CHME-4030 Prof. B.W. Bequette
Spring 2005 16 Jan 05

Chemical Process Dynamics and Control

Days and Room

TuWF 12:00 - 1:50 pm Troy 2012

Office Hours and email addresses

			Time and Location
Instructor:	B. Wayne Bequette	bequette@rpi.edu	Tu, W 11-12, Ri 129
Teaching Assistant:	Matthew Kuure-Kinsey	kuurem@rpi.edu	Tu 7-9, Ri 201A
Student Assistants:	Sonya Mazumdar & Joel Schlosburg		

Questions outside of office or class hours should generally be by email. Also, a WebCT bulletin board will be used to answer commonly asked questions.

Course Objective

The purpose of this course is to introduce undergraduate students to the theory and practice of chemical process modeling and control. The emphasis is on a model-based approach to control system design. The SIMULINK simulation package (based on MATLAB) will be used for dynamic process simulation and control system development. Many of the homework assignments will require computer-based simulations.

Courses at Rensselaer are generally expected to require 2-3 hours of outside work for each credit hour. *You should expect, therefore, to put in roughly 8-12 hours/week outside the classroom.*

The course is taught in a *studio format*, combining lectures, discussions and computer-based simulations in a single laptop-based classroom. To install MATLAB on your laptop, please follow the instructions posted at:

http://www.rpi.edu/dept/cis/software/matlab/public_html/Install.html

Required Text

Bequette, B.W., Process Control: Modeling, Design and Simulation, Prentice Hall (2003)

Homework Assignments

The majority of the computer homework assignments will be performed in 2-person groups; please select your partner carefully, because you will be together throughout the semester. All groups must be finalized by Tuesday, 25 Jan 05. In most circumstances, each individual grade will be the same as the group grade. Each group member will be asked to evaluate the other member of the group, at the end of the semester. Although an assignment is performed by the group, each individual is responsible for all of the material covered by the assignment. Homework is due at the beginning of class. Late homework, including homework turned in during or after class will be accepted, with a penalty of 20% for each day late.

Groups may discuss the problems with other groups, but are not allowed to share solutions (MATLAB m-files, etc.). Violations will be handled in accordance with the student handbook.

Quizzes

Quizzes are generally during Friday class periods. A single crib sheet, in your own handwriting and not photo-reduced, will be allowed. The crib sheet must be turned-in with the quiz solution. *There will be no make-up quizzes without a written excuse from the health center or the dean of students*. Homeworks and quizzes will be returned in class, or in the Coonley Lounge.

Course Grade

The course grade will be determined using the following:

Homework	20%
Case Study Project	10%
Quizzes	45%
Final Exam	25%
Total	100%

Class participation will be considered for borderline grades. Students may be called upon for discussion questions.

Grade Appeals

A student may appeal a grade by attaching a memo (to Mr. Kuure-Kinsey) to the specific exam or homework assignment that is being appealed. This memo must state the specific reason(s) for the regrade. The student has *one* week after the grades have been assigned to contest the grade.

Case Study Project

During the last half of this course, you will work in teams on a case study project that you select from a choice of five processes (to be determined). Each project includes many phases typically associated with a control design project: literature review, model development and process identification, control structure selection and controller tuning for SISO systems, multiple SISO loop tuning. This will give you a chance to "tie it all together", and give you the opportunity to demonstrate your written and oral communication skills. Details will be provided before spring break.

Course Web Page

WebCT (http://webct.rpi.edu) will be used to manage the course web pages. Details will be provided during the first week of the course. Updated lecture, homework and quiz information will be placed on the course web page.

Tentative Lecture/Exam Schedule

Week		Tuesday	Wednesday	Friday
1	18 Jan – 21 Jan	Class	Class	Class
2	24 Jan – 28 Jan	Class	Class	Class
3	31 Jan – 04 Feb	Class	Class	Recitation
4	07 Feb – 11 Feb	Class	Class	*Quiz 1*
5	14 Feb – 18 Feb	Class	Class	Recitation
6	21 Feb – 25 Feb	No class	Class	Class
7	28 Feb – 04 Mar	Class	Class	Class
8	07 Mar – 11 Mar	Class	*Quiz 2*	No class
	14 Mar – 18 Mar	Spring Break	Spring Break	Spring Break
9	21 Mar – 25 Mar	Class	Class	Recitation
10	28 Mar – 01 Apr	Class	Class	Recitation
11	04 Apr – 08 Apr	Class	No Class (GM week)	Class
12	11 Apr – 15 Apr	Class	Class	*Quiz 3*
13	18 Apr – 22 Apr	Class	Class	Recitation
14	25 Apr – 29 Apr	Class	Class	Recitation
15	02 May – 06 May	Class	Class	No class: reading day
	09 May – 13 May	Final Exams	Final Exams	Final Exams

Week	**Tentative** Material Covered:
1	Incentives for process control, fundamental models, introduction to MATLAB. Chapters 1 and 2. Module 1.
2	State space models, transfer functions, empirical models. Chapters 3 and 4. Modules 2 and 4.
3	Introduction to feedback control – Chapter 5. Module 5.
4	PID controller tuning – Chapter 6. Module 5.
5	Frequency response - Chapter 7. Module 6.
6	Internal Model Control (IMC) - Chapter 8. Module 5.
7	IMC-based PID - Chapter 9. Modules 6 and 7.
8	Cascade control. Chapter 10. Module 9.
	Spring Break
9	Feedforward, PID enhancements. Chapter 11. Module 10.
10	Split-range, selective and over-ride strategies. Chapter 12. Module 11. Project (Module 14) – Literature review
11	Control loop interaction, multivariable control. Chapters 13 and 14. Project (Module 14) – Model Development.
12	Multivariable control, plantwide control. Chapters 14 and 15. Project (Module 14) – SISO controller design.
13	Model predictive control (MPC). Project (Module 14) – MV-SISO controller design.
14	Digital control. Module 16. Project (Module 14) – Advanced options.
15	Course Review. Project (Module 14) – oral presentations and written reports.