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Question Paper Code : 41041

B.E./B.Tech. DEGREE EXAMINATIONS, NOVEMBER/DECEMBER 2024.

Seventh Semester

Electrical and Electronics Engineering

EE 3701 — HIGH VOLTAGE ENGINEERING

(Regulations 2021)

Time : Three hours | Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. What are the causes for switching and power frequency over voltages?
2. Define the term insulation coordination.
3. Define Townsend's first and second ionization coefficients.
4. What is the intrinsic strength of a solid dielectric?
5. Draw equivalent circuit of a 3-stage cascaded transformer
6. What are the problems associated with measurement of very high impulse voltages?
7. List out various tests to be carried out on insulator
8. What is non-destructive testing of insulating materials?
9. What is an electrostatic field?
10. Mention how electrostatic field is utilized in biomedical applications.

PART B — (5 × 13 = 65 marks)

11. (a) Show that a travelling wave moves with a velocity of light on the overhead line and its speed is proportional to $1/\sqrt{\varepsilon_r}$ on a cable with dielectric material of permittivity ε_r.

Or

(b) Explain with neat diagrams two different theories of charge generation and separation in a thunder cloud.

12. (a) Explain in detail about the various mechanisms of vacuum breakdown.

Or

(b) Derive an expression for critical electric field and show that the field is independent of the critical temperature of the dielectric. State the assumptions made.

13. (a) 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 Graaff generator.

Or

(b) Discuss and compare the performance of resistance and capacitance based potential dividers for measurement of impulse voltages.

14. (a) Explain the method of impulse testing of high voltage transformers. What is the procedure adopted for locating the failure?

Or

(b) Explain the partial discharge tests on high-voltage cables. How is a fault in the insulation located in this test?

15. (a) Explain with neat diagram the principle of operation of electrostatic precipitator.

Or

(b) Explain with neat diagram the principle of operation of electrostatic painting.

PART C — (1 × 15 = 15 marks)

16. (a) A ten stage Cockraft-Walton circuit has all capacitors of 0.06 μF. The secondary voltage of the supply transformer is 100 kV at a frequency of 150 Hz. If the load current is 1 mA, determine (i) voltage regulation (ii) the ripple (iii) the optimum number of stages for maximum output voltage (iv) the maximum output voltage. (4 + 4 + 4 + 3)

Or

(b) A 12-stage impulse generator has capacitors each rated at 0.3 μF, 150 kV. The capacitance of the test specimen is 400 pF. Determine the wave front and wave tail resistance to produce at 1.2/50 μs impulse wave. Also determine the maximum output voltage if the charging voltage is 125 kV.