BE 435: Transport Phenomena in Living Systems
Spring 2018
Monday and Wednesday: 12:20-2:05 pm
Room: PHO 211

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TA:

The Big Picture: This course presents an introduction to the principles of heat, mass and momentum transfer and their application to solve problems in living systems. We are also particularly keen on understanding the ethical dimension of the problems and understanding the real-world complexity in which engineers need to carry out their professional responsibility. In this regard, we will contextualize the problems in class within global challenges where engineering needs meet global development, poverty, disease and forced displacement.

Furthermore, we will use a blended learning model where key topics will be presented in videos that you will have a chance to view before class, so we could spend more time in constructing, discussing and solving problems. Some videos will focus on key math concepts, and others will enrich the context of the class problems. It is expected that you will watch the videos ahead of time – and the videos will be available throughout the semester.

Policy on inclusion: The goal of the course is to learn, engage and understand – but we will do so in a way that is most respectful and inclusive. We want to ensure that every single student feels welcomed and is able to participate freely in a respectful manner at all times.

Classroom as a "device free zone" policy: The class will be a "device free" zone. This means that no use of cell phones, tablets, or computers will be permitted, except if you have a permission from a doctor to use the device to take notes. You will have to bring the doctor's note if you would like exemption from this policy. I intend to fully enforce this policy and look forward to your cooperation. Trust me – we all can bear a couple of hours without our devices.

Textbooks: *1) Fundamentals of Heat and Mass Transfer-* ***Seventh Edition*** *(*By Incropera, DeWitt, Bergman and Lavine).
2) *BE 435 Course Packet (Will be available with Megan Wallander).*

Course Objectives: Learn the fundamental conservation principles and constitutive laws that govern heat, mass and momentum transport processes and systems and constitutive properties that are encountered in typical biological problems; develop problem solving skills that enable effective expertise for addressing novel biomedical applications. During the course of the term, we will address a number of key problems in biomedical engineering involving various forms of transport phenomenon, we will also have experts come to class to talk about their real-world research and how they use transport fundamentals to address complex biomedical problems. We will also review a few papers addressing cutting edge transport problems in biology, healthcare and biomedical engineering.

Knowledge, Abilities and Skills Students Should have entering this Course: mathematics through differential equations, freshman biology sequence

Knowledge, Abilities and Skills Students Should Gain from this Course: an understanding of the conservation of heat, mass and momentum plus the associated constitutive laws; knowledge of constitutive data unique to living systems including their magnitude and scale; how to determine which laws and data are relevant to a specific biological system and process; how to apply these laws to the solution of biological problems in complex global health scenarios; development/refinement of effective general engineering problem definition and solving skills leading to adaptive expertise; Ethical approach to engineering problem solving and applications in complex environments.

Attendance: required for all class periods. The course is designed for much of the learning experience to occur during the class period.

Student Feedback*:* I take teaching very seriously, and want to constantly improve and want to address problems students may be having during class. Therefore in addition to the end of term class evaluations, we will have a number of "anonymous" evaluations routinely in class. The students will be given an opportunity to raise any concerns they may have about the course teaching and other course related issues. I will try my best to address these issues.

Exam Schedule: There will be three in-class exams during the semester plus a required final exam during the finals week.

Academic Honesty: I am assuming we all will uphold the highest standards of academic honesty. The class will be highly interactive, and hopefully a lot of fun. However, any kind of academic dishonesty in an exam will not be tolerated and severe disciplinary action will be taken.

Course Assignments and Announcement*s*: will be posted on the course website. Problem sets will be typically due on Wednesday unless noted otherwise in the schedule. Typically problem sets will have 4-5 problems. There will be 9 assignments in all and I will drop your two lowest scores in problem sets and take only the top 7 of the problem sets.

Grading Format: The course grade will be based on class participation, performance on three exams, the final, and homework assignments. Performance will be assessed for acquisition of key knowledge components, the ability to use these knowledge tools to solve defined biotransport problems, and the development of expertise to transfer this ability to identify and solve problems in new contexts.

The basis for determining grades will be as follows:

Three in class exams during the semester	60% (20% x 3)
Final exam	25%
Homework	7%
Class participation	8%