

## **ECE 33300 - Automatic Control Systems**

### **Cross-listed Course**

ME 33300

### **Type of Course**

Required for EE Program, Elective for CmpE Program

### **Catalog Description**

Analysis and design of control systems, from modeling and computer solutions to stability and performance issues with an orientation toward electrical and mechanical systems. Classical control system concepts are emphasized but an introduction to modern techniques is also provided.

### **Credits**

3

### **Contact Hours**

3

### **Prerequisite Courses**

ECE 30100

### **Corequisite Courses**

None

### **Prerequisites by Topics**

Calculus, ordinary differential equations, Laplace Transforms, elementary complex variables, elementary linear algebra, and elementary dynamics.

### **Textbook**

Modern Control Systems, R. C. Dorf and R. H. Bishop, Prentice Hall, 13th Ed., 2016.

### **Course Objectives**

This is an introductory course in control systems. The aim is to provide both EE and ME students with the background needed to model and design automatic control systems for electrical, mechanical, and electromechanical systems using the classical concepts of root locus, Bode plots, and Nyquist diagrams, and to assess the stability and performance of such systems. An introduction to the state space techniques is also provided. Matlab and Simulink are used as the primary computer aided design tools for control systems.

## **Course Outcomes**

### **Students who successfully complete this course will have demonstrated**

1. An ability to obtain mathematical models of simple electrical, mechanical, and electromechanical systems. (1)
2. An ability to construct and reduce the block diagrams of interconnected systems. (1)
3. An ability to perform stability analysis of linear time-invariant systems. (2)
4. An ability to perform performance analysis of linear time-invariant systems. (1)
5. An ability to design controllers to meet specifications in the time and frequency domains. (2)
6. An ability to use computer-aided tools for control systems design. (2)

### **Lecture Topics**

1. Basic structures of feedback systems
2. Modeling and simulation of electrical, mechanical, and electromechanical systems
3. Modeling of closed-loop systems
4. Block diagrams and signal flow graphs
5. Stability and stabilization
6. Time-domain analysis: transient & steady-state
7. State space modeling and simulation
8. Root locus methods
9. Frequency domain analysis of open loop & closed loop systems
10. Nyquist analysis
11. Control system design using root locus
12. Control system design using Bode plots
13. PID controller design & implementation

### **Computer Usage**

High

### **Laboratory Experience**

None

### **Design Experience**

High

### **Coordinator**

Yanfei Liu, Ph.D.

### **Date**

08/20/2024