**BENG 186B: BIOMEDICAL INSTRUMENTATION**  
Winter 2015

Class lectures on Tuesdays and Thursdays 3:30pm-4:50pm, Warren Lecture Hall 2205  
Review sessions and quizzes on Wednesdays 4pm-4:50pm, Warren Lecture Hall 2205

Web site: http://isn.ucsd.edu/courses/beng186b

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<th>Instructor:</th>
<th>TAs:</th>
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<td>Office hours: see web site</td>
<td>Consultations: see web site</td>
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**Overview:** This course will provide an overview of instrumentation systems used in clinical medicine and biomedical research. We will review some circuit theory, and its application to bioinstrumentation. Systems for measuring biologic signals will be discussed including biopotentials, stress and strain, pressure, temperature, and optical properties. Electrical hazards, safety, measuring instruments and techniques will be discussed. There will be applications to engineering design including transducer systems and sensing and driving circuits. There will also be discussion of ethical and regulatory issues related to bioinstrumentation. There are guest lectures from experts in bioinstrumentation fields.

The Tuesday and Thursday 3:30-4:50pm lectures will be formal presentations of course and book material. The Wednesday 4:00-4:50pm lecture time will be for the 3 quizzes, and for review sessions.


**Homework:** There will be 6 homework assignments as indicated in the course outline. They are posted on the class web page, and are due at the beginning of class on the due date. Homework assignments are the best way to learn engineering. You are expected to complete every homework problem on your own, but may consult with classmates before completing a problem. Please turn in your homework on time; late assignments will not be accepted. Each homework will have some form of a design problem. Solutions will be made available on the class web page.

**Tests:** There will be three in-class 50-minute quizzes and a final exam. All tests will be closed book, closed note; make sure to bring your calculator (no computers!).

**Grades:** Final letter grades will be based on a combination of homework and test scores. Homework: 40%, Each quiz: 10%, Final: 30%. The quizzes cover all material up to the previous week. The final will cover all of the material in class, including the 2 guest lectures during the 10th week.

**Reviews:** The TAs conduct review sessions and take questions about grading. Consultation hours are posted on the web.
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<th>Week of</th>
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| Jan 6   | Intro to course & bioinstrumentation. Instrumentation systems, operational modes, measurement characteristics. Circuit analysis review.  
*Reading*: Chap. 1 (Sec. 1.2, 1.3, 1.5, 1.8-1.10)  
*HW#1*, Due Thu 1/15 |
| Jan 13  | Switches, relays and potentiometers. Transducers and sensors.  
*Reading*: Chap. 2 (Sec. 2.1-2.9)  
*HW #2*, Due Thu 1/29 |
*Reading*: Chap. 3 (Sec. 3.1-3.5, 3.10-3.12, 3.14, 3.16)  
*Quiz #1*: Wed 1/21, 4:00-4:50pm, Warren Lecture Hall 2205 |
| Jan 27  | Origin of biopotentials.  
*Reading*: Chap. 4 (Sec. 4.1-4.8)  
*HW #3*, Due Thu 2/5 |
| Feb 3   | Biopotential electrodes.  
*Reading*: Chap. 5 (Sec. 5.1-5.11)  
*HW #4*, Due Thu 2/19 |
| Feb 10  | Electrocardiogram, common-mode suppression, active shielding.  
*Reading*: Chap. 6 (Sec. 6.1-6.6)  
*Quiz #2*: Wed 2/11, 4:00-4:50pm, Warren Lecture Hall 2205 |
| Feb 17  | Instrumentation for cardiovascular measurements.  
*Reading*: Chapters 7 & 8 (Sec. 7.1-7.4, 7.14-7.14, 8.1-8.4)  
*HW #5*, Due Thu 2/26 |
| Feb 24  | Chemical biosensors.  
*Reading*: Chap. 10 (Sec. 10.1-10.6)  
*HW #6*, Due Thu 3/12 |
| Mar 3   | Distribution of electrical power, safety in bioinstrumentation, electrical hazards.  
*Reading*: Chap. 14 (Sec. 14.1-14.9)  
*Quiz #3*: Wed 3/4, 4:00-4:50pm, Warren Lecture Hall 2205 |
| Mar 10  | Guest lectures  
Non-contact ECG and EEG. Wireless and global health. |
| Mar 17  | **Final exam, Tuesday March 17, 3:00-5:59pm, Warren Lecture Hall 2205** |