
ECE 8930 Section 008

ECE8930: Scientific Measurement and Instrumentation

Class Location/Time: 109 Rhodes Annex / T. Th. 3:30-4:45pm

Instructor: Hai Xiao
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Office Hours: MW 10:00 – 11:00am, F 11:00am – 12:00 noon

Office: 209 Riggs

Teaching Assistant/Grader (if applicable): _____

Email: _____ Office and Office Hours: _____

Course Description

To introduce the student to time-variant electromagnetic phenomena such as Maxwell's equations, wave propagation in various media, wave transmission and propagation and radiation by ways of waveguides, transmission lines and antennas.

Prerequisites of the course: ECE3800 (or equivalent with consent of instructor)

Course Objectives

At the completion of the course, students should be able to understand the fundamental principles and theories of scientific measurement, establish a systematic approach in analysis, design, calibration, and characterization of sensors, instrument, and measurement systems, and acquire the knowledge on the latest sensors and measurement systems for measuring various physical and chemical quantities.

Required Materials

1. Morris, Alan S., and Reza Langari. Measurement and instrumentation: theory and application. Academic Press, 2012.
2. Lecture notes and handouts.

Reference Materials

1. R. Pallas-Areny, J. G. Webster, "Sensors and Signal Conditioning, 2nd Edition", 2000.
2. P. F. Dunn, "Measurement and Data Analysis," Mc Graw Hill, 2005.
3. E. O. Doebelin, "Measurement Systems: Application and Design", Fifth Edition, Mc Graw Hill, 2004.
4. B. R. Eggins, "Chemical Sensors and Biosensors", May 2002.
5. J. P. Holman, "Experimental Methods for Engineers," 7th Ed. Mc Graw Hill, 2001.

6. J. W. Dally, W. F. Riley, and K. G. McConnell, "Instrumentation for Engineering Measurements, 2nd Edition", 1993.

Topical Outline

1. Measurement units and international standards
2. Performance characteristics of measurement instrumentation
3. Measurement errors
4. Measurement noise and noise reduction methods
5. Signal conditioning/transmission, data acquisition/processing/recording/displaying, and data analysis
6. Analog and digital circuits in measurement instrumentation
7. Modern instrumentations, hardware, software, and human interface
8. Measurement system design and optimization approaches
9. Design of experiments, calibration, characterization, and testing
10. Reliability and safety issues
11. Sensors and transducers (principle, modeling, design, and characterization) including but not limited to temperature, pressure, strain, translational/rotational motions, mass and weight, and chemical and biological quantities

Grading

1. Letter grade assignment:
A – 90% - 100%
B – 80% - Less than 90%
C – 70% - Less than 80%
D – 60% - Less than 70%
F – Less than 60%
2. **Homework: 15%.** Assigned on Tuesday, due next Tuesday at the beginning of class, no late homework will be accepted.
3. **Project term paper: 25%.** Students will be assigned to conduct research on a specific sensor system of their interest. The research work shall include the survey of the latest technologies, an analysis of the system that he or she chooses to study, proposal of possible methods to further optimize the system, and corresponding conclusions. Term papers will be required to summarize their research topics (page limit: 15, double-spaced). **Due date:** two weeks before final's week.
4. **Project presentation: 5%.** Seminars will be arranged to allow the students to present their research work to the class and the opportunity to grade their fellow students.
5. **Midterm exam: 25%.**
6. **Final exam: 30%.**

Additional Policies

1. Lecture notes and homework assignments are available in PDF files and posted for download before each class. Students need to check frequently to make sure they don't miss any assignments.
2. Students **MUST** work **alone** on all exams or tests. Electronic communication devices not allowed.
3. Homework problems for building skill will be assigned and solutions given. Homework will be graded.
4. **Academic Integrity:** Anyone caught in an act of academic dishonesty (cheating) will be penalized to the maximum extent allowed by Clemson University Academic Regulations. The full academic integrity statement is included as a PDF file on your Blackboard. Note that putting false information on a roll sheet is considered academic dishonesty in this course. Signing/writing another person's name on an attendance roll sheet is considered false information and is an act of academic dishonesty. Obviously, any form of cheating on a test or exam is academic dishonesty.
5. **Disability Access:** It is University policy to provide, on a flexible and individualized basis, reasonable accommodations to students who have disabilities. Students are encouraged to contact Student Disability Services to discuss their individual needs for accommodation, obtain a letter if appropriate, and then to discuss those needs with the instructor. In order to obtain accommodations, the student must notify the instructor no later than the end of first week of class.
6. **Missed Tests:** A student may not miss any test and must take the final exam to receive a passing grade in this course. No exceptions will be accepted.
7. **Syllabus changes:** This syllabus may be updated at any time during the semester. Students will be given adequate lead time to react to updates.

Title IX Statement

Clemson University is committed to a policy of equal opportunity for all persons and does not discriminate on the basis of race, color, religion, sex, sexual orientation, gender, pregnancy, national origin, age, disability, veteran's status, genetic information or protected activity (e.g., opposition to prohibited discrimination or participation in any complaint process, etc.) in employment, educational programs and activities, admissions and financial aid. This includes a prohibition against sexual harassment and sexual violence as mandated by Title IX of the Education Amendments of 1972. This policy is located at <http://www.clemson.edu/campus-life/campus-services/access/title-ix/>. If you have questions about Title IX, please contact the Title IX Coordinator Alesia Smith who is also the Executive Director of Equity Compliance, at 110 Holtzendorff Hall, 864-656-3181 (voice) or 864-656-0899 (TDD). The Title IX Coordinator is the person(s) designated by Clemson University to oversee its Title IX compliance efforts.