San José State University
Electrical Engineering Department
EE132-02 Theory of Automatic Controls, Fall 2018

Instructor: Anindita Bhattacharya, PhD

Office Location: EE383

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Office Hours: 1.55PM – 2.55PM on Wednesdays

Class Days/Time: MW 3:00PM – 4:15PM

Classroom: Clark - 222

Prerequisites: EE110 with a grade of “C” or better and EE112 with a D- or better (Differential Equations; Laplace Transforms; Transfer Functions; Bode Plots). Also Basic Matrix Algebra; Mechanics and Dynamics.

Course Description

Theory of linear feedback systems. Transfer functions and block diagrams; Signal flow graphs, Root-locus techniques; Time and frequency domain analysis; Stability analysis, Routh-Hurwitz, Gain margins, phase margins.

Course Goals and Student Learning Objectives

This course is an introduction to control systems. We first learn to write basic mathematical models, manipulate the transfer function block diagrams, and study their stability, and then predict the performance of a closed loop control systems through the systematic study of the servomechanism, including steady state and transient analysis, single loop systems analysis, root-locus and frequency response techniques, and design methods to meet performance specifications. Towards the last part of the course we will include methods for closed loop compensation. MATLAB computer simulations will be introduced to the students.

Course Topics

- Introduction to Control Systems
- Mathematical Foundation
- Mathematical Modeling of Electrical, Mechanical, Thermal and Electromechanical Systems
- Determination of the Transfer Function
- Block Diagram Manipulation
- Signal Flow Graphs
- State Variable Representation
- Time Domain Analysis
- Stability analysis of Control Systems
- Routh-Hurwitz
- Root Locus Techniques
- Frequency Analysis of Control Systems
- Frequency Domain Plots
- Gain Margins; Phase Margins
- Nyquist Plots
- Lead, Lag, PID Compensators
SJSU Studies Learning Outcomes (LO), if applicable

Upon successful completion of this course, students will be able to:
a. Demonstrate an understanding of the fundamentals of Electrical Engineering, including its mathematical and scientific principles, analysis and design
b. Demonstrate the ability to apply the practice of Engineering in real-world problems

Course Content Learning Outcomes

Upon successful completion of this course, students will be able to:
1. Develop the transfer function of a system from the differential equations generated from the physics of the problem
2. Specify the transfer function from the state-space description of the problem
3. Specify the transfer function from the system’s impulse response
4. Demonstrate, build, implement, synthesize a transfer function using operational amplifier building blocks
5. Demonstrate the transient and steady state analysis of a control system
6. Describe stability analysis, and predict the performance of a closed loop control system including root locus and steady state frequency response techniques
7. Demonstrate and modify the behavior of a control system by reshaping the root locus through the addition of GH zeros
8. Specify the gain in a control system such that it displays specified damping
9. Specify a gain in a control system to make it into an oscillator
10. Design a control system to meet a set of requirements
11. Demonstrate analytically systems functionality and performance of a control system
12. Describe appropriate tests to demonstrate systems capability to meet specific requirements

Required Texts/Readings

MATLAB, available for use in Lab ENG-387, or student version can be purchased at the Spartan Bookstore; also available on the Web: [http://www.MathWorks.com](http://www.MathWorks.com); it should include the Control Toolbox.
Other readings and references

Classroom protocol

Students are expected to participate actively in class. Students will turn their phones off or put them on vibrate mode while in class. They will not answer their phones in class.

Assignments and Grading

Homework is an essential part of this course where a good portion of the learning takes place. We will have weekly HW which will be collected the following week. Late Homework will not be accepted.

Exams

There will be 2 examinations in addition to the final comprehensive examination. Exams will be closed book. There will be no make-up exams.
Assessment methods

- Homework including computer simulations
- Two midterms and a comprehensive final exam

Grading policy

HW/Class Part. 20%
Midterm #1 25%
Midterm #2  25%
Final Exam 30%
TOTAL  100%

Grading

94% and Above   A
93% - 90%       A-
89% - 87%       B+
86% - 84%       B
83% - 80%       B-
79% - 77%       C+
76% - 74%       C
73% - 70%       C-
69% - 67%       D+
66% - 64%       D
63% - 60%       D-
Below 60%       F

EE132 THEORY OF AUTOMATIC CONTROLS Course Schedule

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Midterm 1: October 1 (Monday) Regular Class Hours
Midterm 2: November 5 (Monday) Regular Class Hours
Final Exam: December 14 (Friday) 12:15PM to 14:30PM