Homework #6 – Parallel Plate Waveguide
Due 24 October 2017

**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?

![Waveguide Diagram]

**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 $\beta$, and the characteristic impedance $Z_0$. Make your plots to scale.

**Problem #5**
Design a parallel plate waveguide with a 75 $\Omega$ 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 $\varepsilon_r = 2.7$. 