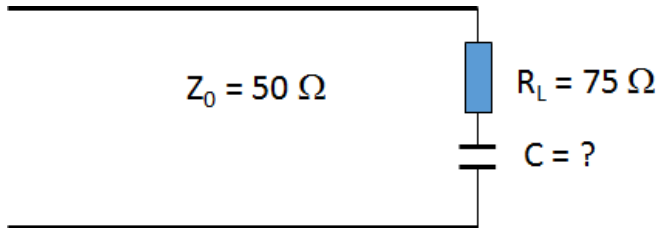


Quiz #2, 10/02/2017

Name: _____ Signature: _____

An lossless $50\text{-}\Omega$ line is terminated with a load. The capacitance is unknown. The voltage standing wave ratio (S) was measured to be 3 at the frequency of 5GHz, Find the capacitance.



Solution:

$$S = \frac{1+|\Gamma|}{1-|\Gamma|} = 3, \quad |\Gamma| = 0.5$$

$$|\Gamma| = \left| \frac{Z_L - Z_0}{Z_L + Z_0} \right| = \left| \frac{75 + \frac{1}{j\omega C} - 50}{75 + \frac{1}{j\omega C} + 50} \right| = \left| \frac{25 + \frac{1}{j\omega C}}{125 + \frac{1}{j\omega C}} \right| = \left[\frac{25^2 + \left(\frac{1}{\omega C}\right)^2}{125^2 + \left(\frac{1}{\omega C}\right)^2} \right]^{1/2}$$

$$\frac{25^2 + \left(\frac{1}{\omega C}\right)^2}{125^2 + \left(\frac{1}{\omega C}\right)^2} = \frac{1}{4}, \quad \left(\frac{1}{\omega C}\right)^2 = 4375\ \Omega^2,$$

$$\omega C = 0.015\ \Omega^{-1}, \quad C = \frac{0.015\ \Omega^{-1}}{\omega} = 0.48\ \text{pF}.$$