

## Biomedical Microdevices

MW 12:00 to 1:15 pm, Holmes Hall 247

### Class Information

This course provides an overview of state-of-the-art micro- and nanodevices for biomedical applications, with an in-depth study of a few selected devices. Topics covered include micro- and nanoscale physics, microfluidic physics and microfluidic devices, and micro- and nanoscale fabrication techniques.

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Office Hours: Wed 1:30 to 2:30 pm or by appointment

Text (optional): E. Meng, *Biomedical Microdevices*. Boca Raton, FL: CRC, 2011. ISBN: 978-1-4200-5122-3.

M. J. Madou, *Fundamentals of Microfabrication, 2<sup>nd</sup> edition*. Boca Raton, FL: CRC, 2002. ISBN: 978-0-84-930826-0.

S. D. Senturia, *Microsystem Design*. Boston: Kluwer Academic Publishers, 2001. ISBN: 0-7923-7246-8.

G. T. A. Kovacs, *Micromachined Transducers Sourcebook*. Boston: McGraw-Hill, 1998. ISBN: 0-07-290722-3.

J. P. Fitch, *An Engineering Introduction to Biotechnology*. Bellingham, WA: SPIE Press, 2002. ISBN: 0-8194-4497-9.

Webpage: See [laulima.hawaii.edu](http://laulima.hawaii.edu)

Grading: Homework / classwork 15%, Class presentation 15%, Micro-project 1 10%, Micro-project 2 20%, Case studies & paper reviews 10%, Course project 30% (Final report 15%, Final presentation 15%)

Exam Dates: N/A

Policies: No late homework is accepted.

### Topics:

- Overview of MEMS / NEMS devices
- Micro / nanoscale science
- Fluidic physics
- Electrical forces
- MEMS / NEMS fabrication
- Microfluidic channel fabrication
- Micropumps
- Biology for engineers, biological techniques
- Cell sorters
- Cell culturing
- Electrical interaction with cells

## **Course SLOs and Their Relationship to Program Outcomes**

After taking this course, students will be able to:

- Understand scaling laws and their application to micro- and nano-devices [1]
- Understand important forces at the micro- and nano-scale [1]
- Analyze microfluidic devices using fluid or circuit theory [1]
- Design a micro- or nano-device suitable for a particular biomedical application [1]
- Design a micro- or nano-fabrication process suitable for a particular device [1]
- Analyze micro- or nano-fabrication processes for potential problems and yield-limiting steps [1]
- Analyze published literature and identify current and fundamental limitations the devices and technology that are described [1, 4]
- Develop a novel idea or improve upon a current device or technology [1, 3, 4]
- Clearly articulate their ideas in technical written reports and technical oral presentations [1, 2, 4].

## **Program Outcomes**

1. Demonstrate mastery of the methodology and techniques specific to the field of study.
2. Communicate both orally and in writing at a high level of proficiency in the field of study.
3. Conduct research or produce some other form of creative work.
4. Function as a professional in the discipline.