MECA 380: Measurements and Instrumentation

Discussion (SSKY 120):
Section 1: MW 8-8:50am  Instructor: Daisuke Aoyagi
Section 2: MW 9-9:50am  Instructor: Daisuke Aoyagi

Lab (OCNL 431):
Section 3: M 2-4:50pm  Instructor: Ramesh Varahamurti
Section 4: T 11am-1:50pm  Instructor: Daisuke Aoyagi
Section 5: W 2-4:50pm  Instructor: Ramesh Varahamurti
Section 7: F 2-4:50pm  Instructor: Ramesh Varahamurti

Instructors: Daisuke Aoyagi daoyagi@csuchico.edu, 898-4619
Instructor: Daisuke Aoyagi
Office Hrs.: MWF 10-11am, Office: OCNL 428

Ramesh Varahamurti rvarahamurti@csuchico.edu, 898-6353
Office Hrs.: TBA, Office: OCNL 418

Prerequisites: CSCI 111 or MECH 208 (Intro Computer Programming, C/C++ or Matlab)
EECE 211/L (Linear Circuits I)

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

Software (recommended)
- National Instruments LabVIEW (Student Edition – free 6-month evaluation available via http://www.ni.com/labviewse/, or purchase ~$20)
• Mathworks MATLAB (Student version Base $49, Suite $99)
• Microsoft Excel 2007 or later

Assignments and Grading
Lab Attendance, Conduct and Participation (20%) Assessed by lab instructor and peer evaluation. *Lab attendance is required.
LabVIEW programming assignments (20%) Assigned for each series of lab activities.
Lab “Notebook” (20%) Required contents (“Deliverables”) will be announced for each series of lab activities. Graded by lab instructor using a rubric.
Group Project and Technical report (20%) Proposal (group), Progress Report (individual), Progress Presentation (group), and Final Report (individual)
Midterms (10%/each) Closed-book, open-notes/printouts, no electronic devices (except scientific calculator)

(Note: subject to change with fair notice.)

Course Topics / Tentative Schedule
(Note: subject to change with fair notice.)

<table>
<thead>
<tr>
<th>Week</th>
<th>Lab</th>
<th>Lecture/Discussion Topics/Due dates</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>LabVIEW Intro</td>
<td>Overview, Basic concepts of measurements, Temperature Measurements, LabVIEW Getting Started Tutorial Modules</td>
</tr>
<tr>
<td>2</td>
<td>Thermistor A</td>
<td>Intro Thermistor Lab, Standards, Static Calibration, Curve fitting, DMM (DCV, Ω), GPIB</td>
</tr>
<tr>
<td>3</td>
<td>Thermistor B</td>
<td>Accuracy, Precision, Random and systematic error, Significant digits, Linear vs Nonlinear system, DUE: Thermistor A Deliverables</td>
</tr>
<tr>
<td>4</td>
<td>Thermistor C</td>
<td>Static and dynamic signals, 1st-order system, impulse and step response, time constant</td>
</tr>
<tr>
<td>5</td>
<td>Thermistor C (cont’d)</td>
<td>Intro Strain Measurement Lab, Strain gauge and installation process, LabVIEW Programming review, NI-cDAQ+NI-9237</td>
</tr>
<tr>
<td>7</td>
<td>Strain Measurement Programming</td>
<td>Uncertainty, Normal distribution, Sample mean, Standard deviation, z-test, SD of the Means, t-test, DUE: Project proposal (group)</td>
</tr>
<tr>
<td>8</td>
<td>Strain Measurement Data Collection</td>
<td>Outlier, Loading error, Technical writing, Midterm 1</td>
</tr>
<tr>
<td>9</td>
<td>(Spring Break)</td>
<td>(Spring Break)</td>
</tr>
<tr>
<td>Week</td>
<td>Lab</td>
<td>Lecture/Discussion Topics/Due dates</td>
</tr>
<tr>
<td>------</td>
<td>-----</td>
<td>-----------------------------------</td>
</tr>
<tr>
<td>10</td>
<td>Strain &amp; Accel. Lab, Intro (No Friday Lab)</td>
<td>Intro Strain &amp; Accel. Lab, Acceleration measurement, MEMS sensor, LabVIEW programming review, NI USB-6009, HP6632A, DUE: Strain Lab Deliverables</td>
</tr>
<tr>
<td>11</td>
<td>Strain &amp; Acceleration, Natural vibration</td>
<td>2nd-order system, impulse and step response, under- vs overdamped systems, natural and ringing frequency, settling time, rise time, overshoot</td>
</tr>
<tr>
<td>12</td>
<td>Strain &amp; Acceleration, Forced vibration</td>
<td>Log decrement method, Digital sampling concepts, Aliasing, Single-ended and differential analog measurement, DUE: Project Progress Report</td>
</tr>
<tr>
<td>13</td>
<td>Project Progress Presentation</td>
<td>Intro Freq. Response Lab, Gain, Phase shift, Resonance, LabVIEW programming review, Keysight 33511B, DSO1002A, DMM (ACV) DUE: Strain and Accel. Lab Deliverables</td>
</tr>
<tr>
<td>14</td>
<td>Freq. Response Lab, Intro</td>
<td>Bode plot, Corner frequency, Low-pass, high-pass, band-pass, band-stop filter, LabVIEW programming review</td>
</tr>
<tr>
<td>15</td>
<td>Freq. Response Lab, Programming</td>
<td>Review, Midterm 2</td>
</tr>
<tr>
<td>16</td>
<td>Freq. Response Lab, Data Collection</td>
<td>Frequency Analysis, Fourier Series, Fourier Transform, FFT, DUE: Project Final Report</td>
</tr>
<tr>
<td>Final</td>
<td></td>
<td>DUE: Freq. Response Lab Deliverables</td>
</tr>
</tbody>
</table>

**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.

**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. The policy on academic integrity and other resources related to student conduct can be found on the Student Judicial Affairs 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.