THE COLLEGE OF NEW JERSEY
DEPARTMENT OF ELECTRICAL ENGINEERING
ENG 352 01 – CONTROL SYSTEMS
FALL 2015

Professor: Francis T. Delahanty
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Office Hours: by appointment
Class meets: Monday/Wednesday – 7:00 to 8:20 PM, Armstrong 154

COURSE DESCRIPTION

The focus of this course is the theory and application of electrical analog and digital control systems. Emphasis is on specific applications of such control systems to industrial processes and especially their application to electrical, hydraulic, pneumatic, and mechanical systems.

REQUIRED TEXT

Control Systems Engineering, Norman S. Nice, 7th Ed., John Wiley and Sons, 2015

PREREQUISITES

ENG 212

COURSE OBJECTIVES AND PERFORMANCE CRITERIA

The overall objectives for this course are:

1. Understand basic control concepts and use them to describe, analyze and interpret existing control systems.
    a. Proficiency in identifying control system types, input and output criteria, and constraints placed on system operation.
    b. The ability to predict and describe the response of a given system and formulate their opinions about the quality of the design.

2. Analyze, formulate, and design simple control systems that meet basic control criteria and given specifications.
    a. The ability to formulate a mathematical model for a given physical system.
    b. The ability to analyze the model and design a controller to control the physical plant based on given operation criteria.
3. Document and present control system analyses and design in a professional manner.
    a. The ability to demonstrate all analysis and design work in writing and/or graph forms.
    b. The ability to verbally discuss topics related to control system analysis and design in a professional manner.

READING ASSIGNMENTS AND HOMEWORK

Reading the chapter prior to its introduction in class will facilitate your understanding of the material minimally by bringing important concepts to your attention, and allowing you to start formulating questions to be addressed in class. Students are encouraged and expected to complete reading assignments prior to attending each class. You may work on the homework assignments individually or in a group. I will **NOT** collect **ALL** of these homework assignments. When collected, homework may be graded as **complete** or **incomplete**, or I will choose one problem from the homework to serve as the grade. If you have difficulty completing major portions of an assignment, then you should make an appointment to see me outside of class. ***Homework is due on the date specified. Late assignments will receive half credit. Assignments more than one class late will NOT be accepted for credit.***

ACADEMIC INTEGRITY
The College's Academic Integrity Policy will be strictly enforced.

TCNJ's academic integrity policy: http://www.tcnj.edu/~academic/policy/integrity.html

ATTENDANCE POLICY
Attendance is essential. Students are expected to be present for all classes. Students who miss a class are expected to contact a fellow student to obtain notes from the missed class.

TCNJ's attendance policy: http://www.tcnj.edu/~recreg/policies/attendance.html

GRADING: (Grading for this course is consistent with TCNJ grading policy. See handbook for details.)

THERE WILL BE 10 SHORT QUIZZES GIVEN DURING THE SEMESTER ON AN AS ANNOUNCED BASIS. THE QUIZZES WILL COUNT AS 2 EXAMS.

I WILL DROP THE TWO LOWEST QUIZZES FOR THE SEMESTER. MISSED QUIZZES FOR ANY REASON WILL RECEIVE A GRADE OF ZERO. THERE IS NO EXCEPTION TO THIS RULE.

10 QUIZZES EQUAL TO 2 EXAMS	**60%**
HOMEWORK	**10%**
***CUMULATIVE* FINAL EXAM**	**30%**
	100%

GRADING SCALE

A	(94% - 100%)	C	(73% - 75%)
A-	(90% - 93%)	C-	(70% - 72%)
B+	(86% - 89%)	D+	(66% - 69%)
B	(83% - 85%)	D	(60% - 65%)
B-	(80% - 82%)	F	(<60%)
C+	(76% - 79%)		

Americans with Disabilities Act (ADA) Policy

Any student who has a documented disability and is in need of academic accommodations should notify the professor of this course and contact the Office of Differing Abilities Services (609-771-2571). Accommodations are individualized and in accordance with Section 504 of the Rehabilitation Act of 1973 and the Americans with Disabilities Act of 1992.

TCNJ's Americans with Disabilities Act (ADA) policy: http://www.tcnj.edu/~affirm/ada.html

Educational Objectives:

(What TCNJ engineers should be able to accomplish during the first few years after graduation)

- To contribute to the economic development of New Jersey and the nation through the ethical practice of engineering;
- To become successful in their chosen career path, whether it is in the practice of engineering, in advanced studies in engineering or science, or in other complementary disciplines;
- To assume leadership roles in industry or public service through engineering ability, communication skills, teamwork, understanding of contemporary global and socio-economic issues, and use of modern engineering tools;
- To maintain career skills through life-long learning and be on the way towards achieving professional licensure.

Electrical and Computer Engineering Program Outcomes

Upon graduation, the knowledge, abilities, tools and skills every student has to enable them to accomplish the Educational Objectives)

The Program Outcomes listed below are expected of all graduates of the Electrical or Computer Engineering Program.

ECE graduates will have:

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 in multidisciplinary 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;

l. an ability to analyze and design complex electrical and electronic devices;

m. an ability to analyze and design software and systems containing hardware and software components.

OVERVIEW OF SEMESTER

Course Week	Text Chapter	Topics
1	1. Introduction	• Course overview • Why do we control systems? • Open vs. closed loop systems. • How is a control system quantified? Transient and steady-state responses, stability.
1,2	2. Modeling in the Frequency Domain	• Laplace transforms • Transfer functions • Modeling of electrical, mechanical, rotational, and gear systems • Nonlinearities
3,4	3. Modeling in the Time Domain	• State-space representation
5,6	4. Time Response	• Poles and zeros • System responses; rise time and settling time • First order systems • Second order systems; natural frequency, damping ratio
7	5. Reduction of Multiple Subsystems	• Design, building and manipulation of system block diagrams
8	6. Stability	• Routh-Hurwitz technique
9,10	7. Steady-State Errors	• Computing steady-state error • Disturbances and steady-state error • System sensitivity
11,12	8. Root Locus Techniques	• Definition of the Root Locus • Plotting the Root Locus • Generalized Root Locus
13	9. Design Via Root Locus	• Cascade Compensators • Modifying the Steady-State error • Modifying the Transient Response • PID and Lag-Lead Controllers
14	10. Frequency Response Techniques	• Bode Plots • Stability, gain margin and phase margin via Bode plots • Open and closed-loop responses