San José State University
Charles W. Davidson College of Engineering
Department of Mechanical Engineering
ME 190, Mechatronic Systems Design, Fall 2019

Instructor:	Saeid Bashash
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Office Hours:	Tuesday & Thursday 5:00 PM-6:00 PM or by appointment
Class Days/Time:	Lecture (40394): Tu-Th 1:30 PM-2:20 PM (Loc: ENG-331) Lab, Sec. 2 (40919): Tu 2:30 PM-5:15 PM (Loc: ENG-135) Lab, Sec. 3 (42760): Th 2:30 PM-5:15 PM (Loc: ENG-135) Lab, Sec. 4 (43339): Fr 1:30 PM-4:15 PM (Loc: ENG-135)
Classroom:	Lecture: Engineering 331 Lab: Engineering 135
Prerequisites:	ME-106; co-req. ME-147

Course Description

Process modeling from test data. Computer-aided dynamic system control analysis and design. Application and integration of microcontroller for digital process and servo control. Development of smart and intelligent products with microcontroller.

Course Learning Outcomes

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

1. *Develop 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 experimental data*
5. *Design and implement hardware controllers*
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

Required Hardware

- Students are expected to have an Arduino microcontroller, a breadboard, jumper wires, and a multimeter. Additional hardware will be provided in the lab.

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.
- Students without a strong background in MATLAB and/or Simulink are highly encouraged to complete "MATLAB Onramp" and "Simulink Onramp" courses from https://matlabacademy.mathworks.com/. These courses are free, and come with a certificate upon successful completion.

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 submit the homework via Canvas before the deadline. There will be **only one allowance** for late homework submission and that will include a **20% grade penalty**. The late submission will be due 3 days after the original deadline.
- Laboratory reports will be handled similarly.
- 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 grades must be taken to the lab TAs and the homework grader first. If the issue is not resolved, you may contact the instructor.
  - Vincent Tran, Lab TA (Tu-Th Sections): vincent.v.tran01@sjsu.edu
  - Eduardo Mateo, Lab TA (Friday Section): eduardo.mateo@sjsu.edu
  - Colin Illas, Homework grader: colin.ilas@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 the aggregation of three sub-grades:

- 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:

Grade	*Points*	*Percentage*
A plus	*96 to 100*	*96 to 100%*
A	*92 to 95*	*92 to 95%*
A minus	*89 to 91*	*89 to 91%*
B plus	*86 to 88*	*86 to 88%*
B	*82 to 85*	*82 to 85%*
B minus	*79 to 81*	*79 to 81%*
C plus	*76 to 78*	*76 to 78%*
C	*72 to 75*	*72 to 75%*
C minus	*69 to 71*	*69 to 71%*
D plus	*66 to 68*	*66 to 68%*
D	*62 to 65*	*62 to 65%*
D minus	*59 to 61*	*59 to 61%*
F	*0 to 58*	*0 to 58%*

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 at http://www.sjsu.edu/gup/syllabusinfo/

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Tentative Course Schedule

Week	Date	Topics
1	8/22	Course overview, introduction to MATLAB
2	8/27-8/29	Introduction to MATLAB and Simulink
3	9/3-9/5	Modeling electrical systems
4	9/10-9/12	Analog and digital filtering
5	9/17-9/19	State-space modeling and simulation
6	9/24-9/26	Laplace Transform and transfer function
7	10/1-10/3	Modeling electromechanical systems
8	10/8-10/10	Midterm Review - **Midterm Exam (10/10)**
9	10/15-10/17	Simulation of DC motors
10	10/22-10/24	Fundamentals of feedback systems
11	10/29-10/31	Control design using classical methods
12	11/5-11/7	Control design using modern methods
13	11/12-11/14	Review of rigid body dynamics
14	11/19-11/21	Modeling MinSeg robot
15	11/26	Linear Quadratic Regulator (LQR)
16	12/3-12/5	Feedback linearization - Final Exam Review
Final Exam	**12/16/2019**	**Monday (Dec 16), 12:15 – 14:30, ENG 331**