

UNIVERSITY OF SOUTH CAROLINA

EMCH 792C Micro/nanofluidics and Lab-on-a-Chip

Fall 2009

OUTLINE

Instructor

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Room A221, 300 Main Street
Office hours: Tu 6:00 – 7:00 p.m., Fr 6:00 – 7:00 p.m. Walk-ins are welcome at other times.
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Textbook

- Micro- and Nanoscale Fluid Mechanics for Engineers: Transport in Microfluidic Devices
By Brian J. Kirby. 2009.

References

- Tabeling, P. Introduction to Microfluidics, Oxford, 2005.
Probstein, R.F. Physicochemical Hydrodynamics, 2nd Ed., Wiley, 1994
Bruss, H. Theoretical Microfluidics, Oxford, 2008.
Nguyen, N-T and Wereley, S "Fundamentals and Applications of Microfluidics", 2nd Edition, Artech House, ISBN: 1580539726
Berthier J. and Silberzan, P. Microfluidics for Biotechnology. Artech House Publishers. ISBN: 1-58053-961-0.

Catalog Course Description

EMCH 792C Micro/nanofluidics and Lab-on-a-Chip. (3) Introduction of microfluidics and applications in life science. Content: Fundamentals and engineering concept: Introduction of basic principle of fluid mechanics, Navier-Stokes equation, non-slip condition, capillary, drop and micro/nanoparticle, electrokinetics; Introduction to microfabrication: soft-lithography, self-assembled monolayers; Microfluidic components and sample preparation: micro- pump, filter, valve, dispenser, mixer, reactor, preconcentrator, separation based on electrokinetics, microactuator and particle manipulator; Experimental measurements: microscopy, fluorescence and laser-induced fluorescence, measurement of flow velocity, temperature and concentration; Applications in chemistry and life science: sensors for pressure, velocity, concentration, temperature, biosensor in environmental monitoring and biodefence, clinical diagnostics, drug discovery and delivery, etc.

Course Objectives: At the conclusion of this course, students will be able to:

1. Understanding some advanced fluid mechanics relevant to micro scale device.
2. Design and analyze microfluidic devices
3. Demonstrate a basic understanding of principle and processes of microfluidic device fabrication, testing and characterization
4. Understanding lab-on-a-chip and the impact of microfluidics device for application in life science
5. Make reasonable decisions about the microfluidic device, selection, options and performance.

Grading: Homework and quizzes 40%
Middle Examinations 25%
Final Examination 35%

Examinations: Open book.