

Microfluidics and Laboratory-on-a-Chip Systems 2019 (MIE1232S)

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Faculty of Applied Sciences and Engineering, University of Toronto

Tremendous opportunities are associated with shrinking large-scale (laboratory) processes to characteristic volumes of 10nL-100 μ L and translating them to continuous-flow formats. Applications of microfluidic and lab-on-a-chip technologies include assays for biomolecular detection, platforms for the perfusion culture of cells, organs and organisms, microfluidic bioprinting, and miniature chemical factories and energy conversion.

The interdisciplinary course considers the different backgrounds of students and consists of a combination of lectures and project work. Projects will consist of individual and group contributions and involve the design, manufacture, testing and live demonstration a microfluidic device. Course participants will receive hands-on experience in several current technologies for the processes for the manufacture of microfluidic devices (soft lithography, hot embossing, 3D printing).

Mark Distribution

Midterm	(20%)
Individual Lab Participation	(10%)
Individual Interim Report	(20%)
Proof-of-Concept Demonstration	(5%)
Group Project Presentation and Demonstration	(20%)
Final Report	(25%)

Course Schedule

Lecture	Date	Topic
1	January 15	Introduction
2	January 22	Device Design, Microfluidic Device Fabrication
3	January 29	Fabrication Processes (continued) World-to-Chip Interconnects
4	February 5	Single-Phase Fluid Flow, Mixing, Separations
5	February 19	Multi-Phase Fluid Flow: Drops, Bubbles and Particles
6	February 26	Projects
7	March 5	Cells on Chips <i>Microfluidics Company Overview</i>
8	March 12	Midterm Soft Material and Tissue Assembly, Bioprinting
9	March 19	Proof-of-Concept Project Demonstrations Microfluidic Diagnostic Devices
10	March 26	Microfluidic Applications in Energy
11	April 2	Flow Chemistry and Materials Synthesis <i>Microfluidics Company Overview</i>
12	April 9, (16)	Project Demonstrations and Presentations

Hands-on Laboratory Modules

Lab	Topic
1	Lithography
2	Soft Lithography
3	Hot embossing
4	3D Printing

Labs will be conducted at the Centre for Microfluidic Systems in Chemistry and Biology.
Contact: Dr. Dan Voicu (dan.voicu@utoronto.ca).

Hands-on-laboratory modules will take place on Monday mornings (9AM-noon). The laboratory schedule will be posted separately.

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Questionnaire

1. In what discipline did you receive your undergraduate training?

2. What is your home department during your graduate studies?

3. Are you already familiar with using Solid Works or AutoCAD?

4. Have you already been trained in one of the local cleanroom facilities? If yes, in what facility and for what processes?

5. Have you used soft lithography?

6. Have you used hot embossing?

7. Have you used a 3D Printer before?

8. Have you used a microscope before for (a) bright field and (b) fluorescence imaging?

9. Do you cook?

10. Are you interested in intellectual property and entrepreneurship?

11. Do you know what an invention disclosure is and are you familiar with UofT's IP policy?

Name:

Student Number:

E-mail address: