BENG 186B: BIOMEDICAL INSTRUMENTATION

Winter 2018

Section 1

Class lectures on Tuesdays and Thursdays 2:00-3:20pm, Center Hall 214
Review sessions and quizzes on Fridays 3pm-3:50pm, Cognitive Science Building 001

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

Instructor:
Dr. Gert Cauwenberghs
Department of Bioengineering
Office: 304 PFBH
Email: gert@ucsd.edu
Office hours: see web site

TAs:
Julia Kudryashev, kudryashev@eng.ucsd.edu
Jeffry Granados, j6granad@eng.ucsd.edu
Nathaniel Gutierrez, nsgutier@ucsd.edu
Consultations: see web site

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 2:00-3:20pm lectures will be formal presentations of course and book material. The Friday 3:00-3:50pm lecture time will be for the 3 quizzes, and for review sessions.

Textbook: Webster JG. Medical Instrumentation: Application and Design, 4th ed. 2010 John Wiley & Sons: New York.

Homework: There will be 6 homework assignments as indicated in the course outline. They are posted on the class web page, and are due over TritonEd 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 TritonEd.

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 10^{th} week.

Reviews: The TAs conduct review sessions and take questions about grading. Consultation hours are posted on the web.

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Section 2

Class lectures on Tuesdays and Thursdays 5:00-6:20pm, Sequoia Hall 148
Review sessions and quizzes on Fridays 3pm-3:50pm, Warren Lecture Hall 2209

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

Instructor:
Dr. Miguel Alvarez-Cabanillas
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Office hours: see web site

TAs:
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The Tuesday and Thursday 5:00-6:20pm lectures will be formal presentations of course and book material. The Friday 3:00-3:50pm lecture time will be for the 3 quizzes, and for review sessions.

Textbook: Webster JG. Medical Instrumentation: Application and Design, 4th ed. 2010 John Wiley & Sons: New York.

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Course Outline—Winter 2018

Week of	Topics
Jan 8	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 Fri 1/19**
Jan 16	Switches, relays and potentiometers. Transducers and sensors. *Reading*: Chap. 2 (Sec. 2.1-2.9) **HW #2, Due Fri 2/2**
Jan 22	Circuit analysis and design. Power supplies. Amplifiers and op amps. Active filtering. Impedance matching. Timing and digital circuits. *Reading*: Chap. 3 (Sec. 3.1-3.5, 3.10-3.12, 3.14, 3.16) **Quiz #1: Fri 1/26, 3:00-3:50pm, CSB 001**
Jan 29	Origin of biopotentials. *Reading*: Chap. 4 (Sec. 4.1-4.8) **HW #3, Due Fri 2/9**
Feb 5	Biopotential electrodes. *Reading*: Chap. 5 (Sec. 5.1-5.11) **HW #4, Due Fri 2/23**
Feb 12	Electrocardiogram, common-mode suppression, active shielding. *Reading*: Chap. 6 (Sec. 6.1-6.6) **Quiz #2: Fri 2/16, 3:00-3:50pm, CSB 001**
Feb 20	Instrumentation for cardiovascular measurements. *Reading*: Chapters 7 & 8 (Sec. 7.1-7.4, 7.14-7.14, 8.1-8.4) **HW #5, Due Fri 3/2**
Feb 26	Chemical biosensors. *Reading*: Chap. 10 (Sec. 10.1-10.6) **HW #6, Due Fri 3/16**
Mar 5	Distribution of electrical power, safety in bioinstrumentation, electrical hazards. *Reading*: Chap. 14 (Sec. 14.1-14.9) **Quiz #3: Fri 3/9, 3:00-3:50pm, CSB 001**
Mar 12	Guest lectures Non-contact ECG and EEG. Wireless and global health.
Mar 22	**Final exam, Thursday March 22, 3:00-5:59pm**