

ECE 457- Microwave Devices and Circuits

Fall 2026

Homework #5- Impedance Matching with TLines

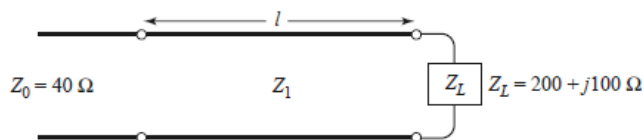
Due: Monday Oct 12th—

1. Pozar 5.5

A load impedance $Z_L = 90 + j60 \Omega$ is to be matched to a 75Ω line using a single shunt-stub tuner. Find two designs using open-circuited stubs.

2. Pozar 5.7

In the circuit shown below a load $Z_L = 200 + j100 \Omega$ is to be matched to a 40Ω line, using a length l of lossless transmission line of characteristic impedance Z_1 . Determine, in general, what type of load impedances can be matched using such a circuit.



3. Pozar 5.9

Design a double-stub tuner using open-circuited stubs with a $\lambda/8$ spacing to match a load admittance $Y_L = (0.4 + j1.2)Y_0$.

4. Using ADS, design the following matching networks for a 250Ω load:
 - a) A lumped LC network
 - b) A single shunt-stub matching network, and
 - c) A quarter-wave matching network

For each of the above circuits, the design frequency should be 5 GHz and the match (return loss) should be no smaller than 30 dB at the design frequency. Defining the matching bandwidth as the frequency range over which the reflected power is at least 15dB down; use ADS to determine the bandwidth of each of the above matching circuits.

5. Consider the matching network shown below which consists of two quarter-wavelength long transmission lines with a characteristic impedance, Z_m . The electrical lengths θ_1 and θ_2 are variable. This type of matching (called “slug matching”) is common in coaxial circuits where the two lines (Z_m) are just dielectric cylinders (or “slugs”) that can be moved along the coaxial transmission line. Assume that $Z_0=50 \Omega$ and $Z_m=25 \Omega$.

- a) Given the minimum and maximum values of $|\Gamma_L|$ that can be matched and the corresponding values of θ_1 and θ_2 (Γ_L is the reflection coefficient at the load)
- b) Show the forbidden region on the Smith Chart for this matching network. That is, show the region where no load can be matched using the slug tuner.

