San José State University
Department of Mechanical Engineering
ME/EE/MatE 168 Microfluidics Fabrication and Design
Section 01, Spring 2022

Course and Contact Information

Class Days and Time:	Thursdays 1:30 PM to 4:15 PM
Classroom:	ENG 115 (and occasionally ENG 311)
Registration Codes:	ME: 27183, EE: 29705, MatE: 29704
Prerequisites:	MatE 25 or MatE 153 or MatE/EE 129
Instructor:	Sang-Joon (John) Lee
Email:	sang-joon.lee@sjsu.edu
Telephone:	408-924-7167
Office Location:	Online by default in Spring 2022 (link posted in Canvas)
Office Hours:	Mondays and Wednesdays 1:30 PM to 2:30 PM

Course Format

This is a mixed-mode class, with both in-person and online components. The class will heavily use the Canvas learning management system (LMS) https://sjsu.instructure.com/ and at times require use of Zoom video conferencing https://sjsu.zoom.us/, for which online meetings require a microphone and speakers. Successful completion of course requirements necessitates accessing the course website frequently. Technical support for Canvas is available at http://www.sjsu.edu/ecampus/. Important communications regarding this class may be sent via Canvas or to student 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: https://catalog.sjsu.edu/preview_course_nopop.php?catoid=12&coid=60810

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

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.

Software Requirements

The course requires use of CAD software (e.g., AutoCAD, SOLIDWORKS, or equivalent) and COMSOL Multiphysics. Information for available site licenses if needed will be provided in class. Students may also access necessary software via the Virtual Desktop Infrastructure (VDI) https://www.sjsu.edu/ecs/vdi/ provided by the College of Engineering.

Course Requirements and Assignments

University policies relevant to syllabi are posted at https://www.sjsu.edu/curriculum/courses/syllabus-info.php. As stated, "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 evaluations. 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. There are three main deliverables for the project: (1) a prerecorded video presentation, (2) a short written paper, and (3) an electronic lab notebook. Specific guidance for each deliverable will be provided via separate documentation.

Grading Information

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

- 20% for Participation Tasks (default individual, except where noted for team submissions)
- 10% for Reading Quizzes (individual)
- 15% for the Topic Review video (team-based)
- 55% for the Term Project (25% for video presentation, 20% for written paper, 10% for lab notebook)

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

Assignment Submission: All graded assignments must be submitted using the designated assignment tool in the Canvas course shell. Assignments will not 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

In accordance with University Policy S16-9 http://www.sjsu.edu/senate/docs/S16-9.pdf, the following link contains university-wide policy information relevant to all courses, such as academic integrity, accommodations, and related concerns: https://www.sjsu.edu/curriculum/courses/syllabus-info.php.

Academic Technology Requirements

Students are required to have an electronic device (laptop, desktop or tablet) with audio. Campus-level resources for technology needs (including equipment loans) are described at https://www.sjsu.edu/learnanywhere/equipment/.

Recording Policy

Students are prohibited from recording class activities (including class lectures, office hours, advising sessions, etc.), distributing class recordings, or posting class recordings. Materials created by the instructor for the course (lectures and lecture notes, presentations, etc.) are copyrighted by the instructor. University Policy S12-17 https://www.sjsu.edu/senate/docs/S12-7.pdf is in place to protect the privacy of students in the course, as well as to maintain academic integrity through reducing the instances of cheating. Students who record, distribute, or post these materials will be referred to the Student Conduct and Ethical Development office. Unauthorized recording may violate university and state law. It is the responsibility of students who require special accommodations or assistive technology due to a disability to notify the instructor.

Course Schedule

This schedule is a tentative plan, subject to change with exact deadlines communicated via Canvas. Reading quiz deadlines will backfill less busy weeks, adjusted around project deadlines.

Date	Class Activities	Approximate deadlines
1/27	Course requirements and expectations Introduction to microfluidics	
2/3	Microfluidic device fabrication overview	
2/10	Device geometry and design rules Lab safety	Topic Review video
2/17	*First day in-person* Photolithography	
2/24	Soft lithography, casting, bonding	Term Project team formation
3/3	Fluidic interfacing, flow and pressure measurement	
3/10	Microscopy and image acquisition	Term Project (preliminary) definition
3/17	Term Project fabrication process planning	Term Project device design (i.e., CAD mask files)
3/24	Term Project experimentation planning	Term Project fabrication plan
3/31	*Spring recess (no class meetings)*	Term Project experiment plan
4/7	Term Project device fabrication Microfluidics simulation	
4/14	Term Project device fabrication Microfluidics simulation	Term Project simulation proposal
4/21	Term Project device fabrication Microfluidics simulation	
4/28	Term Project device interfacing and testing	Term Project simulation results
5/5	Term Project device interfacing and testing	
5/12	Term Project device interfacing and testing	**Term Project final deliverables** (video presentation, written paper, lab notebook)

Final poster presentations will be held during the university-designated final exam period for this class, as listed at https://www.sjsu.edu/classes/final-exam-schedule/spring-2022.php.

The 2021-2022 academic calendar is posted at https://www.sjsu.edu/provost/docs/Academic_Calendar-AY2021-22.pdf.