

CBEMS 135 CHEMICAL PROCESS CONTROL
(Required for ChE)

- Catalog Data:** **CBEMS 135 Chemical Process Control (Credit Units: 4)**
Dynamic responses and control of chemical process equipment, dynamic modeling of chemical processes, linear systems analysis, analyses and design of feedback loops and advanced control systems.
Prerequisites: CBEMS110, CBEMS120B. (Design units: 1)
- Textbook:** Pao C. Chau, Process Control, A First Course with MATLAB, Cambridge Press, 2007
- References:**
- Coordinator:** Henry C. Lim
- Course Objectives:** To design and control chemical processes, a chemical engineer must understand the principles of various controllers. This course is an introduction to the basic concepts in chemical process control. The course builds on concepts from heat and mass transfer, reaction engineering, separation processes, as well as calculus and differential equations.
- Course Outcomes:** Students will:
Write dynamic mass and energy balances.
Derive a process transfer function by writing balance equations.
Be familiar with the experimental procedures to develop a process transfer function.
Be familiar with the frequency response technique.
Construct a block diagram for feedback control system.
Check stability of process control system.
Be familiar with the controller tuning procedure of Ziegler-Nichols and Cohen & Coons.
Develop advanced control systems, including cascade, feedforward-feedback, and ratio control.
Tune various control loops.
- Prerequisites by Topics:** Chemical engineering calculations, Mass and energy balances, Momentum transfer, Heat and Mass Transfer, Reaction Engineering, Differential equations, Computer literacy and basic skills (Fortran, Matlab, C++, Basic, etc).
- Lecture Topics:** Linear System Dynamics, Block Diagrams, Feedback Control, Process Identification, Stability (Routh Criterion, Root Locus, Bode, Nyquist), PID Controllers and Tuning (Ziegler-Nichols, Cohen & Coon), Cascade Control, Feedforward and Ratio Control, Multivariable Control, Time delay Compensation, Model-based Control, Discrete time systems.
- Class Schedule:** Meets for 4 hours of lecture each week for 10 weeks.
- Computer Usage:** Computer literacy and basic skills (Fortran, Matlab, C++, Basic, etc) are

required for solving ordinary linear differential equation for PID controller design.

Laboratory Projects:

Professional Component: This course is designed to contribute to the students' knowledge of engineering topics. The following considerations are included in this course: economic, environmental.

Relationship to Program Outcomes: This course relates to Program Outcomes a, c, e, k, and m as stated at: <http://undergraduate.eng.uci.edu/degreeprograms/chemical/mission>

Design Content Description:

Approach: Two lectures on controller design and a computer project

Lecturer: 100%

Laboratory Portion: 0%

Grading Criteria:	Homework:	30 %
	Exam #1:	35 %
	Exam #2:	<u>35 %</u>
		100%

To obtain the highest grade (A), all the homework should be attempted and submitted on time. In general, exams cannot be made up and no late homework sets will be accepted.

Estimated ABET Category Content:

Mathematics and Basic Science: 0 credit units or 0%

Engineering Science: 3 credit units or 75%

Engineering Design: 1 credit units or 25%

Prepared by: Henry C. Lim **Date:** July 2007

CEP Approved: Fall 2001