Graduate Course for Fall 2022
Micro and Nanoscale Fluid Transport Phenomena
ME536, SLN 23770

Time: M,W 3:30-4:50, SMI 105

Instructor: Jonathan D. Posner

Description:

This course focuses on fundamental fluid transport physics at the micron and nanometer scale. The concepts covered in the class are critical to **understanding the physics of micro and nanofluidic devices** as well as other small scale fluid systems such as biosensors, colloids, nanomotors, and biological systems. At small length scales fluid motion and transport is governed by electromagnetic, interfacial (surface tension), and stochastic phenomena that differentiate these flows from typical macroscale flows. In microfluidic devices these phenomena enable new and high-performance separation, concentration, control, and diagnostic processes. This course will cover Newtonian fluid mechanics, mass transfer, charged double layers, electrokinetically driven flow and transport (electroosmosis, electrophoresis, dielectrophoresis), surface tension. Additional topics can be discussed depending on student interest.

This course is open to students in all engineering disciplines (mechanical, bio, chemical, materials, electrical) as well those in chemistry, physics, and life sciences. The course is 3 hours of lecture per week and will have a midterm and final exams, some homework.

Prerequisites: Fluid mechanics or some transport phenomena strongly recommended, consult with instructor (jposner@uw.edu)

**If you were enrolled in Prof. Olanrewaju's ME536 course last spring, please note that this course will contain unique topics and credit can be earned in ME599 section SLN.

Topics Covered

- Viscous flow in microdevices
- Stokes Flow (internal/particles)
- Mass transport (advection/diffusion)
- Green's function solutions
- Dispersion
- Electrostatics
- Electrokinetics
- Electrophoresis
- Electroosmotic flow
- Electric double layer theory
- Surface tension