

**ME 224: EXPERIMENTAL ENGINEERING**  
**Class: MW 12:00-12:50 PM; TECH: L170**  
**Labs: M 2:00-6:00 PM and Tu 2:00-6:00 PM (Ford B100)**

Instructor: Horacio D. Espinosa  
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This course covers instrumentation and the use of experiments to evaluate real-world systems. Basic, practical electronics, computer data acquisition, programming and signal conditioning are taught and then applied in experiments that investigate heat transfer, fluids mechanics, thermodynamics and structural dynamics. Lab sessions will be held in the Mechatronics lab, Ford Engineering and Design Center Room B100.

**Lab Projects:**

1. Lab Instruments: Multimeters, Oscilloscopes and Function Generators
2. Data Acquisition and LabVIEW programming
3. Signal Conditioning with OP-Amps
4. Temperature Measurement and Control
5. Thermal Diffusion in a Copper Rod
6. MEMS accelerometer
7. Group Project

**References:**

- LabVIEW 8, Student Edition by Robert Bishop, Prentice Hall, 2006.
- “Instrumentation for Engineering Measurements,” James W. Dally, et al., John Wiley & Sons, Inc, 1993.
- “Introduction to Mechatronics and Measurement Systems,” M.B. Histan and D.G. Alciatore, McGraw Hill, 1998.
- “Experimental Methods for Engineers,” J.P. Holman, McGraw Hill, 2001.
- “Modern Instrumentation for Scientists and Engineers,” J.A. Blackburn, Springer Verlag, 2001.

**Grading:** Final course grade will be based on the following distribution.

|                            |      |
|----------------------------|------|
| Homework, quizzes and Labs | 60 % |
| Midterm                    | 20 % |
| Project                    | 20 % |

**Teaching Assistant:** Mark Locascio  
E-mail: m-locascio@northwestern.edu

**Class Web Page:** <http://clifton.mech.northwestern.edu/~me224>

**General Guidelines:**

- Students are expected to read the lab hand-outs posted in the web prior to the week on which the lab will be carried out. **Pop quizzes** will be given to assess student understanding of the lab hand-outs.
- Groups of two students will carry out the labs but each student will need to turn in his/her individual report. Half of the groups will hold lab sessions on Mondays and the other half on Thursdays.
- Homework and lab reports are due at beginning of class on day for which assigned. Late homework will be deducted at the rate of 20% per day late. Maximum grace period is until graded homework or lab reports are returned. You can discuss homework problems but make sure that the work you turn in is your own.
- Instructor reserves the right to raise the final grade of any student by one letter based on participation in class and laboratory sessions.
- Attendance to class and labs is required. If you cannot come please let me and the teaching assistance know in advance. You should just send e-mail.
- Last lab will be a project assigned by the instructor to each group.

**Guidelines for selecting final project group members:**

Identify students in the class having *complementary* background and skills. The best synergy arises between students with different interests and hands-on experiences.

Try not choosing as a team member someone you already know very well or is your friend. Consider this opportunity for networking.

If you are someone that always needs to know “why” before doing something, you may match very well with someone interested in “how” to do something after a problem is posed to him or her. In other words, the “why” students are complementary to the “how” students.

## SCHEDULE

| <b>Week #</b> | <b>Lab #</b> | <b>Lab handouts</b>                                 | <b>HW/Report Due</b> |
|---------------|--------------|---|----------------------|
| 1             | -            | Homework #1   | Week # 2             |
| 2             | 1            | Intro to Lab equipment and simple electronics       | Week # 3             |
| 3             | 2            | Intro to LABVIEW and USB-6009 Data Acquisition card | Week # 4             |
| 4             | 3            | Signal conditioning with op amps                    | Week # 5             |
| 5 and 6       | 4            | Temperature Controller                              | Week # 7             |
| 7             | 5            | Thermal Diffusion in a copper rod                   | Week # 8             |
| 8             | 6            | MEMS accelerometer                                  | Week # 9             |
| 9             | FP           | Final Project                                       | Week # 10            |

**Mid-term exam: in class, closed book; date TBA.**