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CS/M.Tech (EE)/SEM-2/MPS-039/2013

2013

ELECTRICAL TRANSIENTS IN POWER SYSTEM

Time Allotted : 3 Hours *Full Marks :* 70

The figures in the margin indicate full marks.

Candidates are required to give their answers in their own words as far as practicable.

Answer any *five* questions. 5 × 14 = 70

1. If the transmission line is terminated to a R-L network, find the expression for the coefficients of reflection and refraction for current and voltage waveforms.

   Hence find the coefficients of reflection and refraction for current and voltage waves for open circuit and short circuit conditions. 9 + 5

2. a) Describe the expression for determining the magnitude of voltage and current waves reflected and transmitted beyond the junction when an overhead line is connected at a junction with cable.

b) An overhead line is connected in series with a cable. The overhead line has an inductance of 2 mH/km and capacitance of 0·01 μF/km. The cable has a inductance of 0·25 mH/km and capacitance of 0·102 μF/km. If a surge having a maximum value of 100 kV travels along the overhead line towards its junction with a cable, calculate :

i) The surge impedances of the line and the cable.

ii) The velocities of wave propagation in the line and the cable

iii) Reflected and transmitted waves of voltage and current at the junction. 5 + 9

3. Write short notes on any *two* of the following : 2 × 7

a) Bewley's lattice diagram

b) Wave shape of stroke currents for insulation testing

c) Effect of cable on surge.

4. a) Write the lightning phenomenon.

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

4 + 10

5. a) If $Z\,[\,e\,(\,t\,)\,] = F\,(\,z\,)$ and $e\,(\,t\,)$ is Laplace transformable, Prove that $Z\,[\,t.e\,(\,t\,)\,] = -\,Tz\,\dfrac{d}{dz}\left[F(z)\right]$.

b) prove that, $Z\left[\dfrac{e(t)}{t}\right] = \dfrac{1}{T}\int_z^{\infty}\dfrac{F(z)}{z}\,dz$

where, $F\,(\,z\,) = z\,[\,e\,(\,t\,)\,]$. 7 + 7

6. a) Find inverse z-transform of $F(z) = \dfrac{\left(1 - e^{-aT}\right)z}{(z-1)\left(z - e^{-aT}\right)}$

by power series method.

b) If the function $e\,(\,t\,)$ has the Z-transform $F\,(\,z\,)$ and $\lim\limits_{z\to\infty} F(z)$ exists, then prove that $\lim\limits_{t\to 0} e^{*}\,(t) = \lim\limits_{z\to\infty} F(z)$.

c) Find Z-transform of $e^{-\alpha t}\sin\beta t$. 7 + 3 + 4