CHBE481 - ENCH648W, Spring 2017
Transport Phenomena in Small and Biological Systems

Instructor:

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Office hours: Monday and Wednesday: 1:00-2:00pm
Course web: ELMS Enterprise Learning Management System
Class: Monday and Wednesday: 5:00pm - 6:15pm (EGR 1104)

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 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.

For the Spring 2017 semester, the course contains the following chapters:

(a) Transport Phenomena: Governing Equations and BCs - review
(b) Lubrication Theory - review
(c) Droplet dynamics in micro-channels
  Non-lubrication and lubrication relevant theories
(d) Membrane description and moduli
  Capsule dynamics in basic flows
  Asymptotic theories for capsules: small and large deformations
(e) Erythrocyte description and physiological role
  Erythrocyte dynamics in basic flows
  Multi-body effects of erythrocytes in vascular vessels
(f) Leukocyte description and physiological role
  Theories on adherent leukocytes and other cells
(g) Vascular endothelium
(h) Mesoscale Fluid Dynamics
(i) Further chapters may include oxygen delivery in tissues,
  flow in porous media, etc, if time permits.

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).

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