EEL 3302 Engineering Leadership II

Real World Measurements

Instructor: Scott Starks, Ph.D., P.E.
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Course Location: Room 101, Class Room Building
Time: Tuesdays and Thursdays 3:00 – 4:20 PM
Textbooks: *An Introduction to Electric Circuits* by Scott Starks. This primer will be made available free of charge to the class through Black Board.
Leadership: Theory and Practice by Peter Northouse, https://edge.sagepub.com/northouse7e

Course Description

Conducting experiments and making measurements is an essential aspect of all branches of science and engineering. Nearly all of our current quantitative understanding of the natural and engineered world has come from the interplay between theory and measurements. Models and simulations of systems require experimental validation and performance of engineered systems must not only be predicted, but also measured and tested. In this course we will learn the basic tools of making physical measurements and conducting experiments. We will collect data, analyze data, conduct basic error analysis, and design experimental systems. Using inexpensive modern sensors, we will build the necessary supporting electronics and learn to collect data with computer based data acquisition systems. The first part of the course will focus on individual work and students will conduct labs on basic electrical, mechanical, and environmental measurements. The later part of the course will involve a team project where measurements are made outside the controlled environment of the classroom.

Learning Objectives

At the end of the semester, students will:

1. Have the ability to analyze simple electronic circuits.
2. Design and build systems that are capable of sensing various physical phenomena.
3. Understand the theory of operation of real world sensing devices.
4. Be able to design a sensing platform that can be integrated into a real world application or environment.

Competencies

Qualitative analysis, quantitative analysis, teamwork, communication, understanding of context, design, diagnosis, electronic laboratory skills, breadboarding, measurement, sensing, and system integration

Course Topics

I. Introduction to Electric Circuit Analysis
   a. Charge, Current and Voltage
   b. Ohm's Law
   c. Kirchoff's Voltage Law
   d. Kirchoff's Current Law

II. Basic Laboratory Practices
   a. Powered Breadboard
   b. Supply Voltages and Ground
   c. Constructing Circuits
   d. Voltage Divider Principle

III. *Digilent Analog Discovery* – USB Oscilloscope
   a. Downloading "Waveforms" Software
   b. Simple Operations and Measurements Using the Analog Discovery

IV. Resistors and Potentiometers
   a. Resistor Color Codes
   b. Resistor Measurement
   c. Trim Potentiometers

V. Operational Amplifiers
   a. Circuit Configuration
   b. Measurement of Operational Amplifier Characteristics
   c. Closed-Loop Performance
   d. Negative Feedback
   e. Amplifier Design
   f. Practical Limitations

VI. Filters
   a. Passive Filters
   b. Active Filters
   c. Frequency Response (Amplitude and Phase)
   d. Bode Plots

VII. Projects
   Thermal
   EKG/ECG
   Strain Gauge
   Ultrasonic Range Finder
   Remote Data Logger

Grading Policy

Students will be graded on the basis of assigned projects (40%), capstone project (20%), learning check points (20%), E-Portfolio (10%), and assignments relating to *Leadership: Theory & Practice* (10%).

Letter grades will be assigned according to the following scale:
90 – 100 % A
80 – 89 % B
70 – 79 % C
60 – 69 % D
59 or below F

Attendance Policy

Students are expected to attend all classes. Students who miss 3 or more classes **may be dropped** from the class.

Assigned Projects

Students will be required to complete a not yet determined number of projects during the term. These projects primarily deal with the design and construction of electric circuits that can be used for sensing and measurement. Laboratory Reports will be submitted to Blackboard for each project.

Student Groups/Teams

Students will be grouped for each project. This will enable each student to work with other students during the class. The instructor will keep track of and assign the pairs for each project.

Capstone Project

The final two weeks of the course will be devoted to the completion of a Capstone Project. Students will be given the opportunity to choose the topic of their Capstone Project and the group they wish to work with.

Learning Check Points

Students will gain a foundation and an appreciation of the theory of electric and electronic circuits in the class. From time to time, learning check points will be administered to gauge the preparedness of students in the area of electric/electronic circuit theory.

Book: Leadership Theory and Practice

In order to build one's leadership abilities, it is essential to become aware of the contemporary issues that confront leaders. The Engineering Leadership faculty have established a policy that majors will read certain chapters from this book each semester. Students are expected to read this book, complete assignments relating to the book, and to be prepared to discuss its merits during the class.

Cell Phone Policy

Cell phones are not permitted during the lecture. Students are required to turn off cell phones before entering the classroom. Cell phones should be placed out of sight (like in a purse or backpack). Students should **NOT** receive or make calls/text messages during class. **Students using cell phones during class will be asked to leave.**

Eating in Class

Please do not eat during class hours.

Academic Dishonesty

"Any student who commits an act of scholastic dishonesty is subject to discipline. Scholastic dishonesty includes, but is not limited to, cheating, plagiarism, collusion, the submission for credit of any work or materials that are attributable in whole or in part to another person, taking an examination for another person, any act designed to give unfair advantage to a student or the attempt to commit such acts. Proven violations of the detailed regulations, as printed in the *Handbook of Operating Procedures*, and available in the Office of the Dean of Students and the homepage of the Dean of Students at www.utep.edu, may result in sanctions ranging from disciplinary probation, to a failing grade in the work in question, to a failing grade in the course, to suspension or dismissal, among others." (Quote from the Undergraduate and Graduate Catalog)

Accommodation under the Americans with Disabilities Act

If you feel you may have a disability that requires accommodation, contact the Disabled Student Services Office at 747-5148, go to room 106E Union, or e-mail dss@utep.edu.