Study Material

Text Book

Elements of Electromagnetics, 6th Ed.
Matthew N. O. Sadiku
Oxford University Press

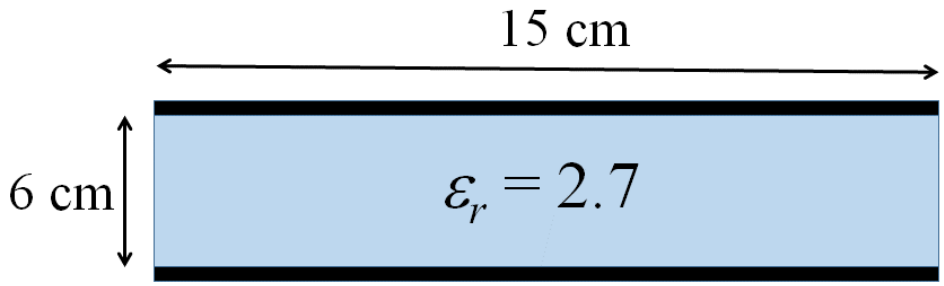
Study Waveguides

Read Chapter 12, pp. 612–646.

Problems

Problem #1

A large parallel plate waveguide is shown below. Over what range of frequencies is this waveguide single mode?



Problem #2

Is the waveguide in Problem #1 a transmission line?

Problem #3

What is the characteristic impedance of the TEM mode for the waveguide in Problem #1?

Problem #4

Let the parallel plate waveguide in Problem #1 operate at 3.5 GHz. Use MATLAB to visualize all of the guided modes in a single figure. In this figure, visualize the mode in the cross section of the waveguide and label each plot with the mode designation (i.e. TM_0, TE_1, etc.), what field component is being visualized (i.e. E_z or H_z), the propagation constant β, and the characteristic impedance Z_0. Make your plots to scale.

Problem #5

Design a parallel plate waveguide with a 75 Ω impedance that is single mode at 5.6 GHz. The separation between the plates should be at least 1 mm and the dielectric medium set to $\varepsilon_r = 2.7$.