

California State University, Chico
Department of Mechanical and Mechatronic Engineering
and Advanced Manufacturing

MECA 482: Control System Design, Fall 2023

Instructor:	David Silveira
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Office hours:	M 10:00AM-12:00PM, W 10:00AM-11:00AM, Th 2:00PM-3:00PM
Class days and times	TuTh 12:30-1:45PM
Classroom:	LANG 107
Prerequisites:	EECE 211 or EECE 215; MATH 260

Course Usage of Canvas

Copies of the course syllabus, homework assignments, tutorials, design project information, and due dates may be found on Canvas. You are responsible for regularly checking the online resources, which are accessed through the [Chico State Portal](#). Updates to Canvas content will not always be announced in class.

Course Description

Modeling and simulation of dynamic system performance. Control system design for continuous systems using both analog and digital control techniques.

Student Learning Objectives

- Identify differences in behavior between systems that are open-loop vs. closed loop, and with negative feedback vs. positive feedback.
- Formulate mathematical models for Linear Time-Invariant systems including transfer functions and State-Space representations.
- Identify transient and steady-state system responses to step and ramp inputs by analyzing system transfer functions.
- Analyze stability of systems with and without control.
- Use Root-Locus method to analyze and design control systems including electronic compensators.
- Construct and analyze physical system for the application of PID controller.
- Model physical systems and derive equivalent transfer function representations.
- Use MATLAB and Simulink to model and analyze feedback and control systems.

Course Content Learning Outcomes

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

- Develop mathematical models of control components and systems.
- Simplify block diagrams and calculate transfer functions and state space models of linear, time-invariant systems.
- Formulate and/or use system specifications needed to design system controllers.
- Test a linear system for stability by determining pole locations.
- Test a linear system for controllability and observability.
- Use the Root Locus method to design controllers to meet specifications.
- Develop and run simulations of control systems using MATLAB and Simulink.

Required Texts/Software

Required Textbook

Control Systems Engineering, 7th Ed., Norman S. Nise, Wiley, 2015.

Recommended Supplemental Materials

Schaum's Outlines: Feedback and Control Systems, 2nd Ed., DiStefano, Stubberud, and Williams, McGraw Hill, 1990.

Required Software

[MATLAB with Control Systems Toolbox](#)

[MATLAB Support Package for Arduino \(suggested\)](#)

Required Hardware

- Personal computer capable of running the above software plus [Zoom](#).
- Microphone and speakers or headphones in case COVID conditions require shift to online instruction.

Classroom Protocol

All students are expected to conduct themselves in a professional manner.

Disruptive behavior which interferes with a positive learning environment will not be tolerated and may be reported to the [Office of Student Conduct, Rights, and Responsibilities](#). Examples of such behavior during lectures and labs include but are not limited to the following:

- Whispered "side" conversations between students in class.
- Persistent early departure from class or late arrival to class. **Students are expected to arrive to class on time. Coming in late disrupts the class and is distracting to other students.**
- Repeatedly asking questions or making statements not relevant to the lecture topic.
- Eating or using cell phones during class.
- Any hostile, abusive, disruptive, or discriminatory verbal or physical conduct.
- Non-compliance with University COVID-19 safety policies.

Dropping and Adding:

You are responsible for understanding the policies and procedures about add/drops, academic renewal, etc. that can be found in the [CSU Chico University Catalog](#). Students who do not attend the first day of class will be dropped if there is a waiting list. It is your responsibility to take the appropriate action to drop or withdraw from the course if you are no longer going to attend, otherwise a failing grade will be assigned.

Assignments and Grading Policy

- **Homework (8% of final course grade):**
 - Homework assignments will be collected as electronic submissions through Canvas only. Hard copies, e-mailed submissions, or links to Google Drive or other file-hosting services will not be accepted.
 - The lowest two scores will be dropped when calculating the course grade. **Late submissions will not be accepted.**

- **Activity Quizzes (2% of final course grade):**
 - Quiz questions on random topics related to lecture content will be given. **Students must bring a device to class that is capable of accessing Poll Everywhere.**
 - Quizzes will be graded on a credit/no-credit basis with participation in any given day's quizzes worth 1 point. More than 1 quiz may be given during a day's lecture and not all lectures will have quizzes. Lectures with multiple quizzes will still count as 1 point.
 - Four absences will be dropped when calculating the course grade. **Make-up quiz questions will not be given and quizzes will not be announced in advance. Students who attend class but have no device to access the quiz will be considered absent.**

