ECE 451 Homework 2 Due Wednesday February 22, 2017

1. A parallel-plate waveguide is filled with a dielectric $\varepsilon = 9\varepsilon_o$ and $\mu = \mu_o$. The separation between the plates is 2.5 cm. Determine the propagating modes for a wave of frequency 5 GHz. For each propagating mode, fill in the following table. Waves are incident on the plates with an angle θ with respect to the normal to the plates. v_{pz} and v_g are the phase and group velocities respectively.

Mode	f_c (GHz)	θ (deg)	v_{pz} (m/s)	v_g (m/s)
TEM				
TE_1				
TM_1				
TE_2				
TM_2				

2. An air-filled rectangular waveguide has largest side a = 1 cm. Find the length of the side b, necessary to have identical cutoff frequency for the TE_{20} and TM_{11} modes.

3. An air-filled, X-band (8-12GHz), WC-94 circular waveguide has an inner diameter of 2.383 cm.

(a) Determine the cutoff frequencies of the TE_{11}, TM_{01}, and TE_{21} modes.

(b) Find the modes that will propagate through this guide at 10 GHz.

(c) Find the frequency range within which only the TE_{11} mode propagates.