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TCET 2220

Homework 2

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* 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.**
  4. **Show that the free-space velocity of light in feet/second is very close to .**

Therefore:

|  |  |
| --- | --- |
| 1 meter | 100 cm |
| 1 ft | 12 inch |
| 1 inch | 2.5 cm |
| 1 meter | 40 inches |
| 1 meter | 3.33 ft |

1 meter = 40 inches because in 1 cm there is 2.5 inches, if you divide 100 cm by 2.5 inches, It gives you 40 inches. In 12 inches, there is 1 ft. therefore in 40 inches there are 3.33 ft.

The speed of light is . if we multiply that time 3.33 ft, we get . which is very close to the one above. ().