

ChEE 413 Syllabus

Prerequisites

ChEE 301A, 301B, 401A (unit operations laboratories), 402 (ODEs, PDEs, Laplace transforms) and 420 (chemical reaction engineering) and familiarity with MATLAB.

Course Objectives

The purpose of this course is to build dynamic models for chemical processes and use the models to develop control systems. Successful completion of this course will allow you to:

1. Develop working knowledge of process control hardware such as valves, thermocouples, pumps, and microcontrollers.
2. Represent dynamic chemical and physical processes by differential equations.
3. Solve systems of differential equations by Laplace transform and numerical methods.
4. Use MATLAB and SIMULINK computational tools to analyze and simulate control systems.
5. Recast a dynamic system using a series of transfer functions in a block diagram.
6. Gain command of the terminology used in chemical process control.
7. Tune a single loop PID controller.
8. Design and troubleshoot control loops based on stability criteria and empirical techniques.
9. Understand how process dynamics affect control.

Instructor

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Office Hours: Tu 1-2 pm	

Teaching Assistants

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Course Times

Lecture MWF 2:00-2:50 am	BLOW (Bio Sciences West) 301
Laboratory Tu or Th 3:30-5:20 pm	Chavez 104 and Harshbarger unit operations lab

Textbook

Process Dynamics and Control, 3rd edition, Wiley (2010) by D. E. Seborg, T. Edgar, D. A. Mellichamp, F. J. Doyle, ISBN 978-0-470-12867-1.

Problem Solving Environment

MATLAB versions 2013-2015a or b; UA software licensing, visit <http://softwarelicense.arizona.edu/mathworks-matlab> to load the program on your personal computer using your UA NetID. MATLAB is installed on the engineering computer clusters, including Harshbarger room 10. Please check that SIMULINK is installed; type `simulink` at the MATLAB command line and SIMULINK should load.

Course Grade

Quizzes (complete before coming to class)	10%
Problem sets	10%
Laboratory assignments and final report*	15%
Exam 1 (Friday, February 19)	20%
Exam 2 (Wednesday, April 6)	20%
Final Exam (Friday, May 6, 1:00 pm-3:00 pm)	25%

*There is an individual component to the grade.

What to Bring to Class

You will sit with three people at a table in class solving problems and discussing the results. You need a device to access D2L, some means of doing simple calculations (a cell phone calculator should suffice most of the time), a paper notebook, and from time to time a laptop computer. The lecture slides will be posted on D2L. It is helpful to be able to access slides from past classes when solving problems. A cell phone should be sufficient. Although you will not be taking notes during lecture and there is a small whiteboard and markers at each table, it is helpful to have a paper notebook to sketch out ideas and work problems as well as return to after class to finish a problem. I will let you know when to bring your laptop computer to class. For example, we will spend a couple of classes reviewing MATLAB and learning how to use SIMULINK. Please bring your laptop computers to lab when directed to by Lauren and Jimmy.

Homework Guidelines

Homework will be assigned weekly, typically on Friday and is due the following Friday. Do all analysis and make plots with MATLAB. Please do not use EXCEL, nor WOLFRAM ALPHA. Clearly document all parameters and variables within a MATLAB script or function using comment statements. Use the `publish` command to output your script and the numerical solution in several different formats such as html. In technical writing, clarity and brevity are valued. Provide sufficient detail that an educated reader can follow your method and strive to write concisely.

Course Policies

Homework assignments are due at the beginning of class on the date specified on the problem set. Submit the homework at your table to allow for easy return. No late homework will be accepted unless prior permission is obtained from the instructor. Medical conditions and other circumstances beyond your control will be considered on an individual basis. Interview trips, conferences, and other scheduled activities are within your control. You are encouraged to discuss problem sets with classmates, but everyone must submit their own work. Do not copy someone else's work or submit joint work. This behavior defeats the purpose of the class and will result in a score of 0 for everyone involved.

Copying on exams will result in a score of 0 for everyone involved, including the person or group supplying the information.

Academic Integrity

This class encourages and requires collaboration, but individual work assignments will be given that are designed with a specific purpose in mind. Individual assignments will be clearly identified or are standard in the case of the final exam. Do not copy someone else's work. Do not work jointly on individual assignments. This behavior defeats part of the rationale of the class and will result in a score of 0 for everyone involved. UA policies can be found at <http://deanofstudents.arizona.edu/codeofacademicintegrity>.

Accessibility and Accommodations

It is the University's goal that learning experiences be as accessible as possible. If you anticipate or experience physical or academic barriers based on disability, please let me know immediately so that we can discuss options. You are also welcome to contact Disability Resources (520-621-3268) to establish reasonable accommodations.

Absence policies

All holidays or special events observed by organized religions will be honored for those students who show affiliation with that particular religion.

Absences pre-approved by the UA Dean of Students (or Deans designee) will be honored.

Policy on Threatening Behavior

The University seeks to promote a safe environment where students and employees may participate in the educational process without compromising their health, safety or welfare. UA policies can be found at: <http://policy.web.arizona.edu/education-and-student-affairs/threatening-behavior-students>.