ABET COURSE OUTLINE

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Academic Year: **2019-2020**
Term: **Fall 2019**

Course Instructor: ***Cong Wang***
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Course Number and Title*:* ***ECE 432: Control Systems***
(3 credits, 3 contact hours, senior elective course)
Reference books*:*
Control System Design - An Introduction to State-Space Methods, by Bernard Friedland
Control Systems Engineering, by Norman Nise, 6th edition

Course Catalog Description (including prerequisites and co-requisites):
A continuation of the study of automatic control systems with emphasis on the modern control theory. Topics covered include state space models, stability, controllability and observability, state feedback control, observers, linear quadratic regulator and optimal control.

Prerequisite: ECE 431

Specific Course Note:
Students are advised to take ECE 439 Control Laboratory at the same time.

Specific Course Learning Outcomes (CLO):

Students will be able to

1. Understand the role, strength, and limits of Modern Control methods (i.e., State Space methods) in control theories, with respect to the Classical Control methods they learned in the prerequisite course ECE 431 Introduction to Feedback Control Systems.
2. Model and analyze the stability, response, controllability, and observability of dynamic systems in real world problems with state space methods in time domain.
3. Design state feedback control algorithm for regulation and tracking tasks via pole placement and optimal control.
4. Design state observer algorithms to facilitate state feedback control.

Relevant Student Outcomes:

(1) An ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics. (CLOs 2, 3, 4)
(2) An ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors. (CLOs 3, 4)
(7) An ability to acquire and apply new knowledge as needed, using appropriate learning strategies. (CLOs 1)

Course Outline:

Week	Contents
1	Labor Day
2	Review of linear algebra
3	Introduction to state-space methods
4	System response and stability
5	Stability
6	Controllability, Quiz 1
7	Controllability, Observability
8	State feedback control using pole placement
9	State feedback control using pole placement, State observers
10	State observers
11	Midterm, Discrete Systems
12	Discrete Systems, Quiz 2
13	Optimal control: introduction, batch solution
14	Optimal control: batch solution, recursive solution
15	Optimal control: closed-form recursive solution
16	Final Exam

Grading weights:
Homework - 10%
Midterm - 45%
Final Exam - 45%