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**TCET 2220**

**Homework 4**

**Chapter 3**

1. A traveling wave of current in milliampers is given by with t in seconds and x in meters. Determine the following:
2. direction of propagation
3. peak value
4. angular frequency
5. phase constant
6. cyclic frequency
7. period
8. wavelength
9. velocity of propapagtion
10. A traveling wave of voltage in volts is given by with t in seconds and x in meters. Determine the following:
    1. direction of propagation
    2. peak value
    3. angular frequency
    4. phase constant
    5. cyclic frequency
    6. period
    7. wavelength
    8. velocity of propagation
11. A sinusoidal current with a peak value of 2 A and a frequency of 50 MHz is traveling in the positive x-direction with a velocity of 2 x 108 m/s. Determine the following:
    1. period
    2. angular frequency
    3. phase constant
    4. wavelength
    5. an equation for the current
12. A sinusoidal voltage with a peak value of 25 V and a radian frequency of 20 Mrad/s is traveling in the negative x-direction with a velocity of 3 x 108 m/s. Determine the following:
    1. cyclic frequency
    2. period
    3. phase constant
    4. wavelength
    5. an equation for the voltage
13. Consider the current traveling wave of Problem 3-1. Determine the following:
    1. a fixed phasor representation in peak units as either I+ or I- (You decide which label is appropriate.)
    2. the corresponding distance-varying phasor I(x) in peak units
    3. the value of the distance-varying phasor at x = 100 m
14. Consider the voltage traveling wave of Problem 3-2. Determine the following:
    1. a fixed phasor representation in peak units as either V+ or V- (You decide which label is appropriate.)
    2. the corresponding distance-varying phasor V(x) in peak units
    3. the value of the distance-varying phasor at x = 4 m
15. Repeat the analysis of Problem 3-5 if the current of Problem 3-1 has a fixed phase shift such that it is described by
16. Repeat the analysis of Problem 3-6 if the voltage of Problem 3-2 has a fixed phase shift such that it is described by
17. Redefine the fixed phasor of Problem 3-5 so that the phasor magnitude is expressed in rms units, and determine the average power dissipated in a 50-Ω resistance.
18. Redefine the fixed phased of Problem 3-6 so that the phasor magnitude is expressed in rms units, and determine the average power dissipated in a 75-Ω resistance
19. Redefine the fixed phasor of Problem 3-7 so that the phasor magnitude is expressed in rms units. Would the power dissipated in a 50-Ω resistanec be the same as in the Problem 3-9?
20. Redefine the fixed phasor of Problem 3-8 so that the phasor magnitude is expressed in rms units. Would the power dissipated in a 75-Ω resistanec be the same as in the Problem 3-10?
21. Under steady-state ac conditions, the forward current wave on a certain lossless 50-Ω line is I+ = 0 A. Determine the voltage forward wave.
22. Under steady-state ac conditions, the forward current wave in a 300-Ω lossless line is V+ =. Determine the current forward wave.
23. Under steady-state ac conditions, the reverse voltage wave on a lossless 50-Ω line is V+ =. Determine the reverse voltage wave.
24. Under steady-state ac conditions, the reverse current wave on a lossless 75-Ω line is I+ = 0.52 A. Determine the reverse voltage wave.
25. A table of specifications for one version of RG-8/U 50-Ω coaxial cable indicates that the attenuation per 100 ft at 50MHz is 1.2 dB. At this frequency, determine the following:
    1. attenuation factor in decibels per foot
    2. attenuation factor in nepers per foot

For a length of 300 ft, determine the following:

* 1. total attenuation in decibels
  2. total attenuation in nepers
  3. V2/V1 ratio using both decibels and nepers for a single wave

1. A transmission line has a attenuation of 0.5 dB/m. Determine the following:
   1. attenuation factor in nepers/m

For a length of 400 m, determine the following:

* 1. total attenuation in decibels
  2. total attenuation in nepers
  3. V2/V1 ratio using both decibels and nepers for a single wave

1. A single-frequency wave is propagating in one direction on a transmission line of length 200 m. With an input rms voltage of 50 V, the output rms voltage is measured as 20 V. Determine the following:
   1. total attenuation in decibels
   2. total attenuation in nepers
   3. attenuation factor in decibels/meter
   4. attenuation factor in nepers/meter
2. A single frequency wave is propagating in one direction on a transmission line of length 400 m. The input power to the line is 40 W, and the output power is 12 W. Determine the following:
   1. total attenuation in decibels
   2. total attenuation in nepers
   3. attenuation constant in decibels/meters
   4. attenuation factor in nepers/meter
3. A transmission line has the following parameters at 50 MHz: L = 1.2 µH/m, R = 15 Ω/m, C = 10 pF/m, and G = 4 µS/m. Determine the following:
   1. Z
   2. Y
   3. ɣ, α, ϐ
   4. attenuation in dB/m
   5. v
   6. Z0
4. A lossy audio-frequency line has the following parameters at 2 kHz: L = 0.1 µH/ft, R = 0.2 Ω/ft, C = 2 pF/ft, and G is negligible. Determine the following:
   1. Z
   2. Y
   3. ɣ, α, ϐ
   4. attenuation in dB/ft
   5. v
   6. Z0
5. A coaxial cable has the following parameters at a frequency of 1MHz:

