ChE 3112 Introduction to Process Control
Required course for ChE program students

Catalog Description: Transient models of chemical processes and introduction to classical feedback control including tuning. P, PI, and PID controllers.

Prerequisites: ChE 2003, Math 3073.

Corequisites: n/a

Prerequisites by Topic: Steady state material and energy balances, differential equations including Laplace transforms (ChE 2003, Math 3073)

Recent Textbook: *Process Dynamics and Control, 2nd Edition*, by Seborg, Edgar and Mellichamp, Published by John Wiley & Sons, 2004.

Other Required Material: None

Course Objectives: By the end of this course the student will be able to:

1. Formulate differential equation models of chemical processes using transient material and energy balances.
2. Develop transfer functions from linear and nonlinear models of chemical processes.
3. Create block diagrams and P&IDs for a variety of chemical processes indicating placement and types of control systems for process equipment.
4. Analyze the dynamic response of chemical processes in both the time and Laplace domain.

Major Topics Covered in the Course: Transient mass and energy balances, Laplace transforms, linearization of differential equations, transfer functions, block diagrams, response of first order, second order and FOPDT systems to typical input changes, approximating models from step tests, modeling systems with SIMULINK, PID controllers, control valves, sensors/transmitters, feedback control loops, P&IDs, introduction to stability and tuning PID controllers.

Class/Laboratory Schedule: Two 50-minute lecture sessions per week for 14 weeks.

Professional Component Contribution: This is an engineering science/design course.

Relationship to Student Outcomes	
outcome:	**Description of related course content:**
(a) an ability to apply knowledge of mathematics, science and engineering	Students learn extend their knowledge of mass and energy balances to transient systems and learn the theory and basic equations of feedback control equipment.
(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 within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability	
(d) an ability to function on multi-disciplinary teams	
(e) an ability to identify, formulate, and solve engineering problems	Students were required to create models and simplify them in acceptable ways to meet required objectives. Exact and approximate solution techniques were used and the results analyzed.
(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, economic, environmental, 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	

Modified by: Christi L. Patton (May 3, 2007) according to the faculty meeting on 4/26/2007.

Modified by: Francis S. Manning, P.E. (May 10, 2008)
New course objectives from Spring 2009 added by G. L. Price
Modified by: Selen Cremaschi (April 5, 2010) Relationship to Program Outcomes updated according to course objectives approved on 9/16/2009.