**EE 483/583 Antennas for Wireless Communications (Spring 2024)**
**Homework 10**
**Thursday, April 11, 2024**

1) Design a rectangular microstrip antenna to operate at a frequency of 2 GHz on a Montoya Corporation substrate with a relative permittivity of 2.2 and dielectric thickness of 0.064" = 64 mils, 0.5 oz. copper cladding (17 μm), and $\tan(\delta) = 0.003$. The antenna is to be matched to a 50 Ω microstrip transmission line on this substrate using an inset feed. Discuss and justify design choices. Accurately sketch a top view of the final design (all dimensions in mm). **EE 583 only**- Include a fully-labeled Smith chart showing the normalized admittances $y_1 = y_2$ and $y_{2t}$ (i.e., $y_2$ translated across length $L + \Delta L$ of microstrip antenna) and discuss results.
2) For the rectangular microstrip antenna of part 1), compute the maximum directivity (unitless and dBi) using both numerical methods discussed in class. Compare the results and discuss any differences. Also, compute the *estimated* half-power beamwidths (HPBW) in the E- and H-planes.
3) For the rectangular microstrip antenna of part 1), compute and graph the E-plane and H-plane **normalized** directivity patterns (both unitless and in dB) with the positive *x*-axis pointing toward top of page. For the radiation patterns in dB, use a 0 to -40 dB scale. Also, find the actual HPBW in the E- and H-planes. In a table, list the estimated HPBWs, actual HPBWs, and percent differences (%). How do they compare?

**Due Thursday, April 18, 2024**