series resistance = 0.3 Ω/m

series reactance = 2 Ω/m

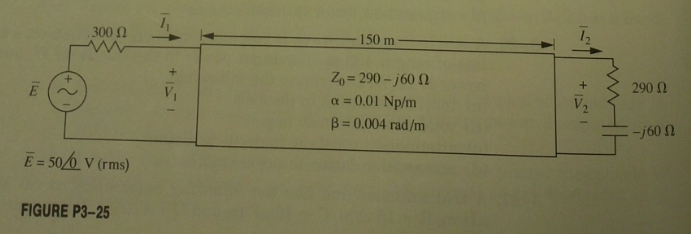
shunt conductance = 0.5 µS/m

shunt susceptance = 0.6 mS/m

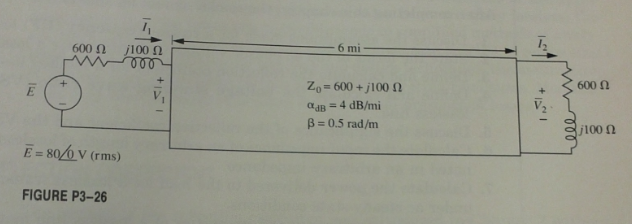
Determine the following:

* 1. ɣ, α, ϐ
  2. attenuation in dB/m
  3. v
  4. Z0

1. For the coaxial cable of Problem 3-23, repeat the analysis at 100MHz if the series resistance increases to 1 Ω/m, but the shunt conductance remains essentially the same. (Note: You must apply basic ac circuit theory to determine the new values for the reactance and susceptance.)
2. For the circuit of Fig. P3-25, determine the following:
   1. input current I1
   2. input voltage V1
   3. input power P1
   4. load current I2
   5. load voltage V2
   6. load power P2
   7. line loss in dB



1. For the circuit of Fig. P3-26, determine the following:
   1. input current I1
   2. input voltage V1
   3. input power P1
   4. load current I2
   5. load voltage V2
   6. load power P2
   7. line loss in nepers



Solutions:

1. From the given equation the following was found.
2. The negative sign between the time and displacement terms indicates that the wave is traveling in the positive x-direction
3. The peak value IP= 8 mA
4. ϐ = 0.025 rad/m
5. =

1. From the given equation the following was found.
2. The positive sign between the time and displacement terms indicates that the wave is traveling in the negative x-direction
3. The peak value
4. ϐ = 0.35 rad/m
5. =
6. A sinusoidal current with a peak value of 2 A and a frequency of 50 MHz is traveling in the positive x-direction with a velocity of Determine the following:
7. Period
8. Angular Frequency
9. Phase constant
10. Wavelength
11. An equation for the current

1. A sinusoidal voltage with a peak value of 25 V and a radian frequency of 20 Mrad/s is traveling in the negative x-direction with a velocity of Determine the following:
2. Cyclic frequency
3. Period
4. Phase constant
5. Wavelength
6. An equation for the current
7. Consider the current traveling wave of Problem 3-1. Determine the following:
8. A fixed phasor representation in peak units as either or (You decide which label is appropriate.)
9. The corresponding distance-varying phasor in peak units
10. The wave of the distances-varying phasor at x = 100 m.
11. Consider the voltage traveling wave of Problem 3-2. Determine the following:
12. A fixed phasor representation in peak units as either or (You decide which label is appropriate.)
13. The corresponding distance-varying phasor in peak units.
14. The wave of the distances-varying phasor at x = 4 m
15. Repeat the analysis of Problem 3-5 if the current of Problem 3-1 has a fixed phase shift such that it is described by
16. A fixed phasor representation in peak units as either or (You decide which label is appropriate.)
17. The corresponding distance-varying phasor in peak units
18. The wave of the distances-varying phasor at x = 100 m.
19. Repeat the analysis of Problem 3-6 if the voltage of Problem 3-2 has a fixed phase shift such that it is described by
20. A fixed phasor representation in peak units as either or (You decide which label is appropriate.)
21. The corresponding distance-varying phasor in peak units.
22. The wave of the distances-varying phasor at x = 4 m
23. Redefine the fixed phasor of Problem 3-5 so that the phasor magnitude is expressed in rms units, and determine the average power dissipated in a 50- resistance.
24. Redefine the fixed phasor of Problem 3-6 so that the phasor magnitude is expressed in rms units, and determine the average power dissipated in a 75- resistance.
25. Redefine the fixed phasor of Problem 3-7 so that the phasor magnitude is expressed in rms units. Would the power dissipated in a 50- resistance be the same as in Problem 3-9?

