Fall 2012

BE5337 Transport Phenomena In Biomedical Engineering

Instructor:	Chuong (chuong@uta.edu)
Time:	5:30-6:50pm, Tuesday and Thursday
Classroom:	ERB-129
Textbook:	Transport Phenomena in Biological Systems; Truskey, Yuan, Katz, 2 nd ed.
TA:	Ishan Khan (ishan.khan@mavs.uta.edu)
TA hours	11:00 am -1:00 pm, Tuesday and Thursday at lunch area (in front of ERB231)

Description:

A review of fundamental principles in momentum transfer, mass transfer, and heat transfer with their applications in the description of blood flow, capillary transport, interstitial fluid transport, lymphatic transport at normal and disease states, as well as the application in drug delivery. We then examine the applications in the design of artificial organs, including membrane blood oxygenator, kidney dialysis devices, and therapeutic applications including hyperthermia, hypothermia, transport of drug molecules in solid tumors, etc.

Objectives:

- To learn basic engineering principles of momentum, mass, and heat transfer in integrated form through an array of examples and analysis from biological systems (cellular, tissue, organ levels) and from the design of medical devices
- To be able to apply these principles, using quantitative methods based on fundamental physical laws, to solve problems in biology, of clinical significance, and problems in the design and development of medical devices, implants, including tissue-engineered constructs.

Prerequisites

Undergraduate fluid mechanics

Course outlines:

1. Introduction of the course

A. Introduction To Physiological Fluid Mechanics.

- 2. Conservation and Momentum Balances.
- 3. Conservation Relations for Fluid Transport, Dimensional Analysis and Scaling.
- 4. Macroscopic Form of Conservation Relations and Applications of Momentum Transport.
- 5. Fluid Flow in the Circulation and Tissues.

B. Fundamentals And Applications Of Mass Transport.

- 6. Introduction to Mass Transport.
- 7. Combined Diffusion with Convection.
- 8. Transport in Porous Media
- 9. Trans-vascular Transport.

C. The Effect Of Mass Transport Upon Biochemical Interactions.

- 12. Cell Adhesion and Cell Signaling.
- 13. Oxygen Transport from the Lungs to the Tissues.

- 15. Transport of Drugs and Macromolecules in Tumors.
- 16. Transport in Organs and Organisms.
- 17. Heat Transfer in Biological Systems.

Exams:

Two midterms and one final

Grading:

Homework	17.5%
Midterm 1	21.0%
Midterm 2	21.0%
Final	21.0%
Project with presentation	15.0%
Attendance and participation	4.5%

Late Homework

Homework set is due at 5:30 pm of the announced due date at the classroom (or otherwise specified). There will be penalty for late submission calculated as 10% for every one hour.

Americans with Disabilities Act: The University of Texas at Arlington is on record as being committed to both the spirit and letter of all federal equal opportunity legislation, including the *Americans with Disabilities Act (ADA)*. All instructors at UT Arlington are required by law to provide "reasonable accommodations" to students with disabilities, so as not to discriminate on the basis of that disability. Any student requiring an accommodation for this course must provide the instructor with official documentation in the form of a letter certified by the staff in the Office for Students with Disabilities, University Hall 102. Only those students who have officially documented a need for an accommodation will have their request honored. Information regarding diagnostic criteria and policies for obtaining disability-based academic accommodations can be found at <u>www.uta.edu/disability</u> or by calling the Office for Students with Disabilities at (817) 272-3364.

If you require an accommodation based on disability, I would like to meet with you in the privacy of my office, during the first week of the semester, to make sure you are appropriately accommodated.

Academic Integrity and Academic Dishonesty: It is the philosophy of The University of Texas at Arlington that academic dishonesty is a completely unacceptable mode of conduct and will not be tolerated in any form. All persons involved in academic dishonesty will be disciplined in accordance with University regulations and procedures. Discipline may include suspension or expulsion from the University. According to the UT System Regents' Rule 50101, §2.2, "Scholastic dishonesty includes but is not limited to cheating, plagiarism, collusion, the submission for credit of any work or materials that are attributable in whole or in part to another person, taking an examination for another person, any act designed to give unfair advantage to a student or the attempt to commit such acts."