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Homework 2

* 1. Calculate the free-space wavelength in meters for the following frequencies.

1. 2 kHz
2. 200 kHz
3. 20 MHz
4. 2GHz
   1. Calculate the free-space wavelength in meters for the following frequencies
5. 80 kHz
6. 8 MHz
7. 800 MHz
8. 8 GHz
   1. Calculate the free-space wavelength in miles for a frequency of 400 Hz
   2. Calculate the free-space wavelength in miles for a frequency of 1.5 Hz
   3. A sinusoidal signal has a free-space wavelength of 80 m. Calculate the frequency
   4. A sinusoidal signal has a free-space wavelength of 6 m. Calculate the frequency
   5. A digital signal utilize pulse whose minimum widths are about 3 ns. Assuming the speed of light, determine the longest length of wired-pair that can be allowed based on the 10% rule.
   6. The longest connecting wires in a digital system are about 20 cm. assuming the speed of light; determine the shortest acceptable pulse width base on the 10% rule.
   7. A communication system operates at a frequency of 800 MHz. Assuming the speed of light, determine the length of connecting line that could be used without considering frequency-domain effects based on the 10% rule.
   8. The length of a connecting cable between two points in a radio-frequency system is 50 cm. Assuming the speed of light, determine the highest operating frequency that should be used without considering frequency-domain effects based on the 10% rule.
   9. In a coil, a current of 100 mA results in a magnetic flux of 50 . Determine the Inductance.
   10. A current 4 mA is flowing in a 20 coil. Determine the magnetic flux.
   11. In a capacitor, a voltage of 20 V results in charge storage of 5 . Determine the Capacitance.
   12. A capacitance of 40 is charged to a voltage of 12 V. Determine the electric charge.
   13. A lossless transmission line has an inductance of 320 and a capacitance of 57pF/m. Determine the characteristic impedance.
   14. A lossless transmission line has an inductance of 1.2 and a capacitance of 15 . Determine the characteristic impedance.
   15. The dielectric constant of mica is 6. Determine the permittivity

* 1. The permittivity of a material is . Determine the dielectric constant.
  2. The relative permeability of nickel is 800. Determine the actual permability.
  3. The permeability of a ferromagnetic material is . Determine the relative permeability.
  4. Determine the velocity of propagation of the transmission line of problem (1.15)
  5. Determine the velocity of propagation of the transmission line of problem (1.16)
  6. The dielectric constant in a transmission line is 4.7 and . Determine the velocity of propagation.
  7. The dielectric constant in a certain transmission line is 3 and . Determine the velocity of propagation.
  8. A coaxial cable has the following specification: , and velocity of propagation = . Determine L and C
  9. A transmission line has the following specification: , and velocity factor = 0.8. Determine L and C
  10. The lower end of the commercial amplitude-modulation (AM) band is about 550 kHz. AM stationary use “quarter-wave” vertical antennas whose lengths are . Determine the length in meters of a vertical antenna operating at the lower end.

* 1. The upper end of the commercial AM band referred to in Problem (1.27) is about 1610 kHz. Determine the length in meters of a vertical antenna operating at the upper end.
  2. One popular simple antenna is the “half-wave” horizontal antenna whose theoretical length is at the operating frequency. In practice, however, the antenna is usually shortened by about 5% due to end effects. Determine the practical length in meters for a half-wave antenna to provide optimum reception at the lower end of the commercial FM band, which is about 88MHz.
  3. Based on the discussion of Problem (1.29), determine the practical length in meter for a half-wave antenna to provide optimum reception, at the upper end of the FM band, which is about 108 MHz.