

CH E 437 –MODELING AND CONTROL IN CHEMICAL ENGINEERING

Type (check one): Required: X Elective:

2005-2006 Catalog Data: CH E 437. MODELING AND CONTROL IN CHEMICAL ENGINEERING. Development of mathematical models for Chemical Engineering systems in terms of ordinary differential equations. Design of feedback control systems. Controller stability and tuning. A laboratory project demonstrating control principles may be included. Prerequisite: CH E 330. Offered in the Fall semester. *One semester; three credits.*

Prerequisites: CH E 330

Co-Requisites: none

Textbook: Riggs, James B., *Chemical Process Control* (2nd edition), Ferret Publishing, 2001.

Other Required Materials: Handouts by the instructor

Other References: Marlin, Thomas E., *Process Control* (2nd edition), McGraw-Hill, 2000.
Ogunnaike, B.A. and W.H. Ray, *Process Dynamics, Modeling and Control*, Oxford University Press, 1994.

Instructor: Dr. Randel M. Price, Associate Professor of Chemical Engineering

Course Objectives: At the end of this course, each student will be able to:

1. Describe the practical use and operation of control instrumentation, including controllers, actuators, and sensors.
2. Write differential equations and transfer function models for standard chemical process systems.
3. Qualitatively describe the behavior of dynamic processes and estimate process time constants.
4. Given a P&I diagram, set of equations, or block diagram, generate the others.
5. Describe the basic concepts of PID control and controller tuning.
6. Understand the stability of open- and closed-loop systems, including safety concerns.

Prerequisites by Topics: 1. Ordinary differential equations
2. Material and energy balances

Topics: 1. Introduction
2. Control loop hardware
3. Modeling using differential equations
4. Laplace transforms and transfer functions
5. Dynamic response of simple systems; performance specifications.
6. Process interconnection and dynamic response
7. Controller algorithms
8. Controller tuning

Class Schedule: Three 50-minute sessions per week (MWF 9:00-9:50 am)

Prepared by: Randel M. Price, Ph.D. **Date:** August 25, 2005

Professional Component:
CH E 437 – CHEMICAL PROCESS MODELING AND CONTROL

Category (check one)	<input type="checkbox"/> Math/Basic Science <input checked="" type="checkbox"/> Engineering <input type="checkbox"/> General Education <input type="checkbox"/> Other
Design (check one)	<input type="checkbox"/> Significant <input checked="" type="checkbox"/> Some <input type="checkbox"/> None
Realistic Constraints (check all that apply)	<input checked="" type="checkbox"/> Economic <input type="checkbox"/> Environmental <input type="checkbox"/> Sustainability <input checked="" type="checkbox"/> Manufacturability <input type="checkbox"/> Ethical <input checked="" type="checkbox"/> Health & Safety <input type="checkbox"/> Social <input type="checkbox"/> Political

Relationship to Program Outcomes:

Check all that apply:

- (a) an ability to apply knowledge of mathematics, science, and engineering
- (b) an ability to design and conduct experiments, as well as to analyze and interpret data
- (c) an ability to design a system, component, or process to meet desired needs
- (d) an ability to function on multi-disciplinary teams
- (e) an ability to identify, formulate, and solve engineering problems
- (f) an understanding of professional and ethical responsibility
- (g) an ability to communicate effectively
- (h) the broad education necessary to understand the impact of engineering solutions in a global and societal context
- (i) a recognition of the need for and an ability to engage in life-long learning
- (j) a knowledge of contemporary issues
- (k) an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice