EE381   **Homework 10**

Due Date: 04/29 **At the beginning of class**
These problems test a variety of skills, including your knowledge of, and ability to calculate
properties of antennas.

Hertzian Dipole

1. A dipole antenna has the following parameters:
   - Antenna length $l = 0.02\lambda$
   - Current magnitude $I_o = 3\ A$
   - Operating frequency $f = 400\ MHz$
   - Radiation range $r = 60\ m$

   Determine the following:
   a. the magnitude of the electric field intensity at $\theta = 90°$
   b. the magnitude of the magnetic field intensity at $\theta = 90°$
   c. the radiation resistance
   d. the radiated power

Half-Wave Dipole

2. A car radio antenna $1\ m$ long operates in the AM frequency of $1.5\ MHz$. How much current
   is required to transmit $4\ W$ of power?

Antenna Characteristics

3. An antenna located at the origin has a far-field electric field given:

$$\vec{E} = \frac{\cos 2\theta}{r} e^{-j\beta r} \hat{\theta} \qquad V/m$$

   a. Obtain the corresponding $\vec{H}$ field
   b. Determine the power radiated
   c. What fraction of the total power is radiate in the belt $60° < \theta < 120°$?

Aperture Antenna

4. Consider an antenna with a circular aperture with a circular beam having a beam width of 4° at 15 GHz
   a. What is the antenna directivity in dB?
   b. If the antenna area is increased by 50%, what will be the new directivity and new beamwidth?
   c. If the aperture is kept the same as in (a), but the frequency is doubled to 30 GHz, what will the directivity and beamwidth then become?

Antenna Array

5. An array comprises two dipoles that are separated by one wavelength. If the dipoles are fed by currents of the same magnitude and phase,

   a. Find the array factor
   b. Calculate the angles where the nulls of the pattern occur
   c. Determine the angles where the maxima of the pattern occur
   d. Sketch the group pattern in the plane containing the elements