Course Syllabus

ME 132: *Dynamic Systems and Feedback*

Spring 2018

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Course Description

ME 132 is an introductory course on dynamic system and feedback for undergraduate students in Engineering and Science majors, and maybe more. The principal goal of the course is to introduce basic concept of feedback control systems, as well as the mathematical tools for system analysis and controller design.

Course Format

ME 132 consists of classroom lectures, weekly homework assignments, 2 midterm exams, a final exam, computer/Lego laboratory sections and (some) online quizzes. Faculty instructor delivers lectures, while graduate student instructors (GSI) supervise laboratory sections.

I. CLASS/LABORATORY SCHEDULE

Three hours of lectures and one hour of laboratory per week.

Lectures: Mon/Wed/Fri, 9:00AM-10:00AM, 2060 Valley Life Sciences Building

Laboratory sections: (**beginning on Tuesday, Jan. 23**)

Lab 101: **Tuesday**, 9:00-10:00AM, 1171 Etcheverry

Lab 102: **Wednesday**, 5:00-6:00PM, Jacobs Hall 10 (1171 Etcheverry)

Lab 103: **Thursday**, 11:00AM-Noon, Jacobs Hall 10 (1171 Etcheverry)

II. ASSIGNMENTS

(1) Homework

Homework will be posted on bCourses on Fridays and due at **5:00 pm sharp the following Friday**. No late homework will be accepted. Two lowest HW set scores will be dropped.

Homework will be due as a pdf to be submitted on bCourses. Homework solutions will be posted on bCourses after the due date. Graded homework will be returned in the next week.

(2) Laboratory Assignments

There will be laboratory assignments every week. Ideally, you will finish the lab assignment while attending the lab (Tuesday - Thursday). All reports must be submitted to bCourses no later than **5:00 pm on the following Monday**. Late reports will not be accepted under any circumstances, so make sure to upload your assignments on time. Leave a few minutes of extra time to avoid any problems caused by heavy internet traffic.

(3) Online Quizzes

There will be occasional online quizzes at bCourses after each lecture. All quizzes associated with a specific lecture must be completed before the next lecture, unless otherwise specified. **You will be able to take each quiz as many times as you like and only your best score will be recorded**. Hence there is no reason to get less than 100% on all quizzes.

II. MIDTERMS AND FINAL EXAM

Closed book, but sheets of notes are allowed, as described below

Midterm 1: Wednesday, February 21, 9-10AM (in class). One sheet of handwritten notes allowed (both sides), plus calculator.

Midterm 2: Monday, April 9, 9-10AM (in class). Two sheets of handwritten notes allowed (both sides), plus calculator.

Final: TBD. Three sheets of handwritten notes allowed (both sides), plus calculator.

If you are on a sports team, or in the band, or represent the university in a similar manner, and will not be available on these times, let me know as soon as possible, and we will make appropriate scheduling arrangements.

IV. PIAZZA

The course discussion forum Piazza is integrated into bCourses (see the left sidebar). The instruction team will monitor and contribute to this forum, and you are encouraged to use it to seek help from the instructors and your peers. You are also encouraged to contribute not only questions, but also answers to questions that you are comfortable with. Everyone should be automatically signed up.

Course Text and Requirements

There is no required text for the course. We will use PowerPoint slides and extensive notes. These resources will be available on bCourses.

There is a good book, "Feedback Systems", by Karl Astrom and Richard Murray that we will refer to. You can purchase the book, or obtain a pdf-version free-of-charge. Check the wiki for more information: http://www.cds.caltech.edu/~murray/amwiki/index.php/Main_Page (Links to an external site.)Links to an external site.

In ME132, you are going to use Matlab, as well as learning how to use Simulink and the Control System Toolbox, and program the Lego EV3 Mindstorm system using the robotC language. The ME132 Computer Laboratory (1171 Etcheverry) provides computers with Matlab/Simulink and all relevant toolboxes, as well as robotC. We highly recommend that you install Matlab on your personal computer, using the license available to all UC Berkeley registered students, which can be obtained at https://software.berkeley.edu/

Academic Honesty

It is acceptable to discuss with your classmates the material contained in the homework assignments, online-quizzes and laboratory assignments. **However, we require that your submissions represent your own work.** Copying someone else's work or allowing your work to be copied constitutes cheating, and will result in zero credit for the entire assignment. In addition, Berkeley students who are found to cheat in assignments or exams will be referred to Student Judicial Affairs. For details, see the website of the Berkeley Center for Student Conduct.

