San José State University
Department of Mechanical Engineering
ME/EE/MatE 168 Microfluidics Fabrication and Design
Section 01, Spring 2020

Course and Contact Information

Class Days/Time:	Thursdays 1:30 PM to 4:15 PM
Classroom:	Engineering 115 and Engineering 311
Registration Codes:	EE: 29382, MatE: 29383, ME: 27112
Prerequisites:	MatE 25 or MatE 153 or MatE/EE 129
Instructor:	Sang-Joon (John) Lee
Office Location:	Engineering 310
Telephone:	408-924-7167
Email:	sang-joon.lee@sjsu.edu
Office Hours:	Mondays and Wednesdays 2:00 PM to 3:00 PM, and by appointment

Course Format

This is a mixed-mode class, with both in-person and online components. Online components require use of the Canvas learning management system, accessed via https://sjsu.instructure.com/. Successful completion of course requirements necessitates accessing the course website frequently, typically at least twice a week on a regular basis. Most or all class assignments will be collected in electronic format, and in some cases acceptable format may be restricted (e.g., PDF files). Accordingly, inexperience or difficulty with document format requirements must be resolved well in advance of (i.e., days before) respective assignment deadlines. Support for Canvas and use academic software tools is available at http://www.sjsu.edu/ecampus/. Important communications regarding this class may be sent via Canvas or to email addresses listed in MySJSU, and thus each student is expected to maintain up-to-date contact information in both systems.

ME 168 Course Description: http://info.sjsu.edu/web-dbgen/catalog/courses/ME168.html

Hands-on design, fabrication, and testing of microfluidic devices. Processes including photolithography, soft lithography, and plasma bonding. Design problems for microfluidic devices. Introduction to microfluidics simulation.

Course Learning Outcomes

Upon successful completion of this course, students will be able to:

1. Conduct focused literature searches on contemporary developments in microfluidics research.
2. Explain principles of fluid mechanics that have special relevance in microscale.
3. Run numerical simulation of fluid flow in microchannels with modern software tools.
4. Fabricate microfluidic chips using microfabrication processes such as UV patterning, soft lithography, and thin film deposition.
5. Assemble fluidic interfaces, plan experiments, and run functional testing of microfluidic chips.
6. Identify safety hazards and exercise safe laboratory practices associated with fabrication and testing of microfluidic devices.

Required Textbook and Reading

Textbook

S. J. Lee and N. Sundararajan, *Microfabrication for Microfluidics*, Boston, MA: Artech House, 2010. ISBN 978-1596934719. The full-text eBook is available to students free of charge through SJSU library at https://sjsu-primo.hosted.exlibrisgroup.com/permalink/f/1cue0e3/01CALS_ALMA51439105240002901

Other Readings

This class will also depend heavily on published research articles. Each student must be familiar with engineering literature search tools and library access to full-text articles. Tutorials are available at http://library.sjsu.edu/ and help is available from library staff.

Course Requirements and Assignments

According to the Office of Graduate and Undergraduate Programs http://www.sjsu.edu/gup/syllabusinfo/, "Success in this course is based on the expectation that students will spend, for each unit of credit, a minimum of 45 hours over the length of the course (normally 3 hours per unit per week with 1 of the hours used for lecture) for instruction or preparation/studying or course related activities including but not limited to internships, labs, clinical practica. Other course structures will have equivalent workload expectations as described in the syllabus."

In addition to textbook reading and class participation, course requirements and assignments are as follows:

- Participation Tasks will be assigned throughout the semester to promote active engagement and accountability. Examples include required discussion posts, project updates, online surveys, and peer review. Tasks may be in-class or online, so it is important to attend class and to check Canvas regularly.
- Reading Quizzes are intended to reinforce textbook reading with short questions, and are to be completed online within Canvas.
- The Topic Review is an opportunity to review, digest, and present contemporary research literature in microfluidics. This focused literature review is manifested as a short pre-recorded video for the benefit of the whole class.
- The Term Project is a team endeavor based on semester-long work with microfluidic device design, fabrication, simulation, and experimentation. The project culminates in a Project Poster that is presented at the end of the semester, along with a Lab Notebook (in electronic form). More specific guidance will be provided for each requirement via separate documentation.

Grading Information

The course grade is calculated from a weighted sum of all graded components as follows:

- 25% for Participation Tasks (mostly individual, except where noted)
- 10% for Reading Quizzes (individual)
- 15% for Topic Review (small team or individual, depending on class size)
- 35% for Project Poster (team-based)
- 5% for Teamwork (individual assessment by fellow team members)
- 10% for Lab Notebook (individual)

Percentage points for grades assignments and exams correspond to letter grade as follows:
97.0-100 A+ | 93.0-96.9 A | 90.0-92.9 A- | 87.0-89.9 B+ | 83.0-86.9 B | 80.0-82.9 B-
77.0-79.9 C+ | 73.0-76.9 C | 70.0-72.9 C- | 67.0-69.9 D+ | 63.0-66.9 D | 60.0-62.9 D- | 0-59.9 F

Assignment Submission: All graded assignments must be submitted using the designated assignment tool in the Canvas course shell. No assignments will be accepted over email.

Team Assignments and Peer Grading: Team assignments will be used for some portions of the course, and some assignments may involve peer grading. Alternative options will be considered for compelling reasons, but arrangements must be pre-approved in writing with ample time before corresponding deadlines (i.e. several days in advance).

Late Policy: Unless otherwise specified for a particular assignment, work that is submitted late will be accepted with reduced credit according to a depreciation rate of 1.5% for each late hour breached.

Exceptions: Any grading appeals or petitions must be communicated promptly in writing (or email). Exceptions will normally be evaluated at the very end of the semester in context with an individual's overall semester track record and all other exceptions class-wide. Special consideration for truly unavoidable and extenuating circumstances will depend on timeliness and supporting documentation (e.g., doctor's note, police report).

University Policies

Per University Policy S16-9, university-wide policy information relevant to all courses, such as academic integrity, accommodations, etc. will be available on the Office of Graduate and Undergraduate Programs' Syllabus Information web page at http://www.sjsu.edu/gup/syllabusinfo/ .

ME/EE/MatE 168 Microfluidics Fabrication and Design

This schedule is subject to change with fair notice via announcement in class or notification via Canvas.

Week	Date	Class Activities	Approximate deadlines (Actual deadlines via Canvas)
1	1/23	Introduction to microfluidics Course requirements and expectations	
2	1/30	Fabrication methods overview **Topic Review** requirements	
3	2/6	Lab safety; photolithography	Team formation
4	2/13	Soft lithography & casting	
5	2/20	Substrate bonding & fluidic interfacing	
6	2/27	Geometry and design rules **Project Proposal** requirements	**Topic Review**
7	3/5	Process characterization Term project device design	Project definition
8	3/12	Process characterization Term project fabrication process planning	
9	3/19	Process characterization Term project experimentation planning	Device geometry (i.e., CAD mask file)
10	3/26	Term Project device fabrication Microfluidics simulation	Experiment plan
11	4/2	Spring recess (no class meetings)	
12	4/9	Term Project device fabrication Microfluidics simulation	
13	4/16	Term Project device fabrication Microfluidics simulation	
14	4/23	Term Project device interfacing and testing Poster preparation and refinement	Fluid physics simulation
15	4/30	Term Project device interfacing and testing Poster preparation and refinement	
16	5/7	Term Project device interfacing and testing Poster preparation and refinement	**Project Poster** **Lab Notebook**

Final poster presentations will be held on Tuesday, May 19th from 12:15 PM to 2:30 PM.