- **PID Controller Design Project:**
 - See the document titled "PID Controller Design Project" posted on Canvas for additional details for each deliverable.
 - List of deliverables and due dates plus proportion of project grade for each item:
 - Progress Report #1: Monday, 9/25 @ 11:59PM (15%).
 - Progress Report #2: Monday, 10/23 @ 11:59PM (15%).
 - Project Demonstration: Week of 11/27 during class hours (20%).
 - Final Project Report: Monday, 12/4 @ 11:59PM (50%). No credit will be given for report if no demonstration performed.
 - **Student groups are expected to do their own work and avoid sharing materials such as parts lists and results of simulations and measurements. If copies of the same material appear in 2 or**

more project submissions, this will be considered evidence of cheating and all students involved will be held equally responsible. Each group is expected to build their own system.

- Progress Report #1 requires instructor approval of selected system before you can continue with the project. 5% of total project grade will be deducted for each day after Monday, 10/2 without approval of system, no limit to total deduction. No credit will be given for project if approval has not been obtained before Monday, 10/23.
- Late submission policies for all three reports are as follows:
 - Up to 24 hours late: -10%
 - 24-48 hours late: -20%
 - 48-72 hours late: -30%
 - >72 hours late: not accepted, no credit.
- **Zero credit will be given for the entire project if the proposed system was not approved by Monday, 10/23 and/or both progress reports were not submitted by the end of the respective late submission periods – no exceptions. Students must show meaningful project progress during the semester. Do not leave the entire project and all submissions to be done at the last minute and expect to receive credit.**
- It is your responsibility to ensure that you have submitted the correct files to Canvas. You will not be asked to resubmit blank, corrupted, or incorrect files; what you submit is what will be graded. Re-submissions of edited versions of previously submitted files will not be accepted after the submission deadline has passed.
- **Exams:**
 - There will be two midterm exams and a comprehensive final exam.
 - **No make-up exams will be given without documentation of a serious and compelling reason for missing the exam as defined in the [University Catalog: Academic Policies and Regulations](#).**
 - Make-up exams must be taken within one week of the originally scheduled exam date.
 - Online exams will be given only if University COVID mitigation policies dictate that classes cannot meet in person. Students cannot request an online exam if this class is permitted to meet face-to-face.
- **Miscellaneous Grading Policies:**
 - If your average exam score (including the Final) is in the F range (below 63%), then your course grade is F.
 - If your average exam score (including the Final) is in the D to D+ range (63-69.9%), then your highest possible course grade is D+.
 - Extra credit will not be offered to individual students regardless of personal circumstances.

- Requests for “grade bumps” at the end of the semester will not be entertained. To maintain fairness and equity in evaluating course performance, individual exceptions to the grading policy will not be made regardless of personal circumstances.
- Requests for review of homework, quiz, or exam grades must be made within one week of the graded item’s return.
- Requests for extensions of any course-related deadlines due to COVID-related issues will be evaluated on a case-by-case basis. Due to the amount of material that needs to be covered and the cumulative basis of the course content, students who need to be absent for multiple weeks due to personal circumstances should consider withdrawing from the course.

• **Breakdown of Final Grade Components:**

Graded Items	Percentage Weight
Homework and quizzes (HQ)	10%
PID Controller Design Project (P)	20%
Exam #1 (E1)	22.5%
Exam #2 (E2)	22.5%
Final Exam (F)	25%

- Formula used to calculate final score:

$$\left(\frac{HQ, received}{HQ, possible} * 0.1 + \frac{P, received}{P, possible} * 0.20 + \frac{E1, received}{E1, possible} * 0.225 + \frac{E2, received}{E2, possible} * 0.225 + \frac{F, received}{F, possible} * 0.25 \right) * 100\%$$

- Mapping of final score to final course grade:

Final Score (%)	Letter Grade
92-100	A
90-91.9	A-
87-89.9	B+
82-86.9	B
80-81.9	B-
77-79.9	C+
72-76.9	C
70-71.9	C-
67-69.9	D+
63-66.9	D
<63	F

