

# MECH 430 Instrumentation and Measurements

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## **Class Meetings**

Tuesday, Thursday 10:00 – 11:00 pm, Bechtel Bldg. Room 403

## **Office hours:**

Tuesday, Thursday 11:00am – 12:00am SRB, 4<sup>th</sup> floor, Room 402

## **Labs**

Mr. Amer Kiblawi – [ak80@aub.edu.lb](mailto:ak80@aub.edu.lb)

Mr. Elie Kfoury – [ek15@aub.edu.lb](mailto:ek15@aub.edu.lb)

Mr. Nareg Karaoghlanian – [nk64@aub.edu.lb](mailto:nk64@aub.edu.lb)

## **Textbook**

Figliola, R. and Beasley, D., Theory and design of Mechanical Measurements, Wiley, 5<sup>th</sup> Edition.

## **Prerequisites**

PHYS 211: Electricity and Magnetism.

EECE 312: Electronics and Electronic Circuits.

## **References**

- A. Smaili and F. Mrad, *Applied Mechatronics*, 2005.
- Sedra, A. and Smith, K., *Microelectronic circuits*, Oxford University Press, 2004
- R. Pallàs-Areny and J. Webster, *Sensors and Signal Conditioning*, Wiley, 2nd ed. 2001.
- E. O. Doebelin, *Measurement Systems Application and Design*, Fifth Ed., McGraw-Hill, 2003.
- P. Horowitz and W. Hill, *The Art of Electronics*, Cambridge University Press, 1989.
- J. Wheeler and A. R. Ganji, *Introduction to Engineering Experimentation*, Prentice Hall, 1996.
- W. Tompkins and J. Websters, *Interfacing Sensors to the IBM PC*, Prentice Hall, 1988.
- J. Fraden, *Handbook of Modern Sensors: Physics Design and Application*, AIP, 1993.
- W. deSilva, *Control Sensors and Actuators*, Prentice Hall, 1989.
- J. W. Gardner, *Microsensors: Principles and Application*, Wiley, 1994.
- H. R. Everett, *Sensors for Mobile Robots: Theory and Applications*, A K Peters, 1995.
- John G. Webster, *The Measurement, Instrumentation, and Sensors Handbook* (Editor), CRC Press, 1998.
- Gregory Kovacs, *Micromachined Transducers Sourcebook*, McGraw-Hill Company, 1998.

## **Description**

A course on the general concepts of measurement systems; classification of sensors and sensor types; interfacing concepts; data acquisition, manipulation, transmission, and recording; introduction to LabVIEW; application; team project on design, and implementation of a measuring device.

## **Objectives**

The students will:

1. Learn the basic elements and practical considerations of a measurement system;
2. Learn the different types of sensors available and how to properly select and use sensors

- for various forms of physical quantities (thermal, fluid, chemical, mechanical, etc.);
3. Acquire knowledge on basic signal conditioning concepts: Filtering, A/D and D/A conversion, amplification, etc.;
  4. Learn the principles of PC-based instrumentation through data acquisition and data processing;
  5. Develop skills in using National Instrument's graphical programming language LabVIEW for virtual instrumentation and industrial automation;
  6. Be able to build an instrument to measure a specific stimulus;
  7. Perform tests on a sensor circuit according to the characteristics presented in class.
  8. Work in teams to design and realize a real instrumentation system for a given application.
  9. Develop technical writing and oral presentation skills.

### **Grading**

Students will be graded according to the following:

Quizzes & Lecture Attendance	10%
Midterm	15%
Final	25%
Lab	30% (Assignment 12%, Midterm 18%)
Project	20%

### **Course Policy**

#### **Class attendance and quizzes**

Class attendance will be taken in each lecture and will be graded.

Quizzes will be held during the first 15 minutes of class. You will not be given extra time if you are late.

#### **Lab attendance and assignments**

Lab attendance is mandatory. Any student who misses two lab sessions will receive a failing grade in the lab work. Assignments are expected to be presented according to the guidelines specified in the lab.

#### **Project**

The final measuring stick for this course is a project that involves both the design and implementation of a instrumentation system. You will be expected to write a report about your project according to the format presented on moodle.

#### **Make-up tests**

NO MAKE UP TEST WILL BE GIVEN. If you miss an exam for a justified cause (*e.g.*, with a medical report) the weight of the grade will change accordingly to compensate for your missed exam or an oral exam will be given. The lab midterm policy will be issued by the instructors.

### **Resources for the Course**

Resources for the course include:

- MOODLE: Includes a forum, which acts like a center of focus for the course. Any concerns you might have or ideas you want the entire class to hear you can post on the forum. Furthermore, assignments, solutions, homework will be posted on Moodle.
- The text and references for the course.
- The library, the web.

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