

Spring 2019

MECA 380: Measurements and Instrumentation

Discussion:	Sec01: PLMS 102, MW 8-8:50am Sec02: PLMS 205, MW 9-9:50am	Instructor: Daisuke Aoyagi Instructor: Daisuke Aoyagi
Lab: (OCNL 431)	Sec03: M 2-4:50pm Sec04: T 11am-1:50pm Sec05: W 2-4:50pm Sec06: R 11am-1:50pm Sec07: F 2-4:50pm	Instructor: Ramesh Varahamurti Instructor: Daisuke Aoyagi Instructor: Ramesh Varahamurti Instructor: Daisuke Aoyagi Instructor: Ramesh Varahamurti
Instructors:	Daisuke Aoyagi daoyagi@csuchico.edu, 898-4619 Ramesh Varahamurti rvarahamurti@csuchico.edu, 898-6353	Office Hrs.: MW2-4pm Office: OCNL 428 Office Hrs.: TBA Office: OCNL 418
Prerequisites:	EECE 211/L, CSCI 111 or MECH 208	

Course Usage of Blackboard Learn

The course syllabus and other material will be posted on Blackboard Learn. You are responsible for regularly checking the online resources, which is accessed through the Chico State Portal.

Course Description

“Measurement of steady-state and dynamic phenomena using common laboratory instruments. Calibration of instruments, dynamic response of instruments, and statistical treatment of data.”

Student Learning Outcomes

Upon successful completion of this course, students will be able to:

1. Measure static and dynamic signals using common laboratory instruments
2. Understand basics of calibration of instruments and statistical treatment of data
3. Use a computer-controlled system to automate measurement process
4. Conduct experiments, analyze and interpret data
5. Write technical reports

Textbook

Figliola & Beasley, Theory and Design for Mechanical Measurements, 6th edition, Wiley 2015, ISBN 9781118881279; (e-book is acceptable.)

Software

- National Instruments LabVIEW, v2015 or newer (Student Edition – free 6-month evaluation available via <http://www.ni.com/labviewse/>, or purchase ~\$20)

- Mathworks MATLAB (Student version Base \$49, Suite \$99) (recommended)
- Microsoft Excel 2007 or later

Assignments and Grading

Lab Attendance, Conduct and Participation (30%)	Assessed by lab instructor and peer evaluation . * Lab attendance is required. Even if you are present in lab, you may get zero credit if, for example, you keep fiddling with your cellphone, not paying any attention.
Lab Notebook (10%)	Graded by lab instructor using a rubric, based on select items (TBA) of the “Deliverables”
LabVIEW programming assignments (30%)	Group assignment for each series of lab activities. Graded by lab instructor using a rubric
Final Project (30%)	Group project. Will discuss requirements and deliverables in class. Expect at least Project Proposal and Final Report (+ summary <i>video</i>)

(Note: subject to change with fair notice.)

Course Topics / Tentative Schedule

(Note: subject to change with fair notice.)

Week	Lab	Lecture/Discussion Topics
1	<i>(Monday Holiday)</i> LabVIEW Intro	Course Overview LabVIEW: Fundamentals, Versions
2	Thermistor A (intro)	Intro Thermistor Lab Basic concepts of measurements LabVIEW: DMM (DCV, Ω), GPIB, VISA, Inst. Driver, Loop, Case
3	Thermistor B (calibration)	Random and systematic error, Accuracy, Significant digits Standards, Static Calibration Curve fitting LabVIEW: Array, Write to Text file
4	Thermistor C (read-out, added features)	Linear vs Nonlinear systems, Static and dynamic signals, 1 st -order system, step response, time constant LabVIEW: Print-Documentation
5	Thermistor C (cont'd)	Final Project Requirements, Expectations, Deliverables Strain gauges and installation process, Wheatstone bridge
6	Static Strain Measurement (Intro)	Intro Strain Measurement Lab Probability and Statistics, Error propagation, LabVIEW: NI DAQmx Driver, cDAQ+NI9237
7	Static Strain Measurement (Programming)	Normal distribution, Sample mean, Standard deviation, z-test LabVIEW: SubVI, Flat Sequence DUE: Final Project Proposal (group)
8	Static Strain Measurement (Data Collection)	SD of the Means, t-test, Uncertainty, Outlier, Loading error
9	<i>(Spring Break)</i>	<i>(Spring Break)</i>

Week	Lab	Lecture/Discussion Topics
10	Strain & Accel. Lab, Intro	Intro Strain & Accel. Lab, Acceleration measurement, MEMS sensor, Digital sampling concepts, Aliasing LabVIEW: NI USB-6009, HP6632A
11	<i>(Monday Holiday)</i> Strain & Acc. (Natural vibration)	2 nd -order system, step response, under- vs over-damped systems, natural & ringing frequencies, settling & rise time, overshoot, Log decrement method
12	Strain & Acc. (Forced vibration)	Frequency response, Gain, Phase shift, Resonance
13	Strain & Acc. (finish up)	Bode plot, Corner frequency, Low-pass, high-pass, band-pass, band-stop filter
14	Final Project	Frequency Analysis, Fourier Series
15	Final Project	Fourier Transform, FFT
16	Final Project	Single-ended versus differential analog measurement
Final		DUE: Final Project Report & Video

Dropping and Adding

You are responsible for understanding the policies and procedures about add/drops, academic renewal, etc., found in the CSU Chico University Catalog. You should be aware of the new deadlines and penalties for adding and dropping classes.

Classroom Protocol

During class, please do not engage in any activities that are not related to the class, e.g. personal web surfing, online shopping, e-mail, Facebook, etc.

University Policies and Campus Resources

Academic Integrity

Students are expected to be familiar with the University's Academic Integrity Policy. Your own commitment to learning, as evidenced by your enrollment at California State University, Chico, and the University's Academic Integrity Policy requires you to be honest in all your academic course work. Faculty members are required to report all infractions to the Office of Student Judicial Affairs (Office of Student Conduct, Rights & Responsibilities). The policy on academic integrity and other resources related to student conduct can be found on the Student Judicial Affairs (Office of Student Conduct, Rights & Responsibilities) web site.

Student Services

Student services are designed to assist students in the development of their full academic potential and to motivate them to become self-directed learners. Students can find support for services such as skills assessment, individual or group tutorials, subject advising, learning assistance, summer academic preparation and basic skills development. Student services information can be found on the current students page of the CSU Chico web site.

Americans with Disabilities Act

If you need course adaptations or accommodations because of a disability or chronic illness, or if you need to make special arrangements in case the building must be evacuated, please make an appointment with me as soon as possible, or see me during office hours. Please also contact Accessibility Resource Center (ARC) as they are the designated department responsible for approving and coordinating reasonable accommodations and services for students with disabilities. ARC will help you understand your rights and responsibilities under the Americans with Disabilities Act and provide you further assistance with requesting and arranging accommodations.

[Accessibility Resource Center](#)

530-898-5959, Student Services Center 170, arcdept@csuchico.edu

Student Learning Center

The mission of the Student Learning Center (SLC) is to provide services that will assist CSU, Chico students to become independent learners. The SLC prepares and supports students in their college course work by offering a variety of programs and resources to meet student needs. The SLC facilitates the academic transition and retention of students from high schools and community colleges by providing study strategy information, content subject tutoring, and supplemental instruction. The University Writing Center has been combined with the Student Learning Center. You can also visit the [Student Learning Center web site](#).