Honor Code
The student community at UC Berkeley has adopted the following Honor Code: "**As a member of the UC Berkeley community, I act with honesty, integrity, and respect for others.**" Your MechE 132 instructors join you in pledging to adhere to this code.

Grades and Grading

The course grade will be assigned based on the following percentages:

- 30% Homework
- 10% Laboratory Assignments
- 3% Online Quizzes (via bCourses)
- 15% Midterm 1 (Feb 21)
- 17% Midterm 2 (Apr 9)
- 25% Final (TBD)

If you find any discrepancies between the issued grades and the grades posted on bCourses, please bring them to the attention of GSI immediately. In general, the course is curved, to College and Department guidelines.

Tentative Course Schedule

Date	Day	Topic	Lab	Due
January				
15	Mon.	NO CLASS - Martin Luther King Day		
17	Wed.	Feedback Systems: Introduction		
19	Fri.	Feedback Systems: Introduction		
22	Mon.	Feedback Systems: Introduction	Lab 1: Function handles, ODEs, simulations	
24	Wed.	Mathematics of First-Order Systems		
26	Fri.	Mathematics of First-Order Systems		HW1
29	Mon.	Mathematics of First-Order Systems	Lab 2: Introduction to Simulink	
31	Wed.	Mathematics of First-Order Systems		
February				
2	Fri.	Mathematics of First-Order Systems		HW2
5	Mon.	Analysis of First-Order Systems	Lab 3: Subsystems and Masks in Simulink	
7	Wed.	Analysis of First-Order Systems		
9	Fri.	Analysis of First-Order Systems		HW3
12	Mon.	Analysis of First-Order Systems	Lab 4: Synthetic Motor Identification	
14	Wed.	Analysis of First-Order Systems		
16	Fri.	Review		HW4
19	Mon.	NO CLASS		
21	Wed.	MidTerm I		**Exam**
23	Fri.	Linear Algebra		
26	Mon.	Linear Algebra	Lab 5: (virtual) Proportional Control	
28	Wed.	Linear Algebra		
March				
2	Fri.	Linear Algebra	of Motor Speed	HW5
5	Mon.	Linear Algebra	Lab 6: Introduction to RobotC	
7	Wed.	Eigenvalues/Eigenvectors and Frequency Response		
9	Fri.	Eigenvalues/Eigenvectors and Frequency Response		HW6
12	Mon.	Eigenvalues/Eigenvectors and Frequency Response	Lab 7: Writing Data and Implementing Proportional Control	
14	Wed.	Eigenvalues/Eigenvectors and Frequency Response		
16	Fri.	Feedback Design: 2nd-order (and larger) closed-loop systems		HW7
19	Mon.	Feedback Design: 2nd-order (and larger) closed-loop systems	Lab 8: PI Control of	

21	Wed.	Feedback Design: 2nd-order (and larger) closed-loop systems	Motor Speed	
23	Fri.	Feedback Design: 2nd-order (and larger) closed-loop systems		
26	Mon.	NO CLASS – Spring Break		
28	Wed.	NO CLASS – Spring Break		
30	Fri.	NO CLASS – Spring Break		
April				
2	Mon.	Feedback Design: 2nd-order (and larger) closed-loop systems	Lab 9: PI Control of Motor Speed	
4	Wed.	Review / Buffer		
6	Fri.	Review		HW8
9	Mon.	MidTerm II	Lab 10: Antiwindup	**Exam**
11	Wed.	Transfer Function and LDO representations		
13	Fri.	Transfer Function and LDO representations		
16	Mon.	Transfer Function and LDO representations	Lab 11: Integral Control with State-	
18	Wed.	Bode Plots		
20	Fri.	System Approximations	Feedback	HW9
23	Mon.	Pole-Placement: Single-Input/Single-Output Systems	Lab 12: Frequency-Response Identification	
25	Wed.	Gain and Time-Delay Margins		
27	Fri.	Gain and Time-Delay Margins		HW10
30	Mon.	Review Week		
May				
2	Wed.	Review Week		
4	Fri.	Review Week		HW11