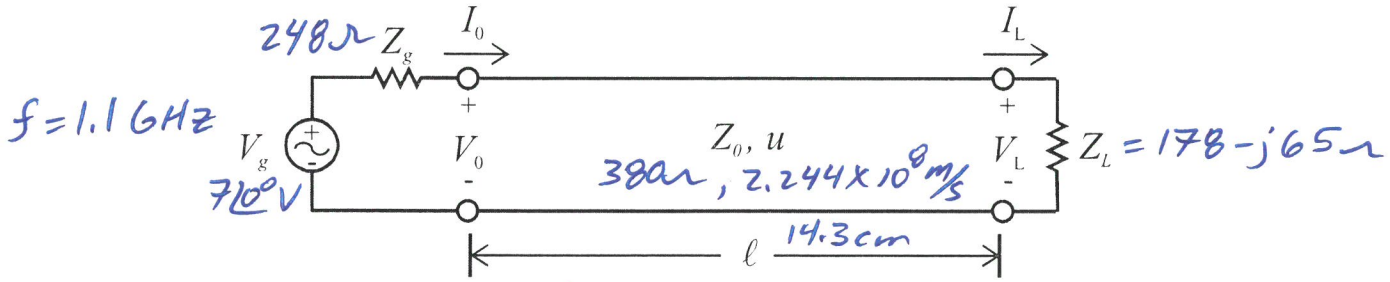
EE 381 Electric and Magnetic Fields Quiz #2 (Fall 2024)

Name Key A

Instructions: Open book & notes. Write answers in indicated spaces and **show all** work for credit.

For the circuit shown, the generator, $V_g = 7\angle 0°$ V & $Z_g = 248\ \Omega$, operates at a frequency of 1.1 GHz. It is connected to a lossless twin-lead transmission line where $Z_0 = 380\ \Omega$, $u = 2.244 \times 10^8$ m/s, and $\ell = 14.3$ cm. The load impedance is $Z_L = 178 - j65\ \Omega$. Calculate the phase constant, input and load reflection coefficients, input impedance, and SWR for this circuit.



$$\beta = \omega/u = \frac{2\pi(1.1\times10^9)}{2.244\times10^8} = 30.80\ \text{rad/m}$$

$$\Gamma_L = \frac{Z_L - Z_0}{Z_L + Z_0} = \frac{(178 - j65) - 380}{(178 + j65) + 380} = 0.3777\angle -155.52°$$

$$\Gamma_{in} = \Gamma_L e^{-j2\beta\ell} = (0.38\angle -155.5°)\, e^{-j2(30.8)0.143}$$

$$= 0.3777\angle 59.776°$$

$$SWR = \frac{1+|\Gamma|}{1-|\Gamma|} = \frac{1+0.3777}{1-0.3777} = 2.214$$

$$Z_{in} = Z_0 \frac{1+\Gamma_{in}}{1-\Gamma_{in}} = 380\ \frac{1+0.3777\angle 59.776°}{1-0.3777\angle 59.776°}$$

$$= 427.315 + j325.361\ \Omega$$

phase constant = 30.80 rad/m load refl. coeff. = $0.3777\angle -155.52°$

input refl. coeff. = $0.3777\angle 59.776°$ SWR = 2.214

input impedance = $427.3 + j325.4\ \Omega$

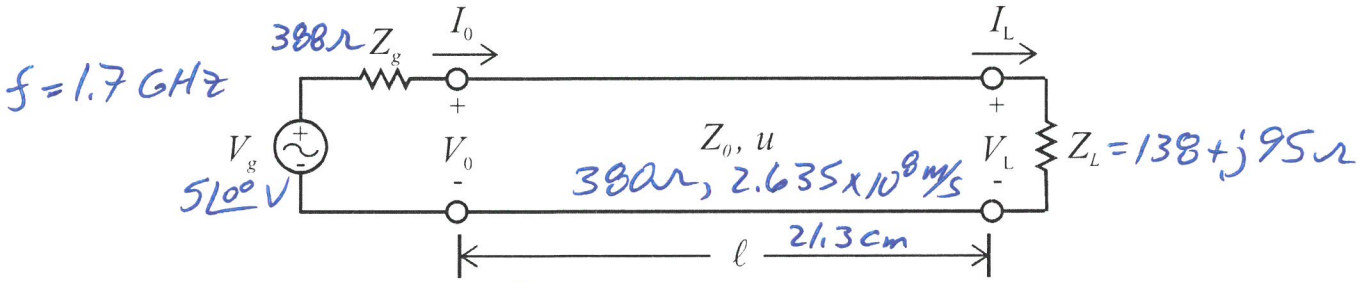
Express reflection coefficients in polar form, e.g., A∠θ (deg), & impedance in rectangular form, e.g., $R + jX$.

EE 381 Electric and Magnetic Fields Quiz #2 (Fall 2024)

Name Key B

Instructions: Open book & notes. Write answers in indicated spaces and **show all** work for credit.

For the circuit shown, the generator, $V_g = 5\angle 0°$ V & $Z_g = 388\ \Omega$, operates at a frequency of 1.7 GHz. It is connected to a lossless twin-lead transmission line where $Z_0 = 380\ \Omega$, $u = 2.635 \times 10^8$ m/s, and $\ell = 21.3$ cm. The load impedance is $Z_L = 138 + j95\ \Omega$. Calculate the phase constant, input and load reflection coefficients, input impedance, and SWR for this circuit.



$$\beta = \frac{\omega}{u} = \frac{2\pi(1.7\times10^9)}{2.635\times10^8} = 40.5367 \text{ rad/m}$$

$$\Gamma_L = \frac{Z_L - Z_0}{Z_L + Z_0} = \frac{(138+j95)-380}{(138+j95)+380} = 0.4937\angle 148.174°$$

$$\Gamma_{in} = \Gamma_L e^{-j2\beta\ell} = (0.494\angle 148.2°)e^{-j2(40.537)0.213}$$

$$= 0.4937\angle -121.245°$$

$$SWR = \frac{1+|\Gamma|}{1-|\Gamma|} = \frac{1+0.4937}{1-0.4937} = 2.95$$

$$Z_{in} = Z_0\frac{1+\Gamma_{in}}{1-\Gamma_{in}} = 380\,\frac{1+0.4937\angle -121.245°}{1-0.4937\angle -121.245°}$$

$$= 163.682 - j182.686\ \Omega$$

phase constant = 40.5367 rad/m load refl. coeff. = 0.4937∠148.174°

input refl. coeff. = 0.4937∠−121.245° SWR = 2.95

input impedance = 163.68 − j182.69 Ω

Express reflection coefficients in polar form, e.g., A∠θ (deg), & impedance in rectangular form, e.g., $R + jX$.