

Study Material

Text Book

Elements of Electromagnetics, 7th Ed.
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Oxford University Press

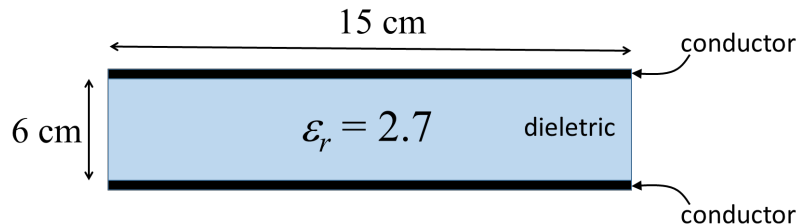
Study Waveguides

Read Chapter 12, pp. 632–660.

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. In a single figure, plot the supported modes from the equations in the notes using MATLAB. Do not jump ahead and attempt to use `tlcalc()`. 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. It is optional to provide this MATLAB code in your homework, but if you do please place the MATLAB code at the end of your document in an Appendix.

Problem #5

Design a parallel plate waveguide with a 75Ω 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 $\epsilon_r = 2.7$.