

## BME-650: Biomedical Measurement and Instrumentation Spring 2006

<b><u>Instructor</u></b>	Ellis Meng Department of Biomedical Engineering DRB 159 (213) 740-6952 ellis.meng@usc.edu	<b><u>TA</u></b>	Rachel Bitton bitton@usc.edu
<b><u>Office Hours</u></b>	by appointment	<b><u>Lectures</u></b>	W 8-10:50am OHE-136
		<b><u>TA Office Hours</u></b>	2-4p, DRB 131

### **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 or instructor approval.

### **Prerequisite knowledge and/or Skills**

Basic knowledge of electronics, physics, and chemistry.

### **Textbook**

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

### **Course Reserves**

(Available for 2 hr check-out in Leavey Library)

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

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.

### **Course Objectives**

This course introduces students to the design of measurement systems and biomedical instrumentation. The course provides an overview of the architecture of electronic instruments used to measure physiological parameters and an in-depth analysis of the major functions integrated in these instruments.

After completing this course, students should be able to:

- Describe the critical measures needed to evaluate biological systems
- Describe the architecture of biomedical instruments and the principle of operation of sensors commonly used for measuring physiological variables
- Analyze biomedical measurement applications in selected organ systems (neuromuscular, cardiovascular, and pulmonary) and analytical laboratory devices (blood lab. machines)

### **Class Format and Grading Policy**

There will be one lecture per week on Wednesday from 8-10:50am in OHE-136.

The final grade will be based on the following:

- (1) Homework (40 %)
- (2) Midterm (30 %)
- (3) Final (30 %)

### Homework 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 a score of 0 on the homework in question and possibly other sanctions as well.

No late homework will be accepted (only exception is a valid family or medical excuse).

### Course Outline and Schedule

Week	Topics Covered	Reading	HW Out	HW Due
1	Course Introduction Review of Electronic Devices	Ch. 1	HW 1	
2	Operational Amplifiers Instrumentation Amplifiers	Ch. 2	HW 2	HW 1
3	Origin of Biopotentials Human Biopotentials	Ch. 4 & 5	HW 3	HW 2
4	Signals and Noise Biopotential Electrodes	Ch. 6 & 7	HW 4	HW 3
5	Other Electrodes	Ch. 8	HW 5	HW 4
6	Midterm Review			HW 5
7	<b>Midterm Exam</b>			
8	Mechanical Transducers	Ch. 9	HW 6	
9	Temperature Transducers	Ch. 10	HW 7	HW 6
3/15/06	SPRING BREAK			
10	Light and Spectrophotometry	Ch. 11	HW 8	HW 7
11	Measurement of Liquid and Gas Flows	Ch. 12	HW 9	HW 8
12	Pressure, Motion, and Force Measurement Analog Linearization	Ch. 13	HW 10	HW 9
13	Review of Digital Electronic Devices Interfacing to Computers Digital Signal Processing	Ch. 14, 16 & 17	HW 11	HW 10
14	No Class			
15	Safety in Bioinstrumentation Final Review	Ch. 18		HW 11
5/8/06	<b>Final Exam 11a-1p</b>			

### Recommended Classes for Further Study in Medical Instrumentation

BME 302L	Medical Electronics
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

### 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.