Yes they are the same.

1. Redefine the fixed phasor of Problem 3-8 so that the phasor magnitude is expressed in rms units. Would the power dissipated in a 75- resistance be the same as in Problem 3-10?

Yes they are the same.

1. Under steady-state ac conditions, the forward current wave on a certain lossless 50- line is = . Determine the voltage forward wave.
2. Under steady-state ac conditions, the forward current wave in 300 lossless line is = . Determine the current forward wave.
3. Under steady-state ac conditions, the reverse voltage wave on a lossless 50 line is = V. Determine the reverse current wave.
4. Under steady-state ac conditions, the reverse current wave on a lossless 75- line is = . Determine the reverse voltage wave.
5. A table of specifications for one version of RG - 8/U 50- coaxial cable indicates that the attenuation per 100 ft. at 50 MHz is 1.2 dB. At this frequency, determine the following:
6. Attenuation factor in decibel per foot
7. Attenuation factor in nepers per foot

For a length of 300 ft. determine the following:

1. Total attenuation in decibel
2. Total attenuation in nepers
3. Ratio using both decibels and nepers for a single wave

In terms of decibels, this ratio may be expressed as

1. A transmission line has an attenuation of 0.05 dB/m. Determine the following:
2. Attenuation factor in nepers/m

For a length of 400 m, determine the following:

1. Total attenuation in decibel
2. Total attenuation in nepers
3. Ratio using both decibels and nepers for a single wave

In term of decibles:

1. A single-Frequency wave is propagating in one direction on a transmission line of length 200m. with an input rms voltage of 50 V, the output rms voltage is measured as 20 V. Determine the following:
2. Total attenuation in decibel
3. Total attenuation in nepers
4. Attenuation factor in decibel/meter
5. Attenuation factor in nepers/meter
6. A single-Frequency wave is propagating in one direction on a transmission line of length 400m. The input power to the line is 40 W, and the output power is 12 W. Determine the following:
7. Total attenuation in decibel
8. Total attenuation in nepers
9. Attenuation factor in decibel/meter
10. Attenuation factor in nepers/meter
11. A transmission line has the following parameters at 50 MHz: , , and . Determine the following:
12. Z
13. Y

= 22.36 x 10-3 + j1.088

α = 22.36 x 10-3 Np/m

= j1.008 rad/ft

1. V
2. A lossy audio-frequency line has the following parameters at 2 kHz: , , and . Determine the following:
3. Z
4. Y

= 5 x 10-5  + j5.029 x 10-5

α = 5 x 10-5 Np/ft

= j5.029 x 10-5 rad/ft

1. Attenuation in dB/ft
2. v

1. A coaxial cable has the following parameters at a frequency of 1 MHz:

series resistance = 0.3

series reactance = 2

shunt conductance = 0.5 uS/m

shunt susceptance = 0.6 mS/m

Determine the following:

Z = 0.3 + j2 Ω/m = 2.022

Y = 0.5µ + j0.6m S/m = 0.6m

=

α = 2.6m Np/m

1. Attenuation in dB/ft

αdB  dB/m

1. V
2. For the coaxial cable of problem 3-23, repeat the analysis at 100 MHz if the series resistance increases to 1 , but the shunt conductance remains essentially the same. (Note: You must apply basic ac circuit theory to determine the new values for the reactance and susceptance.)

1 + j200 = 200 Ω/m

Y = G + jB = 0.5 x 10-6 +

= 0.5 x 10-6 + j0.06 = 0.06 S/m

=

= 8.3m + j3.46

α = 8.3m Np/m

ϐ = 3.46 rad/m

1. αdB = 8.69 x 8.3 x 10-3 = 0.072 dB/m
2. m/s

= 57.74 Ω = 57.74 – j0.139

1. For the circuit of fig. P3-25, determine the following:
2. Input current
3. Input Voltage

V

1. Input power
2. Load current
3. Load Voltage
4. Load Power
5. Line loss in dB
6. For the circuit of fig. P3-26, determine the following:
7. Input current
8. Input Voltage

Ω

V

1. Input power
2. Load current
3. Load Voltage
4. Load Power
5. Line loss in nepers