ECE424F MICROWAVE CIRCUITS

Homework #2

1. A voltage generator V_g has an internal impedance $Z_g = R_g + jX_g$ and provides power to a lossless transmission line of characteristic impedance Z_o and propagation constant β. The line has a length l and is terminated to a load impedance Z_L.

a.) Prove that the real power delivered to the load impedance can be expressed as:

$$P = P_A \frac{\left(1-\left|\Gamma_G\right|^2\right)\left(1-\left|\Gamma_L\right|^2\right)}{\left|1-\Gamma_L\Gamma_G e^{-2j\beta l}\right|^2}$$

where $P_A = \left|V_g\right|^2/(8R_g)$ is the available power from the source and Γ_G, Γ_L are the reflection coefficients at the source and load respectively.

b.) Deduce an expression for the delivered power when the load is matched to the line.

c.) Deduce an expression for the delivered power when the generator is matched to the line.

d.) Starting from the expression found in (a) above, prove that in the case of a conjugate matched line $P = P_A$.

2. Problem 2.13 in textbook.

3. Problem 2.22 in textbook.

4. An air filled transmission line 250m long, operating at 2.86 MHz, is terminated to a load impedance of 200Ω. The line characteristics are $Z_o = 300\Omega$ and $\alpha = 4\times10^{-4}$ Np/m. The line is fed at its input by a voltage generator $V_g = 30V$. Compute the power delivered to the loaded line at input, the power delivered to the load, the power lost in the line and the power reflected from the load.