

San José State University
Charles W. Davidson College of Engineering
Department of Mechanical Engineering
ME 190, Mechatronics System Design, Fall 2018

Instructor:	Saeid Bashash
Office Location:	Engineering 310-I
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Email:	saeid.bashash@sjsu.edu
Office Hours:	Thursday 12:00 PM-2:00 PM Or by appointment
Class Days/Time:	Lecture (40450): Tu-Th 2:00 PM-2:50 PM (Loc: ENG-329) Lab, Sec. 2 (41071): Tu 3:00 PM-5:45 PM (Loc: ENG-135) Lab, Sec. 3 (43536): Th 3:00 PM-5:45 PM (Loc: ENG-135) Lab, Sec. 4 (44413): W 10:00 AM-12:45 PM (Loc: ENG-135)
Classroom:	Lecture: Engineering 329 Lab: Engineering 135
Prerequisites:	ME-106; co-req. ME-147

Course Description

ME-190 is the capstone course for the mechatronics specialization track. Students will integrate and build upon knowledge and skills gained in previous courses to design, assemble, and analyze mechatronic systems using modern methods and tools. Lectures and laboratory experiences will include dynamic systems behavior, motion sensing and control, digital and analog signal filtering, embedded programming, and analysis in time and frequency domains. The course concludes with a team-based multi-week design project.

Course Learning Outcomes

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

1. *Develop state-space and transfer function models for electrical, mechanical, and electro-mechanical systems*
2. *Simulate the models of dynamic systems in the computer environment*
3. *Extract useful data from a noisy signal*
4. *Identify system characteristics by inspection of a data plot*
5. *Design and implement a hardware controller*
6. *Write and optimize code for embedded programming*

Required Texts/Readings/Materials

There are no required textbooks for this course. The main reference is the lecture notes. Two textbooks are recommended for further reading.

Recommended Texts/ Readings/Materials

- William Palm III (2013). System Dynamics. McGraw-Hill Education, 3rd edition.
- Åström, K. and Murray, R. (2012). Feedback Systems: An Introduction for Scientists and Engineers. Princeton University Press, Princeton, NJ. The complete text is available for free online at: http://www.cds.caltech.edu/~murray/books/AM08/pdf/am08-complete_28Sep12.pdf
- MATLAB video tutorials from <https://www.solidprofessor.com/> (Subscription available at discounted rate for SJSU students)

Required Hardware

- Arduino
- An Arduino-compatible analog sensor (More information to be provided)
- Breadboard and jumper wires

Required Software

- MATLAB and Simulink Student Suite to be purchased from: https://www.mathworks.com/store/link/products/student/SV?s_tid=ac_buysuite_sv_bod

Although it is highly recommended to purchase the student license for MATLAB and Simulink, the full package is available on the ME Computer Labs as well.

Course Requirements and Assignments

- All the lecture notes, lab instructions, and homework assignments will be posted on the “Pages” section of the Canvas course website.
- Homework is generally due one week after it is assigned. You must turn in the hardcopy at the *beginning* of the lecture period. There will be **only one allowance** for late homework submission and that will include a **20% grade penalty**. The late submission will be due at the beginning of the following class session.
- Laboratory reports will be handled similarly: a hardcopy must be submitted one week after the laboratory experiment was performed. Turn in the hardcopy to your lab instructor at the beginning of the lab period.
- You are expected to study the lab instructions before attending the labs. There will be a short quiz at the beginning of each lab session examining your preparation and understanding of the lab objective and scope. There will also be an assignment completion check at the end of each lab session. You must notify the lab and course instructors in advance if you will be late to the lab.
- Any complains about the lab and homework assignment grades must be taken to the lab TAs and the homework GA first. If the issue is not resolved, you may contact the instructor.
 - Derrick Lao, Lab TA: derrick.lao@sjsu.edu
 - Jeremy Aires, Lab TA: jeremyaires@sbcglobal.net
 - Nguyen Nguyen, Lab TA: nguyenski91@gmail.com
 - Pratik Mehta, Homework GA: pratik.b.mehta@sjsu.edu

Grading Information

The weighting of course components for determining the course grade are as follows:

- Homework: 15%
- Lab Quizzes and Reports: 25%
- Midterm Exam: 20%
- Term Project: 15%
- Final Exam: 25%

The grade for each lab is split into three parts:

- Quiz at the beginning of the lab: 20%
- Assignment completion check at the end of the lab: 40%
- Report: 40%

The scores on your homework, laboratory reports, midterm exam, term project, and final exam will be combined and totaled using the weighting scheme described above. The grade will be rounded up to the nearest integer, and a final letter grade will be determined using the following criteria:

A+ 100– 97% | A 96 – 93% | A- 92 – 90% |
B+ 89 – 87% | B 86 – 83% | B- 82 – 80% |
C+ 79 – 77% | C 76 – 73% | C- 72 – 70% |
D+ 69 – 67% | D 66 – 63% | D- 62 – 60% |
F < 59%.

Midterm and Final Exams

Both the midterm and the final exam will be based on the topics covered during lectures and lab sessions. The exams will be closed book and closed notes, but you may receive a formula sheet. Reviewing the lecture notes, lab manuals, and homework problems will help prepare for the exams. We will also hold review sessions before each exam.

Classroom Protocol

I expect everyone to make their best effort to attend all class sessions and laboratory periods. Please arrive to the classroom or laboratory *before* the session begins, so that others are not disturbed by your entry after instruction has begun. If you normally keep a cell phone activated and with you, put your cell phone on ‘silent’ or ‘vibrate’ before you enter the classroom. You are encouraged to ask questions and participate actively in the classroom discussions raised during the lectures, however, disrupting the class by engaging in conversation with your classmates must be avoided. Moreover, using computers and tablets during lecture time is highly discouraged unless for taking notes in tablet mode or working on in-class activities.

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 Office of Graduate and Undergraduate Programs’ [Syllabus Information web page](http://www.sjsu.edu/gup/syllabusinfo/) at <http://www.sjsu.edu/gup/syllabusinfo/>

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Tentative Course Schedule

Week	Date	Topics
1	8/21-8/23	Course overview, introduction to MATLAB
2	8/28-8/30	Introduction to MATLAB and Simulink
3	9/4-9/6	Modeling electrical systems
4	9/11-9/13	Analog and digital filtering
5	9/18-9/20	State-space modeling and simulation
6	9/25-9/27	Laplace Transform and transfer function
7	10/2-10/4	Modeling electromechanical systems
8	10/9-10/11	Midterm Review - Midterm Exam (10/11)
9	10/16-10/18	Simulation of DC motors
10	10/23-10/25	Fundamentals of feedback systems
11	10/30-11/1	Control design using classical methods
12	11/6-11/8	Control design using modern methods
13	11/13-11/15	Review of rigid body dynamics
14	11/20-11/22	Modeling MinSeg robot - Thanksgiving Break (11/22)
15	11/27-11/29	Linear Quadratic Regulator (LQR)
16	12/4-12/6	Feedback linearization - Final Exam Review
Final Exam	12/13/2017	Thursday, 12:15 – 14:30, ENG 329