- **Academic Integrity Policy:**
 - **Communication during exams between students or with other persons regarding exam-related matters is strictly prohibited. All students are expected to complete exams on their own without any outside assistance from friends, classmates, online tutoring services such as Chegg and CourseHero, etc. Online postings of exam questions to obtain solutions will be thoroughly investigated.**
 - **Any work (homework, exam, project submission) submitted for grading that involves academic dishonesty will receive a negative score equal to the weight of the work (-100%).**
 - No homework/quiz scores will be dropped for any student who commits academic dishonesty in this course at any time during the semester.
- Second offenses of academic dishonesty during the semester will result in a course grade of F.
- Examples of academic dishonesty include, but are not limited to:
 - Photocopying/scanning homework solutions obtained from another student or an online source and submitting them as your own work.
 - Communication regarding exam-related matters during exams between students and/or persons outside the classroom.
 - Uploading exam questions to websites or tutoring services to obtain solutions.
 - Sharing of any and all project materials between students.
- AI writing tools are not permitted for any stage or phase of work in this class. If you use these tools, your actions will be considered academically dishonest, and a violation of [Chico State's Integrity Policy](#) and you may be reported to the [Office of Students Rights and Responsibilities](#).

University Policies and Campus Resources

Academic Integrity

Students are expected to be familiar with the University's Academic Integrity Policy. Your own commitment to learning, as evidenced by your enrollment at California State University, Chico, and the University's Academic Integrity Policy require you to be honest in all your academic course work. **Faculty members are required to report all infractions to the Office of Student Conduct, Rights, and Responsibilities.** The policy on academic integrity and other resources related to student conduct can be found on the [Student Conduct, Rights, and Responsibilities website](#).

IT Support Services

Computer labs for student use are located on the first and fourth floor of the Meriam Library, Room 116 and 450, Tehama Hall Room 131, and the Bell Memorial Union

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(BMU) basement. You can get help using your computer from IT Support Services; contact them through the [ITSS web site](#). Additional labs may be available to students in your department or college.

Student Services

Student services are designed to assist students in the development of their full academic potential and to motivate them to become self-directed learners. Students can find support for services such as skills assessment, individual or group tutorials, subject advising, learning assistance, summer academic preparation and basic skills development. Student services information can be found on the [Current Students page of the CSU Chico web site](#).

Americans with Disabilities Act

If you need course adaptations or accommodations because of a disability or chronic illness, or if you need to make special arrangements in case the building must be evacuated, please make an appointment with me as soon as possible, or see me during office hours. Please also contact Accessibility Resource Center (ARC) as they are the designated department responsible for approving and coordinating reasonable accommodations and services for students with disabilities. ARC will help you understand your rights and responsibilities under the Americans with Disabilities Act and provide you further assistance with requesting and arranging accommodations.

[Accessibility Resource Center](#)

530-898-5959

Student Services Center 170

arcdept@csuchico.edu

Student Learning Center

The mission of the Student Learning Center (SLC) is to provide services that will assist CSU, Chico students to become independent learners. The SLC prepares and supports students in their college course work by offering a variety of programs and resources to meet student needs. The SLC facilitates the academic transition and retention of students from high schools and community colleges by providing study strategy information, content subject tutoring, and supplemental instruction. The University Writing Center has been combined with the Student Learning Center. You can also visit the [Student Learning Center web site](#).

Canvas ALLY

Chico State is committed to providing you the best learning experience possible. With this goal we have activated Canvas ALLY in your courses. ALLY is a revolutionary product that focuses on making digital course content more accessible to all students. You will now be able to download any content in this course in the format that fits best with your learning style. PDF, HTML, .EPUB and Audio files are now available for most content items. Here is a link to more [information on formats available](#) as well as what each format offers. Should you have any questions or

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experience issues while using ALLY please contact the Office of Accessible Technology and Services at oats@csuchico.edu or 530-898-6532.

COVID-19 Face Mask Requirement

Reminder: The CSU requires students to be fully vaccinated against COVID-19 by September 30, 2021, unless you have an approved exemption. Currently, Chico State does not require everyone to wear an approved face covering in all indoor campus spaces. However, students are free to wear an appropriate face mask covering the nose and mouth if they choose and agree to follow University COVID-19 policies. Policies and requirements regarding COVID-19 are subject to change pursuant to campus, local, state and/or federal guidelines.

Please note that dishonesty relating to the vaccination policy and/or your failure to comply with any other COVID-19 related safety policy or mandate, including the face covering requirement, may result in disciplinary action against you through the office of Student Conduct, Rights and Responsibilities, which can include suspension or expulsion from the California State University system.

Individuals unable to wear a face covering due to a medical condition should contact the Accessibility Resource Center by phone at (530) 898-5959 or by email at arcdept@csuchico.edu.

Transition to Online Instruction

The course instructor reserves the right to modify any portion of the course syllabus in the event pandemic conditions warrant a return to an online instruction format.