



Department of Mechanical Engineering

MCE380: Measurements and Instrumentation Laboratory

Instructor: Hanz Richter, Assistant Professor.

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Office Hours: Tuesday and Thursday, 10:30 AM-12:00 M and Wednesday, 1:00-2:15 PM

Textbook: Holman, Experimental Methods for Engineers.

Course Contents Basic measurement concepts. Uncertainty analysis. Statistical data analysis. Fundamentals of instrument response. Basic electromechanical transduction principles. Thermofluid measurements. Dimensional measurements. Contact and non-contact motion measurement. Measurement of force, torque and strain. Digital data acquisition and computer interfacing.

Objectives This course is designed to:

- Introduce theoretical background required for understanding essential measurement principles and statistical interpretation of experimental data.
- Familiarize the student with common instrument response specifications, both static and dynamic.
- Provide a survey of traditional and state-of-the-art measuring principles and devices for thermofluid, electromechanical and motion systems.
- Introduce digital data acquisition and computer interfacing. LabView software and state-of-the art data interfaces will be used.
- Provide hands-on working experience with industrial and research-grade instrumentation through laboratory experiences.
- Enable students to apply theoretical skills in the design and set-up of a specific measurement system.

Upon completion of this course, students should be able to:

1. Evaluate the uncertainty associated with direct and indirect measurements by worst-case error propagation.
2. Assess the normality of experimental data and calculate confidence intervals for the mean using Student's T-distribution.
3. Understand and perform instrument calibration and obtain regression equations.

4. Plan and execute an experiment. Collect, organize and interpret experimental data using modern acquisition systems.
5. Develop a graphical user interface (virtual instrument) to automate data collection using a computer and software such as LabView.
6. Understand the physical principles behind measurement devices and use this knowledge as the basis for instrument selection and/or development.
7. Stay abreast of innovations in measurement technology and research prospective measurement principles/devices.
8. Design and build a simple measuring device, complete with digital interface, calibration certificate, accuracy statements and user instructions.

Grading System

There will be 2 concise homeworks (analysis and presentation of data collected during short demonstrations), 5 laboratory experiences, 2 midterm exams and a final project. Homework is individual. The laboratory grade corresponding to each one of the 5 experiences will be assigned on the basis of attendance, active participation during the experiments, questioning during or after the experiments, and a written report. Each group will turn in one report. The midterm exams are, hopefully, individual. The final project is a group activity. Students will design and build a simple device to measure a quantity given by the instructor. The relative weights for arriving to the final numerical grade are as follows: homework: 25%; laboratory: 30%; midterms: 20% and final project: 25%. Cutoff numerical grades for conversion to letter grades will be as follows:

Range	Letter
88 – 100	A
75 – 87	B
65 – 74	C
50 – 64	D
0 – 49	F

Late lab reports will be rejected and receive a grade of zero for the whole group. Arrangements may be made to make the laboratory available outside class meeting times, so that groups can finish their projects. Explicit rules and time slots will be arranged in class. A sign-up sheet will be maintained to monitor the students' participation in the laboratory experiences. Make-up examinations will be arranged only due to extenuating circumstances, after proper justification is presented.

Course website

http://academic.csuohio.edu/richter_h/courses/mce380

Class notes, announcements, homework and exam solutions will be posted. The site will also contain interesting links and program downloads.

Academic Integrity

Academic dishonesty will not be tolerated and will be handled according to University policy: <http://www.csuohio.edu/studentlife/StudentCodeOfConduct.pdf>