**READ ASSIGNMENT INSTRUCTIONS:** Everything must be typed. Don’t forget the coversheet! All your plots must have the proper labels and units. This is a design problem and you MUST do it on your own. ALL answers must be provided below the appropriate question. ALL questions must be shown in your assignment. If you use the simulator to find your answer mention FROM THE SIMULATOR. Please print double sided. You receive -15 points if you do not turn in the assignment at the **beginning** of the class!

Assignment

In this problem you are asked to design a 10-meter coaxial cable to handle transmission of a 2.5GHz signal to a 50 ohm antenna e.g., we need to keep the magnitude of the characteristic impedance of the cable **close** to 50 ohms). You need to find the best dimensions (inner radius and shield radius) for the coaxial cable such that minimal attenuation is achieved, while the impedance is about 50 ohms (HINT: initially ignore the length of the cable). We assume the cable is made of copper and paraffin.

1. Use the simulator to find the dimensions of the coax cable. Show the snap shot of your simulation.
2. Find all the parameters for the cable: R’, L’, C’, G’, and the characteristic impedance of the cable. You must write your answers in tabulated form and show the unit for each one.
3. Using VISIO draw the transmission line model for your cable and properly mark each component.
4. Find the wavelength of the signal in vacuum. This is how long the antenna should be!
5. Calculate the following: speed of propagation, wavelength of the signal, and magnitude of the propagation constant. You must compare your values with the simulator. Please write your answers in tabulated form and show the unit for each one. Include the values you got from the simulator and your own answers.
6. Find the real and imaginary parts of the characteristic impedance. Indicate what each one represents.
7. Assume the source is generating a sinusoidal waveform with frequency of 2.5GHz and amplitude of 1V. What is the amplitude of the received signal at the end of the cable due to the attenuation only (assume ‘**t’** is the time that it takes the signal to reach the end of the cable). Write the mathematical expression.
8. Assume the source is generating a sinusoidal waveform with frequency of 2.5GHz and amplitude of 1V. What is the phase shift (in radian) of the signal due to cable’s impedance as it reaches the end of the cable.
9. Using Matlab, plot a graph showing what happens to the magnitude of the characteristic impedance as the frequency changes from 1GHz to 10GHz. **Attach** your Matlab script and the plot.
10. Using Matlab, plot a graph showing what happens to the attenuation of the cable as the frequency changes from 1GHz to 10GHz. **Attach** your Matlab script and the plot.
11. Assuming there is no reflected wave back from the load to the source, and at z=0 V(z=0)=10V, find the expression for V(z) in phasor form (independent of time). Using Matlab plot V(z) as z changes from 0-5. What exactly is the value of the wave as it reaches the load?