**Homework 2**

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

1. 2KHz
2. 200KHz
3. 20MHz
4. 2GHz

1-2 Calculate the free-space wavelength in meters for the following frequencies:

1. 80KHz
2. 8MHz
3. 800MHz
4. 8GHz

1-3 Calculate the free-space wavelength in miles for a frequency of 400 Hz

1-4 Calculate the free-space wavelength in miles for a frequency of 1.5KHz

1-5 A sinusoidal signal has a free-space wavelength of 80m. Calculate the frequency.

1-6 A sinusoidal signal has a free-space wavelength of 6m. Calculate the frequency.

1-7 A digital signal utilizes pulses whose minimum widths are about 3ns. Assuming the speed of light, determine the longest lengths of wire-pairs that can be allowed based on the 10% rule.

1-8 The longest connecting wires in a digital system are about 20cm. Assuming the speed of light, determine the shortest acceptable pulse width based on the 10% rule.

1-9 A communication system operates at a frequency of 800MHz. 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.

1-10 The length of a connecting cable between two points in a radio-frequency system is 50cm. Assuming the speed of light, determine the highest operating frequency that should be used without considering frequency-domain effects based on the 10% rule.

1-11 In a coil, a current of 100mA results in a magnetic flux of 50μWb. Determine the inductance.

1-12 A current of 4mA is flowing in a 20μH coil. Determine the magnetic flux.

1-13 In a capacitor, a voltage of 20 V results in charges storages of 5μC. Determine the capacitance.

1-14 A capacitance of 40μF is charged to a voltage of 12V. Determine the electric charge.

1-15 A lossless transmission line has an inductance of 320 nH/m and a capacitance of 57pF/m. Determine the characteristic impedance.

1-16 A lossless transmission line has an inductance of 1.2 μH/m and a capacitance of 15pF/m. Determine the characteristic impedance.

1-17 The dielectric constant of mica is 6. Determine the permittivity.

1-18 The permittivity of a material is 14x10-12F/m. Determine the dielectric constant.

1-19 The relative permeability of nickel is 800. Determine the actual permeability.

1-20 The permeability of a ferromagnetic material is 10-4H/m. Determine the relative permeability.

1-21 Determine the velocity of propagation of the transmission line of Problem 1-15.

1-22 Determine the velocity of propagation of the transmission line of Problem 1-16.

1-23 The dielectric constant in a transmission line is 4.7, and μ=μo. Determine the velocity of propagation.

1-24 The dielectric constant in a transmission line 3, and μ=μo. Determine the velocity of propagation.

1-25 A coaxial cable has the following specifications: Ro=73Ω, and velocity of propagation is 2.1x108m/s. Determine L and C.

1-26 A transmission line has the following specifications: Ro=150Ω, and velocity of propagation is 0.8. Determine L and C.

1-27 The lower end of the commercial amplitude-modulation (AM) band is about 550KHz. AM stations use "quarter-wave" vertical antennas whose lengths are 0.25λ. Determine the length in meters of a vertical antenna operating at the lower end.

1-28 The upper end of the commercial AM band referred to in Problem 1-27 is about 1610KHz. Determine the length in meters of a vertical antenna operating at the upper end.

1-29 One popular simple antenna is the "half-wave" horizontal antenna whose theoretical length is 0.5λ at the operating frequency. In practice, however, the antenna is usually shorted 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 88 MHz

1-30 Based on the discussion of Problem 1-29, determine the practical length in meters for a half-wave antenna to provide optimum reception at the upper end of the FM band, which is about 108MHz.

1-31Show that the free-space velocity of light in feet/second is very close to c=982x106ft/s.

1-32 Show that the free-space wavelength in feet can be expressed as

You may use the result of Problem 1-31