BIOE 252
BIOENGINEERING FUNDAMENTALS
10 - 10:50 am MWF

INSTRUCTOR

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Teaching Assistants

See contact information on Canvas

COURSE OBJECTIVES AND OUTCOMES

Course objectives: Students should learn:

1. To state and apply the conservation laws of mass, energy and momentum to bioengineering systems.
2. To solve open-ended engineering problems including engineering evaluation, mathematical modeling and device design.
3. To work collaboratively on a team to solve an engineering problem and present their solution through an oral presentation and a written report.
4. To recognize the complex contemporary issues faced by bioengineers and the ethical responsibilities required of bioengineers.

Course outcomes: Students completing the course should be able to:

1. State the accounting equation and conservation law and identify the extensive properties that are conserved.
2. Clearly define and apply system definitions, including open, closed, isolated, steady-state, dynamic, reacting and non-reacting.
3. Apply total and species mass balance equations to engineering systems, including those characterized as open, dynamic, reacting, multicomponent, and multi-unit.
4. Apply total energy balance equations to engineering systems, including those characterized as open, dynamic, and reacting.
5. Apply the conservation of linear momentum and the extended Bernoulli equation to solve engineering systems and derive several laws presented in physics from the momentum conservation equation.
6. Apply a Pugh Matrix to evaluate engineering solutions.
7. Mathematically model a physiological system using engineering principles.
8. Design a device to meet specified engineering criteria.
9. Work collaboratively on an engineering team.
10. As a member of a team, write two technical reports and present two oral technical reports with supporting visuals.
11. Demonstrate an understanding of the ethical and professional responsibilities of engineers.
12. Demonstrate awareness of societal and economic issues in the field of bioengineering.

COURSE ASSIGNMENTS

Homework

One homework problem set is assigned approximately every week. Homework will be due at 5pm via Canvas on the day it is due (please check the schedule on Canvas for the exact deadlines). You will get **one late homework pass** – no penalty, no questions asked. You can use it for a one-day extension on one homework. All you have to do is send the TA an email and let them know you will use your late homework pass before the deadline. This ONLY applies to homework (exams and PBL deadlines do not qualify for homework pass extensions). No late homework will be accepted without permission of the instructor before the homework is due. Grades on approved late homeworks will be reduced 25% per day (including weekends). Illness and family emergencies will be dealt with on an individual basis –contact Dr. Ramos as soon as possible.

Solutions to homework problems will be made available in the course website. **You are not allowed to take pictures, copy, download or transcribe the solutions in any format**. Individuals turning in late homeworks are expected to not consult the posted homework solutions (Honor Code). Students may not consult homework from previous years (Honor Code).

Exams

There will be two exams and a final exam. The exams are given in the evening (6-10pm); all students must attend on the posted dates, unless they discuss this with Dr. Ramos ahead of time. The instructor retains the right to fail a student who does not complete an exam.

Problem-Based Learning Modules

Students will participate in problem-based learning (PBL) modules throughout the semester, to solve open-ended bioengineering problems that focus on a physiological system. Students will work in teams and meet formally with facilitation once a week; students are expected to meet outside of class as well. A written report and oral presentation will be required for each PBL module. The PBLs will count for 40% of the final course grade.

Individual performance will be used as a factor to determine your individual PBL grade. Further details on the PBL assignments and expectations will be discussed in class.

Grading Policy - The final grade will be based on the following.

- Homework 15 %
- PBLs 40%
- Exams 40 %
- Participation 5%

If a student scores an average of less than 60% on their three exams, the instructor may alter the percentage above such that each exam counts for 50% and the PBLs count for 30%.

If you believe that your work has not be graded correctly or fairly, you must submit a written explanation to Dr. Ramos and the course TA within seven days of when the work was graded and returned. No late regrade requests will be accepted. A regrade request may lead to a regrade of your entire work and may result in a lower grade.

COURSE ADMINISTRATION

Attendance

Class time will be used in a variety of ways, including lectures, active learning and problem solving, PBL team meetings, and student oral presentations.

If you must miss a class for any reason, you are responsible for talking to another student in the class and obtaining any course material missed.

Participation

Students are expected to be actively engaged in and out of the classroom. Your participation in class benefits all students and crates a bertter learning environment. Please show up to class awake ready to work.

Office Hours and Problem Sessions

Review sessions and office hours will be offered (check course schedule for additional information). Please come to office hours prepared with questions and ready to work. TAs will be there to facilitate learning, not to provide you with answers to the homework.

Textbook

The textbook for the course is Bioengineering Fundamentals, A. Saterbak, K.-Y. San and L.V. McIntire, Pearson Prentice Hall, 2017, ISBN-13: 978-0134637433). If you are using a previous version of this book, check with a classmate to make sure you are answering the correct problem numbers for the homework.

Honor Code Policy

In this course, all students will be held to the standards of the Rice Honor Code, a code that you pledged to honor when you matriculated at this institution. If you are unfamiliar with the details of this code and how it is administered, you should consult the Honor System Handbook at http://honor.rice.edu/honor-system-handbook/. This handbook outlines the University's expectations for the integrity of your academic work, the procedures for resolving alleged violations of those expectations, and the rights and responsibilities of students and faculty members throughout the process.

Students are encouraged to talk to each other, the teaching assistants, the instructors, or anyone else about any assignment in the course that is not specifically designated as pledged. This assistance is limited to the discussion of the problem and perhaps setting up of a solution (i.e. steps 1 and 2 as defined in the methodology for solving engineering problems in your textbook). Students must complete their own work. Students are not allowed to look at homework problems or solutions or exams from the courses taught in previous years.

Disability Support Services

If you have a documented disability or other condition that may affect academic performance you should: 1) make sure this documentation is on file with Disability Support Services (Allen Center, Room 111 / adarice@rice.edu / x5841) to determine the accommodations you need; and

2) talk with me to discuss your accommodation needs. Any student with a disability requiring accommodations in this class is encouraged to contact the instructor.

Inclusive Classroom

This classroom is a place where everyone will be treated with respect. I welcome individuals of all ages, backgrounds, beliefs, ethnicities, genders, gender identities, gender expressions, national origins, religious affiliations, sexual orientations, ability – and other visible and nonvisible differences. All members of this class are expected to contribute to a respectful, welcoming and inclusive environment for every other member of the class. Please let me know if there is anything I can do to create a better learning environment for you.

Syllabus Change Policy

This syllabus is only a guide for the course and is subject to change with advanced notice