Chemical Engineering 446
Process Control
Fall 2010

Course Description: Design and analysis of feedback control systems in chemical and natural systems. Topics include formulation of dynamic models, time and Laplace domain analysis of open-loop and closed-loop systems, and design of single variable and multivariable controllers.

Course Objectives: Upon completion of this course, students should:

1. Understand the importance of system dynamics and feedback control in Chemical Engineering.
2. Be able to develop fundamental and empirical models with time dependence.
3. Be able to analytically solve linear dynamic models and to use computer-based tools for dynamic model simulation.
4. Be able to analyze open-loop and closed-loop system properties such as stability and performance.
5. Be able to perform model-based design and tuning of PID controllers and other types of single variable controllers.
6. Be able to identify and solve multivariable control problems.
7. Be able to analyze and design feedback systems that arise in natural and engineered systems.
8. Develop good engineering practices for composing and solving problems, particularly open-ended problems requiring computer solutions.
9. Be prepared to use the principles and tools learned in this class to solve problems not covered in detail as part of this course and to continue learning related materials as needed in the future.

These objectives are intended to address the ABET outcomes of (a) Technical Knowledge, (c) Design, (e) Problem-Solving, (g) Communication, (h) Global/Societal Impact, (i) Life-Long Learning, (j) Contemporary Issues and (k) Applications.

Prerequisites: ChE 338 and ChE 361. Corequisites: ChE 444.

Class Times: Tuesdays and Thursdays, 9:30–10:45 am, 201 Lederle Graduate Research Tower (required); Fridays, 10:10–11:00 am, 201 Lederle Graduate Research Tower (as scheduled).

INSTRUCTOR: Prof. Michael A. Henson, 259A Goessmann Lab, henson@ecs.umass.edu. Office hours: TBA.

TEACHING ASSISTANTS: Tim Hanly, 112 ELab II, thanly@ecs.umass.edu. Office hours: Thursdays, 4-5 pm; Shashank Maindarkar, 155 Goessmann Lab, shashankmaindarkar@gmail.com. Office hours: Thursdays, 5-6 pm.

REQUIRED TEXT:

1. D. E. Seborg., T. F. Edgar, D. E. Mellichamp and F. J. Doyle III *Process Dynamics and Control*, 3rd edition, Wiley, New York, 2010.

REFERENCE BOOKS:

1. B. W. Bequette, *Process Control: Modeling, Design and Simulation*, Prentice-Hall, New Jersey, 2000.
2. T. E. Marlin, *Process Control: Designing Processes and Control Systems for Dynamic Performance*, 2nd ed., McGraw-Hill, New York, 2000.
3. B. A. Ogunnaike and W. H. Ray, *Process Dynamics, Modeling, and Control*, Oxford Press, New York, 1994.

GRADING: Your final score will be computed from the following contributions:

Homeworks – 25%
Midterm exams – 45%
Final exam – 30%

The grading scale will be established to achieve a fair grade distribution.

HOMEWORKS: Written homeworks will be assigned throughout the semester. Students are allowed to work together on homeworks, but each student must submit an independent solution. All assignments are due at the beginning of class one week after they are assigned. No late homeworks will be accepted. Solutions must be presented in a neat and clear manner. Students can complete and submit Matlab simulation homeworks as two member groups.

COURSE MATERIALS: Materials will be posted on the course webpage. The URL for the webpage is `www.ecs.umass.edu/che/che446`.

ATTENDANCE: You are expected to attend all required classes. The Student Handbook, Section VIII, outlines the procedures for dismissal from the course for non-attendance. Attendance in the lectures is very important. The lectures are used to present new information and provide background for the assignments. You are responsible for all of the material presented in lectures.

ACADEMIC HONESTY: Academic honesty is extremely important. You must be sure to do your own work and protect your work from plagiarism by others. Delete your files from the work space on the computer when you are leaving. If there is any evidence that the Academic Honesty Policy has been violated, you may be subject to severe penalties, ranging from receiving a grade of F for the course to dismissal from the University. If you fall behind in your work, it is better to accept a zero score for a particular assignment than to compromise your honesty. We are always willing to consider extenuating circumstances if you are in jeopardy.