Introduction to Biomedical Engineering
42-101 (U, 12 Units)

Instructor: Prof. Christopher Bettinger

Contact Information

Office Hours: W 4:30-5:30PM
Office Location: Wean Hall 4315

Email: cbetting@andrew.cmu.edu
Use Subject Line: "101"
Phone: (412) 268-7677

Teaching Assistants	Email	Primary	Secondary
Diane Nelson (Lead TA)	dlnelson@andrew.cmu.edu	Unit 2	Unit 1
Dachan Kwon	dachank@andrew.cmu.edu	Unit 1	Unit 4
Solomon Abiola	sabiola@andrew.cmu.edu	Unit 4	Unit 3
Katherine Lorent	kllorent@andrew.cmu.edu	Unit 3	Unit 2

Lectures: MWF 2:30PM-3:30PM, DH A302*
Recitations: W 3:30PM-4:30PM, DH A302*

**Standard weekly schedule. Please note that classroom is reserved for 230PM to 430PM on MWF in the event that make-up lectures need to be made. This will be made at the discretion of the instructor.*

Pre-requisites: 03-121 or permission of instructor.

Course Description:
This course will introduce aspects of biomedical engineering. The overarching pedagogical goal is to elucidate the bidirectional interaction between biological systems and quantitative models. Specifically, we will both (1) explore how biological systems can be described using engineering principles and (2) use engineering systems to influence the fate of biological systems. Other applications will focus on biomimicry and perturbation of biological systems. These goals will be underpinned with calculus-based mathematical descriptions. Examples that illustrate these concepts will be taken from areas such as biotechnology (molecular and cellular principles), physiological principles (both natural and synthetic), and engineering systems (biomechanics, biomaterials, bioelectronics, bioimaging, etc). Professional issues relating to BME will also be covered.

Teaching Objectives:

A student who completes this course will be able to:

1. Explain and discuss what biomedical engineers do in their professional activities.
2. Familiarize themselves with the basic components that constitute biological matter ranging from molecular scale to organ scale.
3. Understand and apply generalizable engineering concepts to describe many types of systems found in biology and medicine. Systems include, but are not limited to, the following:
    - biotechnology (cellular and molecular)
    - physiological systems (tissue and organ level)
    - biomechanics & materials
    - bioelectronics & bioimaging
4. Apply concepts learned to contemporary biomedical technologies and potentially synthesize new applications in biomedical engineering

Responsibilities of the Instructor:

- Start/End Lectures ***on time***.
- Create a learning environment that encourages instructor-peer and peer-peer interactions.
- Accurately assess the student's knowledge through appropriate evaluation methods.
- Return assignments and exams in a timely fashion
- Respond to emails within 24 hours during the work week (48 hours on the weekend). ***Students must type "101" in the subject line when addressing the instructor or TAs***. Failure to do so may lead to a delayed response.

Responsibilities of the Student*:

- Attend lecture ready to listen, engage, and participate.
- Arrive on time to all classroom activities.
- Turn in all assignments on time and with one's best effort.
- Promote a distraction-free classroom environment through:
    i. NOT using cell phones during classroom activities.
    ii. NOT using laptops, etc. during classroom activities.
- Inform the instructor if there is any meaningful potential conflict, issue, or concern regarding the course or its participants.
- (When Necessary) Turn in "Feedback Cards" at the end of select lectures.

**Observation of these policies (or lack thereof) may impact the student's grade via the class participation component (both positively and negatively).*

Course Textbook(s):

Required: Biomedical Engineering
W. Mark Saltzman
Cambridge University Press ISBN: 978-0-521-84099-6

Additional Materials: Select course notes**, slides, reading, and example problems will be placed on Blackboard @ http://www.cmu.edu/blackboard.

Unannotated notes will be placed online. It is the responsibility of the student to download/print these notes ahead of time and annotate them during class.
In general, annotated notes created during lecture will not be placed online.

Reading Assignments:

- Recommended readings from the text will be assigned appropriately. ***It is expected that the students complete the reading PRIOR to the date listed*** (i.e. the reading is "due" on that date).
- Select readings will also be drawn from recent literature.

Homework Assignments:

- There will be approximately 11 homework assignments distributed on a weekly to bi-weekly basis (approximately).
- Homework must be turned into the instructor before the start of class on due dates.
- Students may discuss homework sets with other students. However, students must write up their own solutions and must disclose any group discussions/collaborations.
- Homework will be graded as one of the following grades: "Check plus" = 100; "Check" = 85; "Check Minus" = 70

Exams:

- There will be four 50-minute in class exams.
- Exams will be closed book, and closed notes with the exception of one 8.5x11 sheet of paper with hand written notes front and back (2 sides, 1 sheet).
- The last exam (Exam #4) will not be cumulative. ***There will be no cumulative final***.
- Make-up exams will be a 15-minute oral exam administered by the instructor. The outcome of this will be a letter grade (with +/- modifiers).

Grading Metric:

Grade Scale (101)*
A = 90-100
B = 80-90
C = 70-80
D = 50-70
R < 50

Component	Weighting
Homework (11)	10% total (Equally weighted)
Exams (4)	20% each
Class Participation	10%

Late Submission and Rescheduling Policy:

- Homework: <= 24 hrs late, 50% penalty. >24 hrs late, zero credit.
- In rare cases (medical, family emergency, etc.) and with prior notification, the exams may be rescheduled at the discretion of the instructor.

Cheating and Plagiarism Policy:

- Gross reproduction of work from colleague or external source without credit.
- Misrepresentation of your work as original.
- See also http://www.studentaffairs.cmu.edu/acad_integ/acad_integ_text.html
- Handling of suspicions will be handled by the course instructor.

Special Learning and Scheduling Situations:

- Please alert the instructor AND the TAs is you have any special learning situations.
- Please provide necessary documentation by the end of the 2nd week of class.
- Please alert the instructor AND the TAs if you have a known special scheduling conflict at the beginning of the semester if possible.

ABET Criteria	*Relation of Class to Criteria*	Mechanism
Ability to apply knowledge of mathematics, science, and engineering	*Primary*	Lectures Homework Exams
Ability to design and conduct experiments, as well as to analyze and interpret data	*Secondary*	Homework
Ability to function on multidisciplinary teams	*n/a*	
Ability to identify, formulate, and solve engineering problems	*Primary*	Lectures Homework Exams
Ability to communicate effectively	*Primary*	Class Discussion
Recognition of the need for, and an ability to engage in life-long learning	*Tertiary*	Lectures Readings
Knowledge of contemporary issues	*Secondary*	Lectures Readings Homework
Ability to use the techniques, skills, and modern engineering tools necessary for engineering practice	*Tertiary*	Lectures Homework
Understanding of biology and physiology	*Primary*	Lectures Homework Exams
Capability to apply advanced mathematics (including differential equations and statistics), science, and engineering to solve the problems at the interface of engineering and biology	*Primary*	Lectures Homework Exams
Ability to make measurements on and interpret data from living systems	*n/a*	
Ability to address problems associated with the interaction between living and non-living materials and systems	*Primary*	Lectures Homework Exams