Reg. No. : | | | | | | | | | | | |

V 4170

B.E./B.Tech. DEGREE EXAMINATION, APRIL/MAY 2008.

Seventh Semester

Electrical and Electronics Engineering

EE 1402 — HIGH VOLTAGE ENGINEERING

(Common to B.E. (Part-Time) Sixth Semester Regulation 2005)

(Regulation 2004)

Time : Three hours

Maximum : 100 marks

Answer ALL questions.

PART A — ($10 \times 2 = 20$ marks)

1. What are meant by Switching Surges? Mention the approximate magnitude of Switching Surges and their frequency.

2. Why a simple spark gap cannot offer full protection against over voltages.

3. Define the following as applied to disruptive discharges :

   (a) Flash over

   (b) Spark over.

4. What is meant by Townsend's discharge? Explain its main features.

5. Mention the specification of impulse voltage as per Indian Standards.

6. What is the need for generating impulse currents.

7. Why we resort to statistical approach during breakdown due to impulse voltages.

8. What are high current shunts? Mention their design criteria.

9. What are atmospheric correction factors? Mention their significance.

10. Define Insulation Co-ordination.

PART B — (5 × 16 = 80 marks)

11. (a) (i) Discuss the mechanism of lightning strokes and over voltages on transmission lines. (8)

(ii) Cloud discharges 15 coulombs within 1.5 milliseconds on to a transmission line during lightning. Estimate the voltage produced at the point of the stroke on the transmission line (Assume the surge impedance of the line as 350 ohms). (8)

Or

(b) (i) Mention the drawbacks of expulsion type lightning arresters. (4)

(ii) Draw a cross sectional view of a non-linear resistor lightning arrester and explain its operation. (12)

12. (a) (i) Define uniform and non-uniform field. (4)

(ii) Explain why electronegative gases have high breakdown stress. (4)

(iii) Discuss Meek's theory of breakdown in gases under non-uniform fields. (8)

Or

(b) (i) Define intrinsic strength of a solid dielectric material. Explain why intrinsic strength is not fully realized in practice. (8)

(ii) Discuss the phenomenon of thermal breakdown in solid dielectrics. (8)

13. (a) (i) Discuss the merits of Cascaded transformer over a two winding transformer for producing very high ac voltages. (6)

(ii) Explain with neat circuit the generation of high DC voltages using an n-stage Cockroft-Walton circuit. Derive an expression for the total ripple content in the output voltage. (Assume necessary data). (10)

Or

(b) (i) Starting from the basic 'Marx circuit' develop the circuit of a modern multistage impulse voltage generator and explain its operation. (10)

(ii) A 12 stage impulse generator has 0.126 μF capacitors. The Wave Front and Wave tail resistances are 800 ohms and 5000 ohms respectively. For a load capacitor of 1000 pF, obtain the front and tail times of the impulse wave produced. (6)

14. (a) (i) Compare the merits and demerits of measuring very high voltages using sphere gaps and potential dividers. (8)

(ii) Describe the generating voltmeter method for measuring high d.c. voltages. (8)

Or

(b) (i) Define 50 percent disruptive discharge voltage as applied to impulse voltages. (4)

(ii) Mention the methods adopted to obtain 50% disruptive discharge voltage and discuss any one method in detail. (12)

15. (a) (i) Explain the need for high voltage testing of electrical apparatus (4)

(ii) Mention the different types and nature of tests conducted. (4)

(iii) Discuss the arrangement with detailed procedure for conducting wet withstand tests and state specification for water used in such tests. (8)

Or

(b) Discuss with circuit arrangements, the detailed procedure for conducting impulse voltage withstand test on a 33kV post insulator. (16)