

Seat No.: _____

Enrolment No. _____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER-VI (NEW) EXAMINATION – WINTER 2023

Subject Code:2160904

Date:15-12-2023

Subject Name:High Voltage Engineering

Time:02:30 PM TO 05:00 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) | What is “conditioning of electrodes”? How does it affect breakdown in vacuum? | 03 |
| | (b) | Define Townsend’s first and second ionisation coefficients. Explain the Townsends criterion for a spark. | 04 |
| | (c) | State and explain Paschen’s law. How do you account for the minimum voltage for breakdown under a given pd condition? | 07 |
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| Q.2 | (a) | Discuss the application of gases in electric power apparatus | 03 |
| | (b) | Explain clearly suspended particle mechanism of liquid breakdown. | 04 |
| | (c) | Explain the mechanism of development of anode and cathode streamers and explain how these lead to breakdown. | 07 |
| <p style="text-align: center;">OR</p> | | | |
| | (c) | What is Finite Element Method for evaluation of field distribution. Discuss the procedure associated with this method and discuss its advantages and limitations. | 07 |
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| Q.3 | (a) | What is corona discharge? Explain briefly | 03 |
| | (b) | why a capacitive potential divider needs to be matched to the cable connecting it to an oscilloscope, and how the matching may be achieved | 04 |
| | (c) | Explain Thermal breakdown in solid dielectrics. How this mechanism is more significant than the other mechanisms | 07 |
| <p style="text-align: center;">OR</p> | | | |
| Q.3 | (a) | Show with the aid of suitable diagrams how the time lag characteristic of spark breakdown may be determined for the standard impulse voltage waveform | 03 |
| | (b) | Describe a high voltage Schering Bridge which uses a guarded standard capacitor, explaining how the guard is maintained at the required voltage during balance | 04 |
| | (c) | Explain with neat sketches Cockroft-Walton voltage multiplier circuit. Explain clearly its operation when the circuit is (i) unloaded (ii) loaded. | 07 |
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| Q.4 | (a) | With the aid of suitable diagrams briefly describe the test cell used in the measurement of dielectric constant and loss tangent of an insulating liquid. | 03 |
| | (b) | Derive an expression for voltage efficiency of a single stage impulse generator | 04 |
| | (c) | Explain clearly the basic principle of operation of an electrostatic generator. Describe with neat diagram the principle of operation, application and limitations of Van de Graf generator. | 07 |

OR

- Q.4** (a) Define the terms (i) Impulse voltages; (ii) Chopped wave; (iii) Impulse flash over voltage; (iv) Impulse puncture voltage; (v) Impulse ratio for flash over; (vi) Impulse ratio for puncture. **03**
- (b) With the aid of suitable diagrams briefly describe the use of sphere gaps in the measurement of high voltages **04**
- (c) Explain briefly various tests to be carried out on a bushing. **07**
- Q.5** (a) Explain the procedure for performing IR test **03**
- (b) A resonance method used to control the output of a high voltage test transformer. Why is this method not suitable for power transmission **04**
- (c) Explain with neat diagrams two different theories of charge generation and separation in a thunder cloud. **07**

OR

- Q.5** (a) List out various tests to be carried out on C.B **03**
- (b) What are partial discharges? Differentiate between internal and external discharges. **04**
- (c) Explain with neat diagram the principle of operation of an Electrostatic Voltmeter. Discuss its advantages and limitations for high voltage measurements **07**
