ECE 432-101, Control Systems, Fall 2012

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Course description: A continuation of the study of automatic control systems with emphasis on computer-aided design and problem solving. Topics covered include state feedback control, observers, industrial regulators, linear quadratic regulators, and the analysis of various common system nonlinearities. Implementation techniques on both analog and digital platforms will be addressed.

Prerequisite: ECE431

Textbook: Feedback Control Systems, Phillips & Parr 5th Ed., Addison-Wesley, ISBN-10: 0131866141 | ISBN-13: 978-0131866140
Required Software: Mathworks MATLAB, http://ist.njit.edu/software/download.php

Specific course learning outcomes
Upon successfully completing the course a student should be able to:

#	Course Learning Outcomes	Student Outcomes
1	Transform system models into the desired format needed for analysis (differential equation, transfer function, or state space).	a, c, e, k
2	Use the model of multiple subsystems to find the overall system model.	
3	Create system models in Mathworks Matlab and Simulink software for system	
4	Convert system models from continuous time to discrete time for use with a digital controller.	
5	Understand how sampling and reconstruction (zero-order hold) affect both the time	
6	Understand how to choose an appropriate sampling rate and anti-aliasing filter for controller design.	
7	Understand how to apply the z-transform to discrete time controller design.	
8	Design full-state feedback controllers using pole placement to achieve system	

9	Design optimal full-state feedback controllers using the Linear Quadratic Regulator	
10	Design controllers with integral action to achieve zero steady state error and command following.	
11	Design state estimators (full-order or reduced order) to estimate the system states	
12	Add controllers and observers to the system models in Mathworks Matlab and	

General student outcomes addressed by the course

(a) An ability to apply knowledge of mathematics, science and engineering (1-12)

(c) An ability to design a system, component or process to meet desired needs within realistic (1-12)

(e) An ability to identify, formulate, and solve engineering problems (1-12)

(k) An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice (1-12)

Tentative Schedule:

Week	Date	Contents
1,2	9/4 & 9/11	Review of Linear Algebra / Differential Equation
3	9/18	Introduction State-space Control Systems
4,5	9/25 & 10/2	Response of Linear Systems
6	10/9	Quiz # 1
7	10/16	Pole Placement Design
8	10/23	Full State Observers
9, 10	10/30 & 11/6	Industrial Regulators, LQR
11	11/13	Quiz # 2
12	11/27	Discrete Time Systems
13	12/4	Z-Transform/Discrete Time Controllers
14	12/11	Discrete Time Controllers / Reduced Order Observers
15	12/18	Final Exam

Grading: Homework & Attendance - 13% Quiz # 1 - 27% Quiz # 2 - 27% Final Exam - 33%

Important Dates: 10/9 - Quiz #1
11/13 - Quiz # 2
11/20 - follows Thursday schedule
12/18 - Final Exam