

# ME220 Introduction to Sensors, Spring 2008

<http://www.stanford.edu/class/me220>

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Teaching Assistants: Paul Csonka and Hyeun-su Kim

The Goal of the course is to provide Undergraduate and Graduate Mechanical Engineers with a practical, working knowledge of modern sensor technologies. The course offers an overview of the basic sensor technology areas with examples drawn from existing products and includes a series of laboratory exercises.

Course content will include some sensor operational principles, some basic electronics, and many specific examples of sensors available from suppliers today. At the end of the course, I hope students will understand how many sensors work, what issues limit the use of sensors for measurements, and how to select sensors for specific applications.

There are 5 problem sets, 5 lab exercises, a midterm exam, and a term paper to make up the assignments of this class. The laboratories take place in Terman 577, which is open 24 hours/day, 7 days/week.

## **ME220 Introduction to Sensors Syllabus**

- 4/2 Pick up syllabus
- 4/7 Course introduction, some sensor examples and definitions
- 4/9 Introduction to Sensor Electronics (Lab #1 out)  
(Fraden Ch. 2)
- 4/14 Strain Gauges: Basics and Examples (HW #1 out)  
(Fraden Ch 3.5, 5, 9)
- 4/16 Thermometers : Measurement Techniques and Examples, Flow Sensors  
(Lab #1 Due)(Lab #2 out) (Fraden Ch. 3.2, 6.3, 7.3, 10.6)
- 4/21 More Thermometers and Flow Sensors (HW #1 Due) (HW #2 out)  
(Fraden Ch. 8)
- 4/23 Guest Lecturer: Dr. Matthieu Liger: Radiation Sensors: Overview of Types, Examples of  
Applications (Lab #2 Due)(Lab #3 out)(Fraden Ch. 3.6, 5.2.4, 8.4)
- 4/28 More IR Sensors and Demo: IR Motion (HW #2 Due)(HW#3 out)  
(Fraden Ch. 10)
- 4/30 Capacitive sensors: Fundamentals, Applications and Examples  
(Lab #3 due)(Lab #4 out) (Fraden Ch. 16)
- 5/5 Accelerometers (HW#3 Due)(HW #4 out)  
(Fraden Ch. 11)
- 5/7 Piezoelectric Sensors (Lab#4 Due) (Lab#5 out)  
(Fraden Ch. 14)
- 5/12 Pressure sensors: Principles and Examples (HW#4 due)(HW#5 out)
- 5/14 Inductive and Magnetic Sensors: (Term Paper Assignment Out)  
(Lab#5 Due) (Fraden Ch. 3.3, 3.4, 7.4)
- 5/16 Active sounding: Methods for measurement, Examples (HW#5 due)
- 5/21 Chemical Sensors
- 5/26 Midterm (take-home) (Term Paper Preliminary Assignment Due)
- 5/28 Memorial Day Holiday (No Class!)
- 6/2 Smart Skis, Gyros, Wrap-up
- 6/4 Guest Lecture

## **Course Structure: 3 Units or 4 Units**

**Lecture notes:** A set of written lecture notes is available on the Web. These notes contain a narrative summary of the lecture content with some figures. These are a work in progress, and any suggestions or contributions are welcome. You are welcome to print them off the web and bring them to class, if desired. Be aware that much of the content given in class will not be in the web notes, and vice-versa.

### **Assignments:**

**Homework:** There will be 5 homework assignments which will consist primarily of design calculations and some speculation about how things work.

**Regular Laboratory:** The lab will include a series of exercises intended to gain familiarity with some of the issues in measurements of signals from sensors. We'll explore several different kinds of sensors, and utilize Labview software and National Instruments Data Acquisition hardware to acquire, filter, analyze and interpret the signals. This aspect of the course is new, and is generously supported through equipment donations from National Instruments.

**Midterm:** There will be one open-book, take home midterm. It is placed about 2/3 of the way through the quarter, so it is actually somewhere between a midterm and a final.

**Term Paper:** There will be a term paper or design project assigned in April.

### **Book:**

There is no assigned book for the course. Handbook of Modern Sensors by Fraden is an optional book that provides additional information and can serve as a good reference to buy and keep. Recommendations for pertinent reading are listed with the lecture dates.

### **Grading:**

Grading is based on:

Homework:	25%
Lab exercises:	20%
Midterm:	30%
Final Paper:	25%

**Late Policy:** 5% penalty for each weekday late. Since grades on most work tend to be in the 90% range, this penalty can be significant. The basic policy is: DON'T BE LATE!

### **General Information:**

Contact info: [rcandler@micromachine.stanford.edu](mailto:rcandler@micromachine.stanford.edu)

Instructor Office Hours: MW 11AM-12 in Terman 544 and by appointment

Teaching Assistant Office Hours: TBD in Location TBD (primarily Terman 577)