

**EE 483/583 Antennas for Wireless Communications (Spring 2025)**

**Homework 3**

**Wednesday, February 5, 2025**

- 1) In free space, a small dipole of length  $\lambda/24$  has an electric field given by (4-36a). Find a) the vector effective length, b) maximum value of the vector effective length and angle(s) at which it occurs, c) the ratio of the maximum effective length to the physical length, and d) the open-circuit voltage if a vertically-polarized uniform plane wave impinges on the dipole with a power density of  $0.4 \text{ mW/m}^2$  at 2.4 GHz at broadside.
- 2) 2.76 Hint: The physical area of the reflector means the area of the aperture not the surface area of the metal parabolic dish. Assume free space.
- 3) 2.94
- 4) 2.98
- 5) 2.103 Hint: The term 'resonant' implies that the reactance of the dipole has been eliminated, i.e.,  $X_A = 0$ .
- 6) 2.106
- 7) 2.111 modified so the transmission line temperature is  $76^\circ\text{F}$  and attenuation is 2.5 dB/100 ft. You may assume the effective antenna temperature incorporates both the antenna noise temperature as well as that due to the antenna physical temperature at the terminals.
- 8) **EE 483 only:** 2.84 Also, find the aperture efficiency in each case.
- 9) **EE 583 only:** 2.87 Begin by calculating the normalized radiation intensity.

**Due Monday, February 10, 2025**