EE 252
Len Tyler **April 8, 2005**

Problem Set #2

Due 4:30 pm Friday, April 15, 2005

Reading assignment: *Stutzman & Thiele* 1.1–1.10, 2.1, 2.2, 2.5, 5.1
(Optional) *Kraus* 2.20–2.25, 5.1–5.3, 5.5–5.8

Problems:

1. *Stutzman & Thiele*, Problem 1.8-2. Plot the power patterns with Matlab.(10 point, a:3, b:1, c:2, d:2)
2. *Stutzman & Thiele*, Problem 1.8-8.(5 point)
3. *Stutzman & Thiele*, Problem 1.9-2.(4 point)
4. (a) Design a two-way radio link to operate over Earth-Mars distances for data and picture transmission with a Mars probe at 2.5 GHz with a 5-MHz bandwidth. A power of 10^{-19} W Hz^{-1} is to be delivered to the earth receiver and 10^{-17} W Hz^{-1} to the Mars receiver. The Mars antenna must be no larger than 3 m in diameter. Specify the effective aperture of Mars and earth antennas and the transmitted power (total over entire bandwidth) at each end. Take Earth-Mars distance as 6 light-minutes.(3 point)
   (b) Repeat (a) for an Earth-Jupiter link. Take the Earth-Jupiter distance as 40 light-minutes.(2 point)
5. (a) Consider a dipole whose terminals are connected to a diode detector. The output of the diode detector is the voltage at the antenna terminals squared. A linearly polarized wave is incident on this antenna. Describe how you can orient your antenna to detect the incident wave polarization. (3 point)
   (b) If the incident wave is circularly polarized, use the previous setup to detect this CP wave. What will be your received power level as compared to that of incident wave? Will you be able to identify the type of circularly polarized wave (right or left handed) and how?(3 point)
6. *Stutzman & Thiele*, Problem 2.5-3.(5 point)
7. *Stutzman & Thiele*, Problem 2.5-11.(5 point)