



Syllabus for ME210-01: Linear Controls

Spring 2019

Instructor: Brandon Stark

Designation:	Lower division graduate course and senior level undergraduate technical elective
Catalog Description:	Dynamics of Linear Systems, Concepts of Stability, Feedback Control, Root Locus Design, Frequency-Domain Analysis and Compensator Design, State-Space Representation, Controllability and Observability, Linear Observers, Matrix Methods for Control Design, Linear Quadratic Regulator (LQR) Optimal Control
Text Books and Other Required Materials:	Feedback Control of Dynamic Systems (7th edition) by G.F. Franklin, J.D. Powell and A. Emami-Naeini, Pearson (2014).
Course Objectives/ Student Learning Outcomes:	After successful completion of this class, students will be able to:

Apply advanced skills to analyze dynamics of linear systems
Apply the knowledge of matrix theory to analyze linear systems and to design linear controls for regulating the dynamics of the system
Gain a thorough understanding of the theory of feedback controls and stability
Apply methods of control design including root locus, frequency domain, state space designs
Understand the concepts of controllability and observability
Apply the concepts of optimization to design optimal controls
Apply control theories, control methods, and critical thinking skills to control problems of engineering systems

Students will practice and demonstrate these abilities in homework exercises and control design projects. They will demonstrate their proficiency formally in the midterm and final examinations.

Program Learning Outcomes:

Prerequisites by Topic: Calculus, Ordinary Differential Equations, Complex Analysis, Linear Algebra, Matrix Theory, Vibration, and Dynamics.

Course Policies: Be on time to class. Tardiness is discouraged. No late assignments will be accepted. Medical or family emergency will be considered on case-by-case basis. In the event that CATCOURSES is down within 24 hours of an assignment deadline, the deadline will be extended by 24 hours after service is restored. All homework assignments must be submitted to CATCOURSES. Do not email assignments to instructor or TAs. No make-up exams. If you miss an exam a zero score will be assigned to the missed exam. No electronic devices other than a calculator will be allowed for the exams. If you miss a class due to personal emergency or medical reasons, please be sure to inform the instructor by e-mail in advance. Homework assignments are to be submitted by the due date/time. You may discuss homework questions with your classmates, but you are responsible for

Designation:	Lower division graduate course and senior level undergraduate technical elective your own work. After an assignment grade has been posted online, students must see the instructor within one week if they wish to discuss the assignment and their work. University's rules on academic honesty concerning exams and individual assignments will be strictly enforced. See UC Conduct Standards: http://studentlife.campuscms.ucmerced.edu/content/uc-conduct-standards		
Academic Dishonesty Statement:	<p>a. Each student in this course is expected to abide by the University of California, Merced's Academic Honesty Policy. Any work submitted by a student in this course for academic credit will be the student's own work.</p> <p>b. You are encouraged to study together and to discuss information and concepts covered in lecture and the sections with other students. You can give "consulting" help to or receive "consulting" help from such students. However, this permissible cooperation should never involve one student having possession of a copy of all or part of work done by someone else, in the form of an e mail, an e mail attachment file, a diskette, or a hard copy. Should copying occur, both the student who copied work from another student and the student who gave material to be copied will both automatically receive a zero for the assignment. Penalty for violation of this Policy can also be extended to include failure of the course and University disciplinary action.</p> <p>c. During examinations, you must do your own work. Talking or discussion is not permitted during the examinations, nor may you compare papers, copy from others, or collaborate in any way. Any collaborative behavior during the examinations will result in failure of the exam, and may lead to failure of the course and University disciplinary action.</p>		
Disability Statement:	Accommodations for Students with Disabilities: The University of California Merced is committed to ensuring equal academic opportunities and inclusion for students with disabilities based on the principles of independent living, accessible universal design and diversity. I am available to discuss appropriate academic accommodations that may be required for student with disabilities. Requests for academic accommodations are to be made during the first three weeks of the semester, except for unusual circumstances. Students are encouraged to register with Disability Services Center to verify their eligibility for appropriate accommodations.		
Topics:	Review of mathematical foundation for analysis of dynamics of linear systems. Concepts of stability, the Laplace domain description of stability, Nyquist stability Feedback controls for linear systems, compensators, frequency domain analysis State space representation of dynamic systems, controllability, observability, pole placement, and linear quadratic regulator (LQR) optimal control		
Class/laboratory Schedule:	Lect: T/Th 3:00-4:15		
Midterm/Final Exam Schedule:	Midterm 1 Exam	3:00pm, March 21, 2019	
	Midterm 2 Exam	3:00pm, May 7, 2019	
	Final Project Due	6:30pm, May 13, 2019	
Course Calendar:			
Professional Component:	Engineering practice of vibration analysis, stability analysis, feedback control design and optimal control of linear dynamic systems.		
Assessment/Grading Policy:	This is a co-listed graduate course ME 210 and undergraduate course ME 141 with the same title. Undergraduate students will be given different homework assignments and tests from those for graduate students. Graduate students will do one or two more difficult problems for all the homework assignments and examinations. All the students will attend the same lectures and control demonstrations.		

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Coordinator:

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Wednesday - 11am-2pm