University of Massachusetts Lowell
Department of Electrical and Computer Engineering &
Biomedical Engineering and Biotechnology (BMEBT) Program

Instructor: Michael O'Connor

Biomedical Instrumentation: ECE 16.460/560
Fall, 2014

DRAFT COURSE DESCRIPTION

Class Schedule: Tuesday 2-4:50PM, North Campus (classroom TBD)
[First class: 9 Sept. No class on 11 Nov.]

Prerequisite: Senior ECE student or BMEBT student. No specific programming background required but students should be willing to perform project work that will require use of software prototyping tools (should not be intimidating – projects designed to be instructive and possibly even fun).

Course format: The course content will be delivered in weekly lectures (13 scheduled lectures). The course will be 'web-enhanced' thereby allowing students to obtain material, if they have to miss any lecture. There will be three content tracks that will be covered each week (approximately 50 minutes per track per week). Outline of the three tracks will follow.

Overall course outline: Analysis and high level design considerations for biomedical instrumentation systems; application of biodesign innovation process and prototyping of mobileHealth applications using a project-based learning approach. The completion of this course should provide both the theoretical background and some practical experience to enable the student to design medical devices.

Course tracks: There are three tracks that will be covered in parallel throughout the course.

1. '**Traditional' biomedical instrumentation course material**:
   This track will review biosensors & physiological transducers (addressed in detail in the ECE course, Introduction to Biosensors [16.441/541]). The main focus of this track will be systems that interface to medical sensors & transducers. This will naturally lead to coverage of measuring, monitoring, recording & therapeutic systems [examples include: oximeters, flowmeters, cardiac monitors, pulmonary analyzers, audiometers, lab instrumentation, ventilators, defibrillators, dialysis machines]. Physiological factors along with safety and regulatory issues will be addressed during consideration of each system. [NOTE: specific coverage will be at system and sub-system level and NOT at circuit design level]
2. **Biodesign Innovation Process:**
   The application of systematic innovation methods that have been used in development of medical devices and related biomedical technology will be explored. In this track there is an emphasis on 'translating' clinical needs into designs. The overall biodesign process starts with 'Needs Analysis' followed by 'Concept Development' before a technology approach is even considered. The objective of this track is to have the student develop strategy and planning needed to innovate novel medical devices and technology. This track is based on Stanford University's biodesign innovation process (see http://web.stanford.edu/group/biodesign/cgi-bin/ebiodesign/) and the "Lean Start Up" Methodology.

3. **MobileHealth Applications and Medical 'Internet of Things' (also known as Connected Medical Devices):**
   This track covers a rapidly developing area in health technology in which there has been extensive use of inexpensive medical sensors. These sensors can be connected using various standards and methods (Bluetooth, USB, Wireless protocols) to a range of platforms (mobile phones or tables, embedded systems, PCs/Macs). We will cover applicable protocols for device connectivity as well as for mobile and Web applications. This content will be mainly be covered through 'hands-on' project-based work. The projects will utilize higher-level prototyping tools (not C, C++).
   [NOTE: Weekly topics will be provided at first lecture and on course web-site]

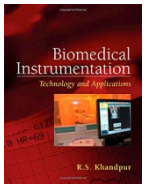
Grading Policy being considered:

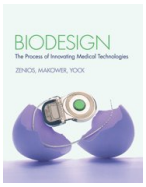
Track 1:	30%	(quizzes)
Track 2:	20%	(one project)
Track 3:	30%	(four projects)
Midterm:	5%	
Participation	5%	
Final:	10%	

Grading Remarks:

- Midterm and Final are tentatively planned to be 'open' and 'take home'
- Considering making all projects team-based – to be discussed with class.

Course References (TEXTS NOT REQUIRED – MATERIAL PRESENTED IN LECTURES):





Track 1: Biomedical Instrumentation: Technology and Applications
By: R.S. Khandpur
ISBN: 978-0-07-144784-3
Publisher: McGraw-Hill, 2005
Track 2: Biodesign: The Process of Innovating Medical Technologies
By: Stefanos Zenios, Josh Makower, Paul Yok, Todd J. Brinton, Uday N. Kumar, Lyn Denend, Thomas M. Krummel, Christine Kuriara
ISBN: 978-0-521-51742-3 (hardback)
Publisher: Cambridge University Press, 2010
Track 3: In class material to be provided and online material

Instructor Information – PLEASE CONTACT ME IF YOU HAVE ANY QUESTIONS

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