

## EE 4328-005/ EE 5389-003

### Microfluidics

(Tentative syllabus subject to change, Spring 2014)

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**Class Meetings:** Tu/Th 3:30-4:50 pm, SH 315

**Office Hours:** 4:50 – 5:50 pm Thursdays or by appointment

**Pre-requisites:** For senior standing undergraduates or graduate students.

#### Course Description and Objectives

This course introduces the basic principles of micro-scale fluidic mechanics, discusses key components in microfluidic devices and their fabrication techniques, and review applications of microfluidics in various emerging fields.

Through lectures, recent literature review papers, classroom discussion, and a course project, students will have a clear understanding about microfluidics and microfluidic devices. This course is designed to bring interdisciplinary views and approaches in the course materials and will prepare students to apply acquired knowledge in their future academic/industrial career.

**Textbooks:** No textbook is required but relevant references on each topic will be specified.

#### Suggested Readings:

*Introduction to Microfluidics*, by Patrick Tabeling, Oxford University Press, 2010

*Micro- and Nanoscale Fluid Mechanics: Transport in Microfluidic Devices*, by Brian Kirby, Cambridge University Press, 2010

#### Lecture Topics:

1. Review of essentials in macrofluidics
2. Fundamentals of microfluidics
  - a. Micro-scale fluidic mechanics
  - b. Scaling effect
  - c. Surface forces
  - d. Electrokinetics and electrophoresis
3. Microfabrication techniques
4. Microfluidic devices
  - a. Micropumps
  - b. Micromixing
  - c. Actuators and other components
5. Applications
  - a. Analytical bio/chemistry: Point-of-care devices and lab-on-chips
  - b. Biomolecule separation and particle sorting
  - c. Droplet microfluidics
  - d. Physiology: Blood flow in the microvasculature and related instrumentation

**Course Project** includes an in-class presentation and submission of a term report. Students can either choose from a given topic or suggest a topic for instructor's approval.

**Grading:** Homework 30%, Final exam 20%, and Course Project 50% (course project proposal 25% and project presentation 25%). Letter grading.