit of partial discharge. 03
(b) Describe the working of a Van de Graff generator with a neat sketch. 04
(c) Explain capacitance voltage Transformer with its schematic representation, Equivalent circuit and its phasor diagram. 07

OR

- Q.3 (a) Discuss advantages and disadvantages of series parallel resonant circuit. 03
(b) Draw and explain Marx circuit and modified Marx Circuit of multistage impulse generator. 04
(c) Enlist different theories of breakdown in commercial liquids and explain any one of them. 07

- Q.4 (a) Enlist the breakdown mechanisms for solid dielectric. 03
(b) Explain particle exchange mechanism for vacuum breakdown. 04
(c) Explain the high voltage Schering bridge for the $\tan \delta$ and capacitance measurement. 07

OR

- Q.4 (a) Explain thermal breakdown in solid dielectric. 03
(b) Explain purification method for liquid dielectric. 04
(c) Explain principle of Electrostatic voltmeter and limitation of it for high voltage measurement. 07

- Q.5 (a) List out the common test facilities available in High Voltage Lab. 03
(b) Explain Metal Oxide Arrestor. 04
(c) Enlist the high voltage tests to be performed on power transformer and explain any one in detail with relevant sketch 07

OR

- Q.5** (a) What are the different methods of high DC voltage Measurement? **03**
Explain generating voltmeter method in detail.
- (b) Explain the tests to be carried out on an insulator. **04**
- (c) Describe various tests to be carried out on a circuit breaker. **07**

GUJARAT TECHNOLOGICAL UNIVERSITY**BE- SEMESTER-VII (NEW) EXAMINATION – WINTER 2024****Subject Code:3170917****Date:30-11-2024****Subject Name:High Voltage Engineering****Time:10:30 AM TO 01:00 PM****Total Marks:70****Instructions:**

1. Attempt all questions.
2. Make suitable assumptions wherever necessary.
3. Figures to the right indicate full marks.
4. Simple and non-programmable scientific calculators are allowed.

		MARKS
Q.1	(a) Why is the breakdown strength higher in electronegative gases than in other gases?	03
	(b) Obtain current growth equation due to Townsend's first and second ionization coefficients.	04
	(c) What are the mechanisms by which lightning strokes develop and induce over voltages on overhead power lines?	07
Q.2	(a) Explain suspended particle theory related to liquid breakdown.	03
	(b) What are the commercial liquids? Explain purification test cell system related to liquids.	04
	(c) Explain corona discharge. What are different factor affecting Corona losses? How Corona loss can be eliminated?	07
	OR	
	(c) What is paschen's law? Explain minimum voltage for breakdown under a given pd condition.	07
Q.3	(a) Explain Metal Oxide Arrestor.	03
	(b) Explain generating voltmeters used for measuring high voltage.	04
	(c) Describe the working of a Van de Graff generator with a neat sketch.	07
	OR	
Q.3	(a) What is surge arrester? Explain it's application in power system.	03
	(b) Discuss the method of balanced detection for locating partial discharges in electrical equipments.	04
	(c) Explain cascade transformer unit with isolating transformer for high alternating voltage generation.	07
Q.4	(a) Explain how a sphere gap can be used to measure the peak value of voltages.	03
	(b) List out the common test facilities available in High Voltage Lab.	04
	(c) A 12 stage impulse generator has $0.126\mu\text{F}$ capacitors. The wave front and wave tail resistances connected are 800Ω and 5000Ω respectively. If the load capacitor is 1000pF , find the front and tail times of the impulse wave produced.	07
	OR	
Q.4	(a) Explain Trigatron gap.	03
	(b) Enlist factors affecting ionization process and state processes responsible for gaseous breakdown.	04
	(c) Discuss the modified Marx circuit for generating an impulse wave and components used in it.	07
Q.5	(a) Discuss power frequency tests of insulator.	03
	(b) What is Finite Element Method? Brief it for solving the field problems	04
	(c) What is meant by insulation co-ordination? How are the protective devices chosen for optimal insulation level in a power system?	07

OR

- Q.5** (a) Discuss Hall effect in Hall generator. **03**
(b) Give comparison between uniform and non-uniform field. **04**
(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 the Townsend's first ionization constant 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 previous value. **07**

Seat No.: _____

Enrolment No. _____

GUJARAT TECHNOLOGICAL UNIVERSITY
BE - SEMESTER-VII (NEW) EXAMINATION – WINTER 2023

Subject Code:3170917

Date:08-12-2023

Subject Name: High Voltage Engineering

Time: 10:30 AM TO 01:00 PM

Total Marks:70

Instructions:

1. Attempt all questions.
2. Make suitable assumptions wherever necessary.
3. Figures to the right indicate full marks.
4. Simple and non-programmable scientific calculators are allowed.

