CHBE481 - ENCH648W, Fall 2014
Transport Phenomena in Small and Biological Systems

Instructor:

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Office hours: Monday and Wednesday: 2:00-3:00pm
Course web: ELMS Enterprise Learning Management System
Class: Monday, Wednesday and Friday: 11:00 - 11:50am (CHM 0119)

Course Description:

Interdisciplinary course primarily for senior undergraduate and graduate students from engineering or science departments. The course's main goal is to make the students familiar with the fundamental physics and modeling of transport phenomena in small and biological systems, and their current scientific and engineering utilization in microfluidics, nanofluidics and biological systems.

The course is divided into 4 parts: (a) review of momentum, energy and mass transport and relevant mathematical methodologies at the microscopic level, (b) transport in small systems, (c) transport in biological systems, and (d) special lectures on active research in small and biological systems.

The course gives emphasis on small-scale complex systems such as transport physics at the micro- and nano-scale, hydrodynamics, diffusion, mixing and electrodynamics of small-scale systems. In addition, the course focuses on physiological transport phenomena including fluid flow in circulation and tissues, mass transport in biological systems, blood flow, hemodynamics and hemopathology, cell adhesion and transport in organs.

Recommended Textbooks:

Transport Phenomena in Biological Systems, by Truskey, Yuan and Katz, Pearson Prentice Hall (2009).
Introduction to Microfluidics, by Patrick Tabeling, Oxford University Press (2005).

On reserve in the Engineering Library. Note that the library has also other books with similar titles; all of them may be used for further study.

Grading Policy:

Homework and Class Participation	15 %
Project	15 %
Mid-term exam	30 %
Final exam	40 %

Examinations:

All exams are "closed-books"/"closed-notes" (notes on 1 sheet of paper allowed).
Date for "mid-term" exam (subject to change): Wednesday October 29, 2014.
Final Exam: the date is set by the University.

Homework Assignments:

Homework problems will be assigned on a regular basis.
The homework must be submitted at the beginning of the class the date it is due.
The problems and the solutions will be posted on the course web page.
Team homework: 2 students - only one solution per team.

Project:

The goal of the project is to familiarize the students with the current scientific and engineering utilization of transport phenomena. **Teams of two students** will choose (in agreement with the course instructor) a research topic involving application of transport phenomena in small and biological systems involving nanotechnology, bioengineering, biomedicine, polymer science, etc. Based on recent publications, the students shall write a proposal (up to 10 double-space pages excluding references) describing the proposed research. The proposal should include abstract, introduction, review of relevant publications, proposed research, conclusions and references. The paper is due one week before the end of the semester, i.e. on Friday December 5, 2014.

Suggested Prerequisites:

The students who may want to take this class should have experience with:
(a) Undergraduate Transport Phenomena (at least for one semester);
(b) Applied Mathematics for Engineers (including Vector Calculus and Ordinary Differential Equations) from relevant undergraduate or graduate courses.

Academic Honesty:

Plagiarism and academic dishonesty will not be tolerated, and suspected incidence will be referred to the Student Honor Council of the Judiciary Programs. For more information see:
http://www.testudo.umd.edu/soc/dishonesty.html & http://www.shc.umd.edu

The following information is suggested by the Student Honor Council:

The University of Maryland, College Park has a nationally recognized Code of Academic Integrity, administered by the Student Honor Council. This Code sets standards for academic integrity at Maryland for all undergraduate and graduate students. As a student you are responsible for upholding these standards for this course. It is very important for you to be aware of the consequences of cheating, fabrication, facilitation, and plagiarism. For more information on the Code of Academic Integrity or the Student Honor Council, please visit http://www.shc.umd.edu.