Pset 8 (8.311)

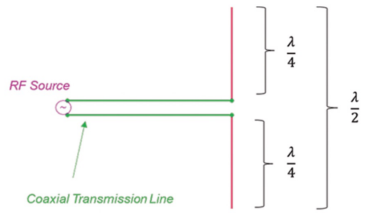
(50 pts)

1a) Calculate the time averaged energy density of an Electromagnetic plane wave in a conducting medium. Show that the magnetic contribution dominates.

b) Show that the intensity is $(k/2\mu\omega)\, E_0^2 \exp[-2\kappa z]$. ($\kappa$ is a kappa).

(50 pts)

2) For a metallic coaxial cable with a circular cross section, find the lowest order TEM mode and calculate it's cutoff frequency.



(70 pts)

3) Solve the dipole antenna radiation problem for the optimal length of antenna $l=\lambda/2$, assuming that the current distribution in each of its arms is sinusoidal. $I(z,t) = I_0 \cos(\pi z/l)$. That is, calculate the vector potential in the far field, the radial component of the pointing vector, and approximately the total power radiated radially.