

**ELE489 ELE562/3 Biomedical Instrumentation** 4 credits MWF11 K216 Spring 2009

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week	date	lecture topics	Reference
1	1/21 1/23	introduction: medical instrumentation, biomedical signal processing introduction to PHENOM: Personal HEart fuNctiOn Monitor	Chap. 1 handout
2	1/26 1/28 1/30	analog circuit design with operational amplifiers instrumentation amplifiers electrocardiogram (ECG): physiology	Chap. 3  Chap. 4
3	2/2 2/4 2/6	electrocardiogram (ECG): instrumentation noninvasive measurement of arterial oxygen saturation pulse oximetry	handout handout
4	2/9 2/11 2/13	instrumentation for photoplethysmogram ( <b>Phase 1 Report due</b> ) noninvasive measurement of arterial oxygen saturation electrical safety: current levels for various electrical hazards	handout Chap. 14
5	2/16 2/18 2/20	no class (President's Day) electrical safety: ground loop, patient isolation, noise rejection <b>Exam #1</b>	Chap. 2
6	2/23 2/25 2/27	electromyogram (EMG), electroencephalogram (EEG); electrodes amplifiers for biopotentials: design and applications review of the Microchip PIC microprocessor ( <b>Phase 2 Report due</b> )	Chap. 5 Chap. 6 handout
7	3/2 3/4  3/6	analysis of PHENOM firmware CITI (Collaborative Institutional Training Initiative) CITI training <a href="http://www.uri.edu/research/compliance/humansubj.htm">http://www.uri.edu/research/compliance/humansubj.htm</a> FDA regulations on medical devices	handout  handout
8	3/9 3/11 3/13	Premarket Notification (510k) and Premarket Approval (PMA) introduction to biomedical signal processing ( <b>CITI certificate due</b> ) analog and digital filters ( <b>Phase 3 Report due</b> )	
9	3/16-22	no class this week (spring recess)	
10	3/23 3/25 3/29	Digital QRS detection multiplication of backward differences (MOBD) algorithm performance evaluation of QRS detection	handout  handout
11	3/30 4/1 4/3	<b>Exam #2</b> false positive and false negative, sensitivity and specificity receiver operating characteristic (ROC) analysis	handout
12	4/6 4/8 4/10	statistics in biomedical research: t-test examples analysis of variance (ANOVA), linear regression pressure measurement techniques: pressure transducer, micromanometer	handout handout handout
13	4/13 4/15 4/17	frequency-domain characteristics of pressure measurement systems student project presentation: final oral report (session 1) student project presentation: final oral report (session 2)	Chap. 8
14	4/20 4/22 4/24	"pop test" of catheter/transducer system flow measurement: electromagnetic flow probe, ultrasonic flow probe mean flow measurement by indicator dilution method	handout handout handout
15	4/27 4/29 5/6	Fick principle for measuring cardiac output conclusions ( <b>Phase 4 Report &amp; device due</b> ) W 9:00 - 11:00 am <b>Exam #3</b>	

**Grading:** Exam #1 (22%), Exam # 2 (22%), Exam # 3 (22%), CITI (4%), Project (30%).**Text:** *Medical Instrumentation: Application and Design*, 3rd edition, edited by J. G. Webster, New York: John Wiley & Sons, 1998.

### **PHENOM Project Phases**

Phase 1 – Breadboard the electrocardiogram (ECG) and photoplethysmogram (PPG) circuits; Obtain recordings on the oscilloscope. (due 2/9/2009)

Phase 2 – Solder the ECG and PPG on the protoboard; Obtain recordings on the oscilloscope. (due 2/27/2009)

Phase 3 – Solder the PIC processor circuit on the protoboard; Connect to the LCD graphic display; Execute a sample program. (due 3/13/2009)

Phase 4 – Integrate the entire PHENOM circuits in a project box; Develop a novel feature or features in the C++ language. (project presentation 4/15-17, final report due 4/29/2009)

### **PHENOM Project Management**

- Each team is consisted of three students.
- The three team-members will take turn to be the team leader for each of the first three phases.
- For Phase 4 the following jobs will be split among the team members: 1) hardware manager, 2) software manger, and 3) document and overall project manager.

### **Students with Disabilities**

Any student with a documented disability is welcome to contact me as early in the semester as possible so that we may arrange reasonable accommodations. As part of this process, please be in touch with Disability Services for Students Office in Memorial Union, room 330 or phone 874-2098.