EE311 Name ___________________________

Spring 2020 Code _____________

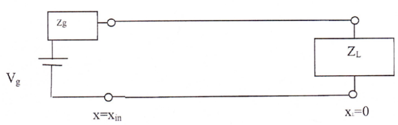
Game 4/27/20 T-line voltage and current

To GET FULL CREDIT FOR THIS PROBLEM, YOU NEED TO GET HAVE YOUR RESULTS (without exponentials such as $e^{j\frac{5\pi}{2}}$ $or\ e^{j\frac{18\pi}{4}}$ etc.

For the following T-line system, you know Z_L=100 ohms Z_0=50 ohms Z_g =150 ohms and the length of the line is $\frac{755\lambda}{4}$

If you know that $V^-(x_{in} = -\frac{755\lambda}{4})$ is 20 volts

a) Find V^+ $and\ total\ I$ at the input of the line ($x_{in} = -\frac{755\lambda}{4}$)
b) Find I^- at the load positions (x=0)
c) Find the average power at the input of the line ($x_{in} = -\frac{755\lambda}{4}$)
d) Can you find V_g? Explain and show if you can or cannot and find it if you think you can



a) To do this the easiest way is to find Zin
   a. $\Gamma_L = \frac{Z_L - Z_0}{Z_L + Z_0} = \frac{100-50}{100+50} = \frac{1}{3}$
   b. $Z_{in} = Z(x_{in} = -\frac{755\lambda}{4}) = Z_0 \frac{1+\Gamma_L e^{j\frac{4\pi}{\lambda}(-\frac{755\lambda}{4})}}{1-\Gamma_L e^{j\frac{4\pi}{\lambda}(-\frac{755\lambda}{4})}} = Z_0 \frac{1-j\Gamma_L}{1+j\Gamma_L} = Z_0 \frac{1-j\frac{Z_L-Z_0}{Z_L+Z_0}}{1+j\frac{Z_L-Z_0}{Z_L+Z_0}} = \frac{{Z_0}^2}{Z_L} = 25\Omega = Z_{in}$
   c. $\Gamma\left(x_{in} = -\frac{755\lambda}{4}\right) = \frac{Z_{in}-Z_0}{Z_{in}+Z_0} = \frac{25-50}{25+50} = -\frac{1}{3}=\Gamma_{in}$
   d. $\Gamma_{in} = \frac{V_{in}^-}{V_{in}^+}$ so $V_{in}^+ = 20(\frac{1}{\frac{1}{-3}})$= -60 V
   e. $I_{in} = \frac{V_{in}}{Z_{in}} = \frac{-40}{25} = -1.6\ A$=$I_{in}$ $I_{in}^- = -\frac{V_{in}^-}{Z_0} = -\frac{20}{50} = -0.4\ A$
b) $I_L^- = I_{in}^- e^{j\beta\left(\frac{755\lambda}{4}\right)} = I_{in}^- e^{j\frac{2\pi}{\lambda}\left(\frac{755\lambda}{4}\right)} = I_{in}^- e^{j\pi\left(\frac{755}{2}\right)} = \mathbf{-0.4e^{j\left(\frac{\pi}{2}\right)}}$ =**j0.4 A**= I_L^-
c) $Since\ this\ is\ lossles\ should\ it\ be\ different\ thatn\ the\ one\ at\ the\ input?$ Let us see. As you can see they are the same. However, for tests, games etc. we need to show what the question is asking for.
   a. $P_{in\ ave} = \frac{1}{2}V_{in}I_{in}^*$=$\frac{1}{2}(-40)(-1.6)$=32 W=$P_{in\ ave}$
d) We can find V_g $how?$ $V_{in} = V_g \frac{Z_{in}}{Z_g+Z_{in}} \rightarrow\rightarrow V_g = V_{in}\frac{Z_g+Z_{in}}{Z_{in}} = -40\ \frac{150+25}{25} = -280V = V_g$