EXERCISES

1. An air line has a characteristic impedance of 70Ω and a phase constant of $3\ rad/m$ at $100\ MHz$. Calculate the inductance per meter and the capacitance per meter of the line.

2. A transmission line operating at $500\ MHz$ has $Z_o = 80\Omega$, or $\alpha = 0.04\ Np/m$, $\beta = 1.5\ rad/m$. Find the line parameters $R, L\ G$, and C.

3. A distortionless line has $Z_o = 60\Omega, \alpha = 20\ mNp/m, u = 0.6c$, where c is the speed of light in a vacuum. Find R, L, G, and λ at $100\ MHz$.

4. A telephone line has $R = 30\ \Omega/km$, $L = 100\ mH/km$, $G = 0$, and $C = 20\ \mu F/km$. At $f = 1\ kHz$, obtain:
   a. The characteristic impedance of the line
   b. The propagation constant
   c. The phase velocity

5. A certain transmission line $2\ m$ long operating at $\omega = 10^6\ rad/s$ has $\alpha = 8\ dB/m$, $\beta = 1\ rad/m$, and $Z_0 = 60 + j40\Omega$. If the line is connected to a source of $10 < 0°\ V$, $Z_l = 40\ \Omega$ and terminated by a load of $20 + j50\ \Omega$. Determine:
   a. The input impedance
   b. The sending-end current
   c. The current at the middle of the line

6. The transmission line shown in Figure 1 is $40\ m$ long and has $V_g = 15 < 0°\ V_{rms}$, $Z_0 = 30 + j60\Omega$, and $V_L = 5 < -48°\ V_{rms}$. If the line is matched to the load and $Z_g = 0\ \Omega$, calculate:
   a. The input impedance Z_{in}
   b. The sending-end current I_{in} and voltage V_{in}
   c. The propagation constant γ

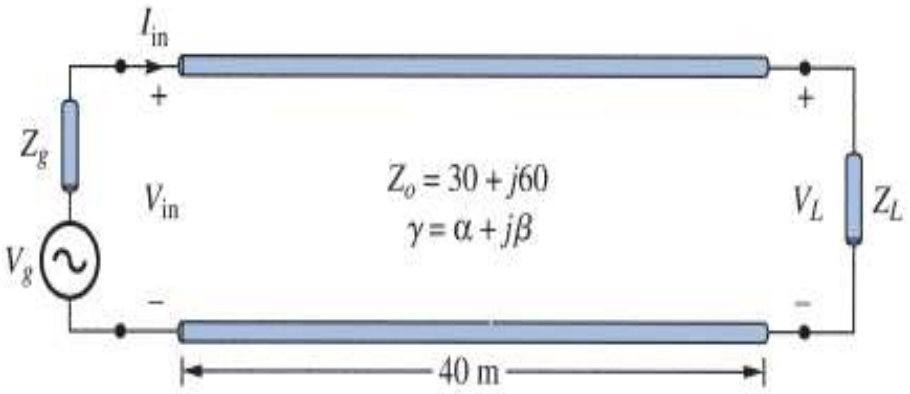

Figure 1

7. A lossless transmission line with $Z_o = 50\Omega$ is $30\ m$ long and operates at $2\ MHz$. The line is terminated with a load $Z_L = 60 + j40\Omega$. If $u = 0.6c$ on the line, find
   a. The reflection coefficient Γ
   b. The standing wave ratio s
   c. The input impedance
   Solve this problem with and without a Smith's chart.

8. A 70Ω lossless line has $s = 1.6$ and $\theta_r = 300^o$. If the line is 0.6λ long, obtain
   a. Γ, Z_L, Z_{in}
   b. The distance of the first minimum voltage from the load
   Solve this problem with and without a Smith's chart.

9. A load of $100 + j150\Omega$ is connected to a 75Ω lossless line. Find
   a. Γ
   b. s
   c. The load admittance Y_L
   d. Z_{in} at 0.4λ from the load.
   e. The location of V_{max} and V_{min} with respect to the load if the line is 0.6λ long
   f. Z_{in} at the generator
   Solve this problem with and without a Smith's chart.

10. A lossless 60Ω line is terminated by a load of $60 + j60\Omega$.
    a. Find Γ and s. If $Z_{in} = 120 - j60\Omega$, how far (in terms of wavelengths) is the load from the generator?
    b. Calculate Z_{max} and $Z_{in,min}$. How far (in terms of λ) is the first maximum voltage from the load?
    Solve this problem with and without a Smith's chart.