Expected Outcomes for EE117: Electromagnetic Fields and Waves

1) Knowledge of basic wave propagation: be able to discuss and deduce equations to describe wave propagation, to relate wave velocity and time delay and should be able to formulate potential concepts to relate wave properties and their excitation.

2) Should be able to specify the “constitutive relationships” for fields and understand why they are required.

3) An ability to apply complex phasors (Fourier) to fields for sinusoidal waves.

4) To have acquired knowledge of transmission lines for pulsed and sinusoidal steady state excitation; to have an understanding of wave interference and resonance on transmission lines and to be able to quantitatively deduce capacitive and inductive responses to pulsed excitation.

5) To have acquired techniques for the measurement of basic transmission line parameters such as the reflection coefficient, standing wave ratio, and impedance.

6) Understanding of the Smith chart, its application to matching, and experimental verification.

7) Have an ability to determine and describe static and dynamic electric and magnetic fields for technologically important structures; the coil, charge distributions, the dipole, the coaxial cable, dielectric and conducting spheres immersed in electric fields and the depletion region of a p-n junction.

8) Knowledge of, physical interpretation, and ability to apply Maxwell’s equations to determine field waves, potential waves, energy and charge conservation conditions.

9) Experimental measurement of voltages induced by time varying magnetic flux. Flux determination.

10) A knowledge of and experimental measurement of the influence of boundaries on waves. Thus, knowledge of and the application of boundary conditions for fields, Brewster’s angle to eliminate reflections and polarize radiation, total reflection from a boundary, evanescent fields and some knowledge of their application to modern optics.

11) Basic concept of the guiding of electromagnetic waves by constructive multiple reflections from conductors and dielectrics. Have some knowledge of cut-off, dispersion, and why non-dispersive TEM waves in ideal coaxial lines and fibers are so useful.

12) Have acquired a basic knowledge of antenna concepts including, directivity, antenna gain, effective area, radiation resistance and be able to carry out far field calculations.

13) To have some knowledge of antenna arrays and their usefulness to modern wireless applications.

14) An ability to use the Friis equation to carry out basic wireless power budget calculations. The role of thermal noise.

15) Some ability to use numerical techniques such as Matlab and perhaps finite elements to solve and visualize electromagnetics.