ECE 438 – Control Systems

Credits: 3, **Contact Hours:** Two 75-minute lecture session per week.

Coordinator: C. Zhou, Associate Professor of ECE

Textbook: G. F. Franklin, J. D. Powell, and A. Emami-Naeini Feedback Control of Dynamic Systems, Eighth Edition, Pearson, 2019

2019 Catalog Data: ECE 438: Control Systems. Credit 3.
Signal-flow graphs and block diagrams. Types of feedback control. Steady-state tracking error. Stability and Routh Hurwitz criterion. Transient response and time domain design via root locus methods. Frequency domain analysis and design using Bode and Nyquist methods. Introduction to state variable descriptions. Lecture: 3 Lab: 0 Credits: 3 Satisfies: Professional Elective (P)

Prerequisites or co-requisites by topic: Prerequisite: [(BME 330) or (ECE 308)]

Enrollment: Elective course for EE and CPE majors.

Specific outcomes of instruction:
After completing this course, the student should be able to do the following:

1. Analyze the transient and steady state dynamic response of systems, both in the time and frequency domain
2. Translate control design objectives to dynamic response requirements
3. Select basic feedback compensation structures and types appropriate to control design objectives
4. Design feedback controllers using root locus methodologies to meet system objectives
5. Design feedback controllers using frequency response techniques to meet system objectives
6. Use computer-based analysis and design tools (such as MATLAB software) in the analysis and design of control systems

Relationship of ECE 438 specific outcomes of instruction to student outcomes:

	Student Outcomes	**Course Goals**
1	An ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics	1,2,3,4,5,6
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	2,3,4,5,6
3	An ability to communicate effectively with a range of audiences	
4	An ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts	
5	An ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives	
6	An ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions	
7	An ability to acquire and apply new knowledge as needed, using appropriate learning strategies	

Topics:

- Introduction to feedback control systems (0.5 week)
- Overview of Laplace transforms (0.5 week)
- Time response and pole/zero locations (2 weeks)
- Stability and the Routh Array (2 week)
- Steady state error and system type (1 week)
- Root locus (2 weeks)
- Lead compensator design (1 week)
- Lag compensator design (1 week)
- Bode plots (2 week)
- Nyquist diagram (2 week)
- Tests and Final Exam (1 week)

Prepared by: C. Zhou **Date:** February 26, 2020