

**ECEn 560**  
**Electromagnetic Wave Theory**

Homework #8

Due Feb. 4, 2016 (may be turned in late for half credit)

1. Find the far field of the turnstile antenna consisting of two Hertzian dipoles at right angles with current distributions  $\bar{J}_1 = \hat{x}Il\delta(\bar{r})$  and  $\bar{J}_2 = \hat{y}iIl\delta(\bar{r})$ . Sketch the radiation pattern.
2. The power radiated by an antenna is 1 W and the radiation pattern is  $\cos^2 \theta$ . Find (a) the peak power density 1 km from the antenna and (b) the directivity.
3. For a narrow beam, highly directive antenna, by neglecting pattern sidelobes and approximating the radiated power density in the main beam as constant, derive an approximate relationship between directivity and beamwidth.
4. Estimate the radiation resistance of a half-wave dipole using a sinusoidal current distribution. Use the approximate integral value

$$\int_0^\pi \frac{\cos^2 [(\pi/2) \cos \theta]}{\sin \theta} d\theta \simeq 1.22$$