

ENCH 468W – ENCH 648W

Transport Phenomena in Small and Biological Systems (Elective)

Instructor: Prof. Panos Dimitrakopoulos

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.

Prerequisites

The course assumes that students have a prior course in transport phenomena such as *ENCH 422* or *ENCH 424* or permission of the instructor.

Textbooks

Analysis of Transport Phenomena, by William M. Deen, Oxford University Press (2012).

Transport Phenomena in Biological Systems, by George A. Truskey, Fan Yuan and David F. Katz, Prentice Hall, 2nd edition (2009).

Introduction to Microfluidics, by Patrick Tabeling, Oxford University Press (2006).

Instead of Deen's book, senior undergraduate students may use the books from their undergraduate Transport Phenomena courses, e.g. Middleman's books.

Course Objectives

To make students familiar with the fundamental physics, the modeling, and industrial and physiological applications of transport phenomena in small and biological systems that are applicable to different areas in the engineering profession and research, including the emerging fields of micro/nanotechnology and biotechnology.

Topics Covered

Review of momentum, energy and mass transfer theory at microscopic level; transport physics at the micro- and nano-scale; hydrodynamics, diffusion, mixing and electrostatics of small-scale systems. Physiological transport phenomena, fluid flow in circulation and tissues, mass transport in biological systems, blood flow, hemodynamics and hemopathology, cell adhesion, and transport in organs.

Class Schedule

1 hour and 15 min. course period; meets twice weekly.

Fall 2012 schedule: Monday and Wednesday, 3:00pm-4:15pm