

BME-650: Biomedical Measurement and Instrumentation Spring 2009

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Lectures MW 8-9:20 am
OHE 136
Course Website See Blackboard

Course Description from Catalog:

Design of measurement systems and biomedical instrumentation; architecture of electronic instruments used to measure physiological parameters, analysis of major process functions integrated in these instruments. Open to M.S., Medical Device and Diagnostic Engineering and biomedical engineering Ph.D. students only.

Course Prerequisites: BME 513 recommended.

Prerequisite knowledge and/or Skills

Basic knowledge of electronics, physics, and chemistry. Fundamental knowledge of basic electronic circuits is **strictly required**.

Textbook: None, lecture notes only.

Recommended References: (Available for 2 hr check-out in Science and Engineering Library)

King, P., R. C. Fries. Design of Biomedical Devices and Systems, Marcel Dekker, 2003.

Normann, R.A. Principles of Bioinstrumentation, John Wiley & Sons, 1988.

Pallás-Areny, R., J. G. Webster. Sensors and Signal Conditioning, Wiley, 2000.

Togawa, T., T. Tamura, P.A. Oberg. Biomedical Transducers and Instruments, CRC Press, 1997.

Webster, J.G. Bioinstrumentation, Wiley, 2004.

Webster, J.G. Medical Instrumentation: Application and Design, 3rd ed., John Wiley & Sons, 1998.

Class Format and Grading Policy: There will be one lecture per week on M and W from 8-9:20am in OHE 136.

The final grade will be based on the following:

- (1) Homework (40 %)
 - a. In general, weekly homework is assigned on Wednesday and due the following Wednesday at the beginning of class. Assignments test your understanding of material presented in class and your ability to apply that knowledge to engineering problems. From time to time, you may also be asked do your own research and discover new material as part of your homework assignment.
 - b. Do not use email to ask questions about homework. All questions on homework should be posted to the appropriate discussion board on Blackboard. The TA will check posts until 6p each day. Posts made after this time will be addressed the following morning.
 - c. Please bring a physical copy to class (do not use the digital drop box). All derivations must be included with symbols before numbers are "plugged in." Units must accompany numerical results when applicable. DEN students should use the normal DEN homework submission procedure (time stamped before the beginning of class).
 - d. Collaboration is permitted on HW, however copying is not. Collaboration is highly encouraged and includes discussions of concepts, exchange of information, and working together. Each student is responsible for individually preparing and fully understanding the work they submit. Review the university and course Integrity Policies (course one below). They will be strictly enforced.
 - e. Late homework is not accepted (only exception is a valid family or medical excuse).
- (2) Exam 1 (30 %)
- (3) Exam 2 (30 %)

Homework/Academic Integrity Policy

Students are expected to do their own homework assignments and should completely understand everything that they submit as their own. It is anticipated and expected that students consult one another for clarification of concepts, advice, to compare homework solutions, etc. You may also use whatever materials you find on the web, in other texts, or other sources to assist in

preparing your homework. You **may not** consult homework from previous offerings of BME 650 (in any form). Also, copying homework prepared by another student and plagiarizing are strictly prohibited. Violations of this policy will result in an **automatic F** in the class and filing of an academic misconduct report to the Office of Student Conduct. All students are expected to be familiar with and adhere to the USC standards of Academic Integrity (<http://www.usc.edu/student-affairs/SJACS/docs/AcademicIntegrityOverview.pdf> and <http://www.usc.edu/student-affairs/SJACS/docs/GradIntegrity.pdf>).

Statement for Students with Disabilities

Any student requesting academic accommodations based on a disability is required to register with Disability Services and Programs (DSP) each semester. A letter of verification for approved accommodations can be obtained from DSP. Please be sure the letter is delivered to me (or to the TA) as early in the semester as possible. DSP is located in STU 301 and is open 8:30 a.m. – 5:00 p.m., Monday through Friday. The phone number for DSP is (213) 740-0776.

Course Outline and Schedule (Tentative)

	Topics Covered	HW Out	HW Due
Week 1 1/12,14/09	Course Introduction Characteristics of Measurement Systems	Quiz	
Week 2 1/21/09	Operational Amplifiers Instrumentation Amplifiers	HW 1	Quiz
Week 3 1/26,28/09	One Recorded this Week (tentative)	HW 2	HW 1
Week 4 2/2,4/09	Signals and Noise Filters		HW 2
Week 5 2/9,11/09	Origin of Biopotentials	HW 3	
Week 6 2/18/09	Human Biopotentials Biopotential Electrodes	HW 4	HW 3
Week 7 2/23,25/09	Other Electrodes	HW 5	HW 4
Week 8 3/2,4/09	Mechanical Transducers Midterm Review		HW 5
Week 9 3/9,11/09	Exam 1, given in 2 parts (in class/DEN)		
3/16,18/09	Spring Break		
Week 10 3/23,25/09	Temperature Transducers	HW 6	
Week 11 3/30, 4/1/09	Light and Spectrophotometry	HW 7	HW 6
Week 12 4/6,8/09	Measurement of Liquid and Gas Flows	HW 8	HW 7
Week 13 4/13,15/09	Pressure, Motion, and Force Measurement Analog Linearization	HW 9	HW 8
Week 14 4/20,22/09	Review of Digital Electronic Devices Interfacing to Computers Digital Signal Processing	HW 10	HW 9
Week 15 4/27,29/09	Safety in Bioinstrumentation Final Review Exam 2, 11a-1p		HW 10

Recommended Classes for Further Study in Medical Instrumentation

BME 302L	Medical Electronics
BME 405L	Senior Projects: Measurements and Instrumentation
BME 425	Basics of Biomedical Imaging
BME 523	Measurement and Processing of Biological Systems
BME 525	Advanced Biomedical Imaging
BME 620L	Applied Electrophysiology
AME 305	Mechanical Design
AME 503	Advanced Mechanical Design