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Question Paper Code : 41026

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

Fifth/Sixth/Seventh Semester

Electrical and Electronics Engineering

EE 3037 — POWER SYSTEM TRANSIENTS

(Regulations 2021)

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. What is the cause of transients?
2. Using Laplace transform how do you express voltage across capacitance with initial condition?
3. Distinguish between resistance switching and load switching.
4. Define Ferro resonance.
5. What are the effects of lightning transients?
6. What is the role of ground wires to protect against lightning?
7. What is a travelling wave?
8. What are the advantage of Bewley's lattice diagram.
9. Draw the voltage transient waveform which occur due to closing of lines.
10. Define transient over voltage factor.

PART B — (5 × 13 = 65 marks)

11. (a) (i) Discuss about the different sources of transients occuring in power system. (6)

(ii) Explain the importance of study of transients in a system planning. (7)

Or

(b) A series RL circuit consists of a resistor with a resistance of 100 ohms and an inductor with an inductance of 0.2 H. A sinusoidal voltage source with an amplitude of 10 volts and a frequency of 50 Hz is connected to the circuit, At time t=0 , the voltages source is turned on. Calculate the following:

(i) The time constant of the circuit. (4)

(ii) The peak current in the circuit during the transient response. (4)

(iii) The time it takes for the current to reach 90% of its steady–state value. (5)

12. (a) Write short note on the following:

(i) Capacitor switching with multiple restricts. (7)

(ii) Transient due to load switching. (6)

Or

(b) Elaborately discuss about normal and abnormal switching transients. draw relevant diagrams.

13. (a) Explain the theory of cloud formation.

Or

(b) (i) Discuss the characteristics of lightning strokes. (6)

(ii) Evaluate the interaction between lightning and power system. (7)

14. (a) Consider a transmission line with a length of 50 meters and a characteristic impedance of 75 ohms. If the frequency of the input signal is 1 GHZ, calculate:

(i) The wavelength of the signal in the transmission line. (4)

(ii) The natural frequency or resonant frequency of the transmission line. (4)

(iii) Determine whether standing waves will be formed on the transmission line at this frequency. (5)

Or

(b) (i) Derive the reflection and refraction coefficients of a travelling wave. (6)

(ii) Describe the transient response of systems with series and shunt lumped parameters. (7)

15. (a) Write short note on the following:

(i) Short line and kilometric fault. (7)

(ii) Nature of over voltages produced by faults. (6)

Or

(b) Elaborately describe about switching surges on integrated system.

PART C — (1 × 15 = 15 marks)

16. (a) Develop the EMTP representation of any 6 power system parameters and explain each in detail.

Or

(b) In an RLC circuit, a sinusoidal voltage source with a frequency of 100 Hz is suddenly applied across the circuit. The circuit consists of a resistor with a resistance of 50 ohms, an inductor with an inductance of 0.2 H, and a capacitor with a capacitance of 100 μF. Determine the transient response of the circuit at twice the frequency of the applied voltage. Specifically, calculate:

(i) The angular frequency of the applied voltage. (3)

(ii) The resonant frequency of the RLC circuit. (3)

(iii) The expression for the transient response of the current at double the frequency. (3)

(iv) The peak current amplitude at double the frequency. (3)

(v) The time it takes for the current to decay to 10% of its initial of its initial amplitude at double the frequency. (3)