



## ECE 3300 Laboratory Introduction and Overview

Welcome to the labs for ECE 3300 Beginning Electromagnetics. This class has a series of 6 labs that build upon each other to teach you basic skills in using lab equipment and in computational electromagnetics. The following is a brief description of the labs and how they tie in with ECE 3500 Fundamentals of Signals and Systems.

### Lab 1: Dielectric Properties and Link Budget

- Dielectric properties of materials
- How these properties affect electric fields (loss, phase shift, velocity of propagation, etc)?
- Mix water, sugar, and salt to create mixture with electrical properties of muscle
- Determine a link budget for a pacemaker communication system.

### Lab 2: Transmission Lines and Time Domain Reflectometry (TDR)

- Different types of transmission lines, including coaxial cable, two wire lines, and microstrip.
- Impedance, RLGC, velocity of propagation, etc.
- Use TDR to determine loads, learn about transient voltages, and better understand the concept of impedance.

### Lab 3: Matching Antenna Networks

- Design single stub matching circuits in a steady state environment.
- Learn about antennas, their input impedance, radiation pattern and how to match the antenna to a source.

### Lab 4: Plane Wave Simulation with FDTD

- Simulate RLGC transmission line with FDTD programmed in Matlab™.
- Observe reflections at tissue interfaces.

### Lab 5: Calculating EM Fields with Biot-Savart Law

- Solve the Biot-Savart law using trapezoidal integration.
- Compute fields for the monopole antenna from Lab 3.

### Lab 6: FSK Communication System

- Test a frequency shift keyed (FSK) communication system for a cardiac pacemaker.
- Send a message in Morse code to other members of your team
- Verify the link budget by checking how far the system transmits