# CSU Course Syllabus: Fall 2019

# ECE411 - Control Systems

# TR 2:00-3:15pm, Engr B105

**Instructor:** Dr. Peter M. Young, Engr B114, Ext. 1-5406,
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**Office Hours:** TR 11-12, Engr B114

**Book:** *Feedback Control Systems*
Phillips and Parr

**Prerequisites:** ECE312

**Grading and Exams:**

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|---|---|
| Midterm Exam | 30% |
| Final Exam | 40% |
| Lab & Computer Projects | 20% |
| Homework Assignments | 10% |

**Course Schedule:** Homework problems will usually be assigned every other week (due two weeks later). In addition there will be a series of laboratory and computer experiments. You are expected to work on all these problems yourself (or within your team), but *reasonable* collaboration is allowed.

No collaboration is allowed for the Midterm and Final Exams. Both exams will be in class, open book and open notes.

**Course Objective:** Control system analysis and design for continuous-time linear systems: stability and performance; time and frequency domain techniques.

# ECE411 Course Outline

## PART I: ANALYSIS

**Introduction and Background** Chapter 1 and Appendices

Introduction to feedback and control system concepts. Review of Laplace Transforms, transfer functions and linear systems. Interconnection of systems

**Mathematical Modeling** Chapter 2

Mathematical modeling of physical systems. Examples of mechanical and electrical systems. Approximation of nonlinear systems with linear ones.

**System Response and Characteristics** Chapters 4-5

Time and frequency domain performance of linear systems. Tracking and disturbance rejection. Steady state accuracy and transient response.

**Stability Analysis** Chapter 6

Stability for open and closed loop systems. Tests for stability: characteristic equations and the Routh Hurwitz array.

### REVIEW AND MIDTERM EXAM

## PART II: DESIGN

**Root Locus** Chapter 7

Effects of poles and zeros. Introduction to pole placement and root locus design.

**Frequency Domain Methods** Chapters 8,9

Frequency domain performance analysis: Nyquist and Bode plots. Introduction to frequency domain design techniques via root locus, Nyquist, and Bode methods. Relationship between time domain and frequency domain performance. Design of PI, PID, lead, lag, and lead-lag controllers.

**State Space Methods** Chapter 3

State Space representation of linear systems. State equations and similarity transformations. Relationship to transfer function models.

**Advanced Controller Design** Chapter 10 and Handouts

Introduction to modern control design techniques for multivariable systems. State estimation and pole placement design. Design case studies.

### REVIEW AND FINAL EXAM