

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

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|------------|-----|---|-----------|
| 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**
