ENCH630: TRANSPORT PHENOMENA, Spring 2019

Instructor:

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Office hours: Mondays and Wednesdays: 1:00-2:00pm
Course web: ELMS Enterprise Learning Management System
Class: Mondays and Wednesdays: 3:30pm - 4:45pm (EGR 2116)

Teaching Assistant/Graduate Reader:

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Office hours: Tuesdays 5:00-6:00pm

Course Description:

Momentum, energy and mass transfer theory is taught at both the macroscopic and microscopic levels utilizing integral and differential conservation equations; similarities between the three types of transport; dimensionless analysis and time scales; and the similarity methodology. The course includes steady- and unsteady-state creeping and laminar flows; viscous and inviscid flows; transport at interfaces; lubrication theory; boundary layer theory; forced and natural convection; with specific application to complex and biological chemical engineering processes.

The course is divided into 3 parts: (a) similarities between the three types of transport and relevant mathematical methodologies (Appendix from Deen, Chapters 1-4, 6), (b) fluid mechanics (Chapters 6-9), and (c) energy and mass transfer (Chapters 10-12). In addition, the course gives emphasis on small-scale complex and biological systems such as transport in porous media and microfluidics, hemodynamics and cell adhesion. Additional material includes lectures on physiological and mesoscale fluid dynamics.

Recommended Textbooks:

Analysis of Transport Phenomena, by William M. Deen, Oxford University Press (2nd Edition, 2012).
Advanced Transport Phenomena: Fluid Mechanics and Convective Transport Processes, by L. Gary Leal, Cambridge University Press (2007).

Note that the Engineering Library has also an array of 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" (personal notes on 1 side of one page allowed).
Date for "mid-term" exam: Monday April 1, 2019.
Final Exam: the date is set by the University. (Saturday, May 18, 2019, 1:30pm-3:30pm).

Homework Assignments:

Homework problems will be assigned on a regular basis, posted on ELMS.
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 to 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 on Wednesday May 8, 2019.

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.