NORTH CAROLINA STATE UNIVERSITY
Department of Forest Biomaterials – Paper Science and Engineering

Course: PSE 475, Process Control, 3 Credit hours, Fall 2011

Instructor: Dr. Richard A. Venditti, Office: Biltmore Hall Room 1204
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Classes: MW 1:30-2:20 PM, Biltmore Hall Room 2221
Labs: Tues. 130-320, or 335-525 PM, Biltmore Hall Room 1234
Problem Session: Friday, 1:30-2:20 PM, Biltmore Hall Room 2221
Exams: To be scheduled.

Prerequisite: Senior Standing

GER: none

Learning Outcomes:

After completing this class:

- The student will be able to apply the basic principles and methods of process control to develop control solutions pertinent to the chemical industries.
- The student will be able to model and characterize time-dependent processes using differential equations.
- The student will be able to use Laplace Transform methods to determine the time dependent behavior of these processes.
- The student will be able to predict the effects of controller tuning on the closed loop dynamic process behavior.
- The student will be able to design and tune feedback control, feedforward control, and advanced regulatory control loops.

The student will be able to characterize real chemical process based systems in the lab and then develop proper automated control systems to control the processes.

Required Instructional Materials for Class:
Chemical Process Control, 3rd Edition, by James B. Riggs and M. Nazmul Karim, Ferret Publishing, Lubbock TX, 2006. ISBN 0-9669601-4-9. Students will be required to bring text to first exam. Approximate Cost: about $125

PSE 475 Course Pack (2011), available at Sir Speedy, 2526 Hillsborough St. Cost, about: $30.

Process Simulator I. Available on the Web: www.che.ttu.edu/pcoc/software. See textbook for more details. Cost: free.

Four function calculator.

Course Overview.
This course describes the process to model dynamic chemical processing systems with linearized approximations. The tools to analyze the dynamic response of multiple sub-processes combined in complex systems are taught. The implementation, operation, and optimization of a single loop feedback control process are described. Advanced process control techniques such as cascade control, feedforward control and dead time compensation control are described. The course has a major laboratory portion in which students learn dynamic process modeling, the instruments and organization of such instruments in a feedback control loop, the operation of a feedback control process, and the optimization of a feedback control process.

Course Structure: Lectures on Mondays and Wednesdays. Tuesday afternoons will be lab sessions. Friday problem sessions will include course review, extra help, and homework review; the problem sessions are not mandatory. Exams will be scheduled in the evenings to provide 1.5 hours for the exam.

Course Topics:	**Lectures**
1. Introduction to Process Control	1
2. Control Loop Hardware	1
3. Dynamic Process Modeling	4
4. Laplace Transforms and Transfer Functions	3
5. Dynamic Behavior of Ideal Systems	4
6. PID Feedback Control	5
7. PID Feedback Controller Tuning	2
8. Cascade Control	1
9. Ratio and Feedforward Control	3
10. Deadtime Compensators	1
11. Control in the Pulp and Paper Industry	1
Tests	3
Total	29

Labs	**Sessions**
Lab Orientation – Safety	1
Dilution Control	2
Heat Exchanger Control	2
Tank Level Control	2
Sensor Calibration and Signal Connections in Control	2
Filters and Derivative Action	1
Self Tuning and Disturbance Rejection	1
Industrial Equipment Flow Loop Experiment	1
Industrial Plant Control	1
Hands-on Lab Exam	1
Total	14

Calendar: WPS 475 Fall 2011

Monday	Tuesday	Wednesday	Thursday	Friday
		Aug 17 Class		
Class	Lab 1 Introd	Class		Prob Session
Class	Lab 2	Class	Sept 1	Prob Session
Sept 5 Labor Day No Classes	Lab 3	Class		Prob Session
Class	Lab 4	Class		Prob Session
Class	Lab 5	Class		Prob Session
Class	Lab 6	Class		NO PROB SESSION
Oct 3 Class	NO LAB	NO CLASS	No Classes: Fall Break	
Class	Lab 7	Class		Prob Session
Class	Lab 8	Class		Prob Session
Class	Lab 9	Class		Prob Session
Class	Nov 1 Lab 10	Class		Prob Session
Class	Lab 11	Class		Prob Session
Class	Lab 12	Class		Prob Session
Class	Lab 13	Thanksgiving Break		
Class	Lab 14 Practicum	Class	Dec 1	Final Exam Rev.
Reading Days		Dec 7, Final Exam 1-4 PM		December 10
			December 15 FE end	

Grading:

Homework:	25 %	
Laboratory:	25 %	
Lab participation	5%	
Exams (3):	20 %	(dates and times to be announced, 4 function calc allowed)
Class Participation	5%	
Final Exam:	20 %	

- To pass the course, a final exam grade of greater than 65 is required.
- Class participation includes arriving on time for class, attendance in class, attentiveness in class, and asking questions/commenting during lectures about class material. Electronic devices are not allowed in the class. Pop quizzes. (You may ask at any time about your class participation grade.)
- Questions about HW or tests or labs will not be answered by the instructor or teaching assistant the day the assignment is due.
- Lab participation includes a peer review in concert with a comprehensive practicum evaluation
- **Assignments not turned in on time will receive a zero grade.** Exceptions may be made at the discretion of the instructor for emergencies.

Numerical Grade	Grade	Grade Points
97-100	A+	4 1/3
93-96.9	A	4
90-92.9	A-	3 2/3
87-89.9	B+	3 1/3
83-86.9	B	3
80-82.9	B-	2 2/3
77-79.9	C+	2 1/3
73-76.9	C	2
70-72.9	C-	1 2/3
68-69.9	D+	1 1/3
66-67.9	D	1
65-65.9	D-	2/3
Below 62	F	0

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