EE311 Name _____

Spring 2020 Code _____

Game 4/23/20 T-line steady state III

Find h

For the following T-line system you know that

a) The length of the line is $\frac{7\lambda}{2}$ this means that if x=0 is at the load, the input is at x= -$\frac{7\lambda}{2}$

b) You know that $V^+(x=0) = 180e^{-j\frac{\pi}{2}}$ V and. $V^-(x=0) = -60e^{-j\frac{\pi}{2}}$ V

Find and show your work

1) $V^+\left(x=-\frac{7\lambda}{2}\right)$ and $V^-\left(x=-\frac{7\lambda}{2}\right)$ these are the values of the + and – traveling voltages at the input of the line.
2) *Knowing that the characteristic impedance of the line is* 60 *ohms find* I^+ *and* I^- *at the input of the line*
3) What is the impedance at the input of the line? Can you find it

Looking at our solutions there are few items that are of important.

4) It seems that many of us are not comfortable with things like $180e^{j\frac{13\pi}{2}}$
5) In reality after talking to more than a few and seeing some questions, I am convinced that most of us are not really comfortable with it. **It is at the edge of not KNOWING and We should really know this!**
6) We should be able to handle this
7) From now on, we would like you to do take care of this
8) How to go around it? $180e^{j\frac{13\pi}{2}} = 180\left(\cos\left(\frac{13\pi}{2}\right) + jsin\left(\frac{13\pi}{2}\right)\right) = j180$
9) In other type of problems always use $e^{j\theta} = \cos(\theta) + jsin(\theta)$

$$V^+\left(x=-\frac{7\lambda}{2}\right) = V^+(0)e^{-j\beta\left(-\frac{7\lambda}{2}\right)} = 180e^{-j\frac{\pi}{2}}e^{j\frac{2\pi}{\lambda}\left(\frac{7\lambda}{2}\right)} = 180e^{j\frac{13\pi}{2}} = 180j \; V = V_{in}^+$$

$$V^-\left(x=-\frac{7\lambda}{2}\right) = V^-(0)e^{j\beta\left(-\frac{7\lambda}{2}\right)} = -60e^{-j\frac{\pi}{2}}e^{j\frac{2\pi}{\lambda}\left(\frac{7\lambda}{2}\right)} = -60e^{j\frac{15\pi}{2}} = -60j \; V = V_{in}^-$$

$$I_{in}^+ = \frac{V^+\left(x=-\frac{7\lambda}{2}\right)}{60} = 3j \; A \qquad I_{in}^- = -\frac{V^-\left(x=-\frac{7\lambda}{2}\right)}{60} = jA$$

$$Z_{in} = Z\left(x=-\frac{7\lambda}{2}\right) = \frac{V\left(x=-\frac{7\lambda}{2}\right)}{I\left(x=-\frac{7\lambda}{2}\right)} = \frac{180j-60j}{3j+j} = 30\Omega = Z_{in}$$