		MARKS
Q.1	(a) Define the terms: breakdown, ionization, and homogeneous field.	03
	(b) Explain treeing and tracking related to solid breakdown.	04
	(c) Describe the working of a Van de Graff generator with a neat sketch.	07
Q.2	(a) Explain with diagrams, full wave rectifier circuit for producing high d.c.voltages.	03
	(b) Draw and explain Marx circuit and modified Marx Circuit of multistage impulse generator.	04
	(c) What is paschen's law? Explain minimum voltage for breakdown under a given pd condition.	07
	OR	
	(c) Explain how a sphere gap can be used to measure the peak value of voltages. What are the parameters and factors that influence such voltage measurement?	07
Q.3	(a) Draw & Discuss Equivalent circuit of partial discharge.	03
	(b) Explain particle exchange mechanism for vacuum breakdown.	04
	(c) Explain capacitance voltage Transformer with its schematic representation, Equivalent circuit and its phasor diagram.	07
	OR	
Q.3	(a) Discuss post breakdown phenomenon.	03
	(b) What are the commercial liquids? Explain purification test cell system related to liquids.	04
	(c) Explain electrostatic voltmeter in brief.	07
Q.4	(a) Explain front and tail times of an impulse wave with neat sketch.	03
	(b) How Potential Divider method used for measurement of high voltage DC with its limitations.	04
	(c) Discuss the modified Marx circuit and components used in it, for generating an impulse wave.	07
	OR	
Q.4	(a) Draw block diagram of Digital PD Analyser.	03
	(b) Discuss Rod Gap Arrester.	04
	(c) What is capacitance voltage transformer (CVT)? Explain tuned CVT for voltage measurement with phasor diagram.	07
Q.5	(a) List out the common test facilities available in High Voltage Lab.	03

- (b) Explain with neat sketch, testing transformer construction. **04**
(c) Define Townsend's first and second ionization coefficients. Obtain **07**
Current growth equation due to first and second ionization.

OR

- Q.5** (a) What is partial Discharges? **03**
(b) Discuss Hall effect in Hall generator. **04**
(c) Explain how partial discharges in an insulation system or equipment can **07**
bedetected and displayed.

GUJARAT TECHNOLOGICAL UNIVERSITY**BE - SEMESTER-VII (NEW) EXAMINATION – WINTER 2022****Subject Code:3170917****Date:10-01-2023****Subject Name:High Voltage Engineering****Time:10:30 AM TO 01:00 PM****Total Marks:70****Instructions:**

1. Attempt all questions.
2. Make suitable assumptions wherever necessary.
3. Figures to the right indicate full marks.
4. Simple and non-programmable scientific calculators are allowed.

MARKS

- | | | | |
|------------|------------|---|-----------|
| Q.1 | (a) | List out different methods of calculation of electric field and list out advantage and disadvantages of Finite Difference Method (FDM). | 03 |
| | (b) | Apply Townsend's Law to derive it's first ionization coefficients with their characteristics. | 04 |
| | (c) | Analyze Electronegative gases & Discuss the criteria for its breakdown. | 07 |
| Q.2 | (a) | What is difference between Commercial Liquid and pure Liquid? | 03 |
| | (b) | Explain purification and breakdown tests for Liquid Dielectric. | 04 |
| | (c) | Enlist different theories of breakdown in commercial liquids and explain any one of them. | 07 |
| OR | | | |
| | (c) | Explain solid breakdown due to treeing & tracking. | 07 |
| Q.3 | (a) | Describe with a neat sketch the working of a Van de Graff generator. | 03 |
| | (b) | Develop Marx circuit for multistage impulse generators. | 04 |
| | (c) | Construct the three stage cascade connection of transformers for producing very high A.C voltages | 07 |
| OR | | | |
| Q.3 | (a) | How a sphere gap can be used to measure the peak value of voltages. What are the factors that influence such voltage measurements? | 03 |
| | (b) | Explain with neat diagram the principles of operations of an electrostatic voltmeter. Discuss its advantages and Limitations for high voltage measurements. | 04 |
| | (c) | Explain capacitance voltage transformer with its schematic representation, Equivalent circuit & Phasor diagram. | 07 |
| Q.4 | (a) | Discuss factors affecting breakdown of gases. | 03 |
| | (b) | Discuss H.V testing of overhead line insulator. | 04 |
| | (c) | What is meant by insulation co-ordination? How are the protective devices chosen for optimal insulation level in power system? | 07 |
| OR | | | |
| Q.4 | (a) | Give comparison between uniform and non-uniform field. | 03 |
| | (b) | Explain briefly impulse testing of power transformer. | 04 |
| | (c) | Explain the lightning mechanism including stepped leader stroke and power return stroke with appropriate diagram. | 07 |
| Q.5 | (a) | What is the principle of operation of a resonant transformer? List out its advantage and disadvantages. | 03 |

- (b) Explain properties of transformer oil. **04**
- (c) A ten stage Cockcroft-Walton circuit has all capacitors of $0.06 \mu\text{F}$. The secondary voltage of the supply transformer is 100 kV at a frequency of 150 Hz. If the load current is 1mA determine: **07**
1. Voltage Regulation,
 2. The Ripple,
 3. The optimum number of stages for maximum output voltage

OR

- Q.5** (a) What are the different methods of high DC voltage Measurement? **03**
Explain generating voltmeter method in detail.
- (b) Discuss high voltage Schering bridge. **04**
- (c) A 12-stage impulse generator has $0.126 \mu\text{F}$ capacitors. The wave front and the wave tail resistances connected are 800Ω and 5000Ω respectively. If the load capacitor is 1000 pF , find the front and tail times of the impulse wave produced. **07**
