Name:

Homework 8, due Wednesday 9/25/2013.

Problem 1: A transmission line has R'=4.2 mΩ/m, L'=2.1 μH/m, C'=5.5 pF/m, and G'=0.26 nS/m. The frequency is 1 kHz. Find (a) the characteristic impedance of the line Z_0, (b) propagation constant γ, (c) phase velocity u_p, and (d) wavelength λ.

Problem 2: A coaxial cable has its conductors made of copper ($\sigma_c=5.8\times10^7$ S/m) and its dielectric made of polyethylene ($\varepsilon_r=2.25$, $\mu_r=1$). If the radius of the outer conductor is 3 mm, determine the radius of the inner conductor so that $Z_0=75\Omega$.

Problem 3: On a distortion-less transmission line, the voltage wave is given by:

$$V(x)=120e^{0.0025x}\cos(10^8t+2x)+60e^{-0.0025x}\cos(10^8t-2x)$$

Where x is the distance from the load. If $Z_L=300$, find (a) attenuation constant α, (b) phase constant β, (c) phase velocity u_p, (d) characteristic impedance Z_0, and (e) the current at x I(x).

Problem 4: A transmission line has a characteristic impedance of $Z_0=65+j38\ \Omega$, a propagation constant of $\gamma=0.7+j2.5\ m^{-1}$, and length of x=0.8 m. Find the input impedance and voltage standing wave ratio of the line if the end of the line is (a) open-circuited, (b) short circuited, (c) impedance matched (d) connected to a load with $Z_L= j27\ \Omega$.
