CHEN403 (b) – Process Dynamics & Control

Spring Semester 2009

Instructor:	John Jechura
Class Hours:	M W 5:00 – 6:15 (AH 340)
Office Hours:	By appointment
Web Site:	http://home.comcast.net/~jjechura/CHEN403/
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Text

Process Dynamics & Control, 2nd ed.
Dale E. Seborg, Thomas F. Edgar, & Duncan A. Mellichamp
John Wiley & Sons, 2004

Supplemental Texts

Chemical and Bio-Process Control, 3rd Edition
James B. Riggs and M. Nazmul Karim
Ferret Publishing, 2006
http://www.che.ttu.edu/pcoc/software (VBA Simulator – Intro.ppt; Visual Basic Simulators.xls)

Principles and Practice of Automatic Process Control, 3rd ed.
Carlos A. Smith & Armando B. Corripio
John Wiley & Sons, 2006

Process Control – Modeling, Design, & Simulation
B. Wayne Bequette
Prentice Hall, 2003

Problem Solving in Chemical Engineering with Numerical Methods
Michael B. Cutlip & Mordechai Shacham
Prentice Hall, 1999

Course Objective

This course is intended to provide the student with an introduction to the theory of chemical process dynamics and the practice of process control. Emphasis will be placed on:

- Development of mathematical models of chemical processes.
- Techniques used to analyze the dynamic behavior of a chemical and biochemical processes.
- Traditional SISO (single input, single output) control schemes and how they can affect the dynamics of a chemical process.
- Analysis, design, and tuning of feedback control systems.

Upon successful completion of CHEN 403 the student should be able to:

- Derive process models involving unsteady state mass and heat balances.
- Linearize differential equations using Taylor series approximations.
- Solve systems of linear ordinary differential equations using Laplace transforms.
- Define the transfer function for a system.
- Understand the dynamics of first-, second-, and higher-order systems by quantitatively describing system response to inputs like step changes.

- Describe the concept of a feedback controller, perform stability analysis on a feedback system and quantitatively describe dynamic behavior of a feedback control system.
- Write the control law expression for a general Proportional Integral Derivative (PID) controller.
- Understand the advantages and disadvantages of using different types of controllers.
- Analyze process data to obtain parameters for the dynamic model.

Grading Policies

Homework	10%
Quizzes	20%
Final Project	10%
Mid-Term & Final Exams	(3 of 4) 20% each

Homework will be announced at least one week before it is due. Late homework will not be accepted. Homework assignments will be posted on the web site & announced in class. Format requirements for these assignments are as follows:

1. Start each problem on a new page.
2. Only write on one side of the paper.
3. Clearly indicate your answer in a box.
4. Staple all pages together. Paper clips and "dog-eared" corners are unacceptable.

Homework assignments may require the use of computer software such as *Excel, MATLAB, Mathematica, Mathcad*, *POLYMATH*, and/or *Athena*. If one of these systems is used, it should be clearly indicated on the homework assignment. If appropriate or requested, an electronic file may be submitted as a supplement to the written homework solution. Electronic files submitted to the instructor containing a virus will be immediately given a zero grade. Students should either have access to a PC or have a valid account on the system in the Chemical Engineering Coady Computer Laboratory (AH430).

There will be three mid-term exams & 1 cumulative final exam scheduled during the semester. Each of the exams will be worth the same fraction to the final grade. Only the top 3 grades will be used; the 4th (and lowest) will not be averaged into the grade. The mid-term exams will be scheduled in the evening along with Section A. If the student is not able to take the exam with the rest of the class, special arrangements must be requested before the scheduled time; the final agreement to do this is at the discretion of the instructor.

Quizzes will be 10 minutes in length and given at the beginning of the class. Quizzes will be unannounced. There will be no make-up quizzes. The student may be excused from the quiz at the discretion of the instructor. Excused absences will only be considered if the instructor receives an e-mail message stating the intended absence & reason before the class period with the quiz.

The exams will have closed-book and open-book sections; quizzes will be open-book and open-notes. The use of calculators is encouraged, but laptop computers will not be allowed. No in-class consulting will be allowed unless specifically noted. Sharing of other students' books, notes, and calculators constitutes "consulting" and will not be allowed.