**Assignment #8: Due Friday April 17, 2015 at 2:30 pm**

**Problems**

There are only three problems in this problem set. Each one is worth 20 points.

**Problem 8-1: Attenuation in a Wave Guide**

In class we have been focusing on the $TE_{1,0}$ mode of a rectangular wave-guide of dimension $a > b$ (see equation (8.46) of Jackson page 362). For this mode, evaluate the Poynting flux $P_{1,0}$ , the value of $dP_{1,0}/dz$ , and thus the attenuation constant $\beta_{1,0} = -\frac{1}{2P_{1,0}}\frac{dP_{1,0}}{dz}$ (see equations (8.59) and (8.63) Jackson p. 865). Plot $\beta_{1,0}$ versus $\omega/\omega_{1,0}$ for this mode. At what value of the frequency $\omega$ is $\beta_{1,0}$ a minimum?

**Problem 8-2: Q of a mode in a cavity**

Suppose we have a cavity with dimension $0 < x < a$ , $0 < y < b$ and $0 < z < d$ containing a resonant mode in the cavity given by

$$B_z = B_o \cos(\pi x/a)\sin(\pi z/d)$$

(this is just our $TE_{1,0}$ mode from above converted to a standing wave in the z-direction satisfying the appropriate boundary conditions). Calculate the *Q* of this mode in this cavity, following the development leading up to equation (8.96) of Jackson p 373). Assume that the skin depth in the conductor $\delta = \sqrt{2/\mu_c\sigma\omega}$ is small compared to any of *a*, *b*, or *d*.

**Problem 8-3: Jackson 8.5 part (a) only, page 398.**