San José State University
Department of Mechanical Engineering
ME 284 Sensor Technology and Principles, Section 01, Fall 2021

Course and Contact Information

Class Days/Time:	Tuesdays and Thursdays 6:00 PM to 7:15 PM
Classroom:	Online only (link posted in Canvas)
Registration Code:	47514, 3 units
Prerequisites:	BSME or instructor consent
Instructor:	Sang-Joon (John) Lee
Email:	sang-joon.lee@sjsu.edu
Telephone:	408-924-7167
Office Location:	Online only in Fall 2021 (link posted in Canvas)
Office Hours:	Tuesdays and Thursdays 10:30-11:30 (link posted in Canvas)

Course Format

This class is fully online and heavily requires use of Zoom video conferencing https://sjsu.zoom.us/ and the Canvas learning management system (LMS) https://sjsu.instructure.com/. Online meetings require a microphone and speakers. Cameras are encouraged but optional. 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.

Course Description: https://catalog.sjsu.edu/preview_course_nopop.php?catoid=12&coid=60809

Sensors and principles, including mechanical and magnetic sensors, optical sensors, chemical sensors, and biosensors; Sensor circuitry, signal characterization and processing; Sensor design, fabrication and applications.

Course Learning Outcomes

Upon successful completion of this course, (in relation to common resistive, capacitive, inductive, and magnetic sensors) students will be able to:

1. Explain relevant applications, principles of operation, and functional limitations for common sensors.
2. Interpret commercial sensor data sheets and select an appropriate sensor according to functional needs.
3. State and explain the materials, device architecture, and fabrication methods for common sensors.
4. Perform calculations relevant to transduction physics and sensor data analysis.
5. Describe elementary electronic components and their functions in sensor circuitry.
6. Interpret sensor signal conditioning (noise attenuation, amplification, filtering).
7. Identify requirements for sensor integrating with other devices (microcontrollers, actuators, and other sensors).
8. Conduct elementary multiphysics simulation involving sensor transduction principles.
9. Perform independent literature-based research and write a professional review of advances in sensor technology.

Required Textbooks

Resistive, Capacitive, Inductive, and Magnetic Sensor Technologies, by Winncy Y. Du, Taylor & Francis Group, CRC Press, 2015, ISBN 978-1-4398-1244-0. Additional required reading may be assigned from full-text resources available via the university library.

Software Requirements

Some class exercises will use COMSOL Multiphysics for simulation of sensors. The software is available for student use over the Virtual Desktop Infrastructure https://www.sjsu.edu/ecs/vdi/ or alternatively in supported computer laboratories within the Engineering Building.

Library Resources

The engineering librarian as listed at http://library.sjsu.edu/staff-directory/sjsu-library-subject-liaisons can provide faculty and students with research instruction and resources, as needed, in person and online through the library website http://library.sjsu.edu/. Research guides http://libguides.sjsu.edu/ are accessible for departments and subject areas, including a guide specific to mechanical engineering at http://libguides.sjsu.edu/me.

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."

- Participation Tasks: Throughout the semester there will be several participation tasks to promote active engagement. Specific examples may include assigned discussion posts, surveys, progress updates, and peer review. These will be tallied for credit with strict deadlines and there are no make-up options.
- Checkpoint Quizzes: Short online quizzes will be used to checkpoint baseline knowledge and concepts from the class and its reading assignments. These quizzes permit use of any available source (books, notes, online resources), but must be done strictly individually. Collaboration on any of these quizzes is cheating and will be reported as academic dishonesty.
- Homework: Routine homework will be assigned at least five days before each respective deadline. Collaboration among classmates on general approach and cross-checking intermediate values is welcome and even encouraged. However, all homework must still be freshly prepared and submitted individually. Raw copying of software code, solutions or copy/paste use of figures is cheating and will be reported as academic dishonesty. Homework will be graded not only on correctness but also on professional written and visual communication.
- Projects: There are multiple projects in the course (as listed below). The projects are open-ended and one or more are team-based. In addition to collective efforts, all team projects will require a written individual contribution log. Specific requirements and expectations are detailed in separate documentation for each project.

Grading Information

The course grade will be weighted as follows:
20% for Homework (individual)
10% for Checkpoint Quizzes (individual)
10% for Participation Tasks (individual)
20% for Sensor Product Comparison (team-based presentation)
20% for Research Advances in Sensor Technologies (team-based paper & synopsis presentation)
20% for Sensor Transduction Simulation (individual presentation)

The overall course grade is calculated from a weighted sum of all graded components. Graded percentage points correspond to letter grade 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

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. Exams, however, are strictly limited to designated times; late exams are not accepted.

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 updates to be communicated in class or notification via Canvas.

Dates	Lesson topics	Related Reading
8/19	Course overview and structure, sensor terminology and concepts	Du Chapter 1
8/24, 8/26	Resistive sensors	Du Chapter 2
8/31, 9/2	Capacitive sensors	Du Chapter 3
9/7, 9/9	Inductive sensors	Du Chapter 4
9/14, 9/16	Magnetic sensors	Du Chapter 5
9/21, 9/23	Optical and other sensors	(assigned separately)
9/28, 9/30	Contemporary research in sensor technologies (and publications thereof)	
10/5, 10/7	**Sensor Product Comparison** presentations	
10/12, 10/14	Guest speakers on contemporary research in sensor technologies (tentative)	
10/19, 10/21	Introduction to multiphysics simulation for sensors	
10/26, 10/28	Microfabrication processes for sensors	(assigned separately)
11/2, 11/4	**Research Advances in Sensor Technologies** synopsis presentations	
11/9	Sensor microsystems packaging *(No class meeting on 11/11, in observance of Veteran's Day)*	(assigned separately)
11/16, 11/18	Sensor circuits and signal conditioning	Du Chapter 6
11/23	(Working session and support on simulation refinement) *(No class meeting on 11/25, in observance of Thanksgiving Holiday)*	
11/30, 12/2	**Sensor Transduction Simulation** presentations	

All students are expected to be available during the university-designated final exam period for this class, as listed at https://www.sjsu.edu/classes/final-exam-schedule/fall-2021.php. The time will be used for project presentations.

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