

國立宜蘭大學一百零三學年度第二學期電磁學作業

分數

第幾回	命題教師	作業範圍	班級	學號	姓名
2	邱建文	Ch8.1-Ch.8.4	電子二乙		

本次作業完成方式：☐獨立完成 ☐與他人討論完成 ☐參考別人完成，參考_____同學(請誠實勾選一項)

1. If the return loss of an load terminated to a $50\ \Omega$ transmission line is 6 dB, please find the reflection coefficient, VSWR, and the reflection power ratio

$$RL = -20 \log |\Gamma| \text{ (dB)} = 6$$

$$RL = 10 \log \frac{P_i}{P_r} = 6$$

$$\log |\Gamma| = \frac{-6}{20} = -0.3$$

$$\log \frac{P_i}{P_r} = 0.6 \Rightarrow \textcircled{3} \frac{P_i}{P_r} = 4$$

$$|\Gamma| = 0.5$$

$$SWR = \frac{1+|\Gamma|}{1-|\Gamma|} = \frac{1+0.5}{1-0.5} = 3$$

2. A terminator which has a load impedance of 85 ohm terminates a 50 ohm transmission line. Find the reflection coefficient, VSWR, return loss and the reflection power ratio.

$$\Gamma = \frac{Z_L - Z_0}{Z_L + Z_0} = \frac{85 - 50}{85 + 50} = 0.26$$

$$SWR = \frac{1+|\Gamma|}{1-|\Gamma|} = \frac{1+0.26}{1-0.26} = 1.703$$

$$RL = -20 \log |\Gamma| = -20 \log 0.26 = 11.7 \text{ (dB)}$$

$$RL = 10 \log \frac{P_i}{P_r} = 11.7 \quad \frac{P_i}{P_r} = 10^{1.17} = 14.8$$

3. A $50\ \Omega$ transmission line, with a length of 0.25λ , is terminated a load impedance of $100 + j80\ \Omega$. Find (a) the reflection coefficient at the load, (b) the reflection coefficient at the input, (c) VSWR on the line, (d) the return loss, and (e) the impedance at the input of the line.

$$\ell = \frac{1}{4}\lambda \quad \beta\ell = \frac{2\pi}{\lambda} \times \frac{\lambda}{4} = \frac{\pi}{2}, \quad \tan \beta\ell \rightarrow \infty \quad Z_L = 100 + j80$$

$$\text{(a)} \quad \Gamma_L = \frac{Z_L - Z_0}{Z_L + Z_0} = \frac{100 + j80 - 50}{100 + j80 + 50} = \frac{50 + j80}{150 + j80} \times \frac{150 - j80}{150 - j80} = \frac{13900 + j8000}{28900} = 0.481 - j0.277$$

$$= 0.555 \angle 29.9^\circ$$

$$\text{(b)} \quad \Gamma(\ell) = \Gamma_L e^{-j2\beta\ell} = (0.555 \angle 29.9^\circ) e^{-j\pi} = (0.555 \angle 29.9^\circ) e^{j\pi} = 0.555 \angle -150^\circ$$

$$\text{(c)} \quad SWR = \frac{1+|\Gamma|}{1-|\Gamma|} = \frac{1+0.555}{1-0.555} = 3.494 \quad \text{(d)} \quad RL = -20 \log |\Gamma| = -20 \log 0.555 = 5.114 \text{ (dB)}$$

$$\text{(e)} \quad Z_{in} = Z_0 \frac{Z_L + jZ_0 \tan \beta\ell}{Z_0 + jZ_L \tan \beta\ell} \xrightarrow{\tan \beta\ell \rightarrow \infty} Z_0 \times \frac{Z_0}{Z_L} = \frac{2500}{100 + j80} \times \frac{100 - j80}{100 - j80} = \frac{250000 - j200000}{16400}$$

$$= 15.244 - j12.195 \ (\Omega)$$