

Southern Polytechnic State University
EE4201: Control Systems
Course Syllabus

Course Description

This is the first control course for engineering students. The following topics will be covered in the course: Basic Ideas of Feedback Control; Control System Modeling; Laplace Transform; Transfer Functions; Time Response of First-Order and Second-Order Systems; Reduction of Multiple Subsystems; Stability Analysis; Stead-State Errors; Design Via Root Locus; Frequency Response Analysis; PID Control, MATLAB/Simulink and its Control Toolbox.

Instructor:

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Course URL at GaVIEW Vista 8

<https://spsu.view.usg.edu>

Textbook (Required):

Control Systems Engineering, 5th Edition or 6th Edition, Norman S. Nise, Published by Wiley.

Prerequisite:

MATH 2306 and EE 2301

Learning Outcomes:

Upon completion of the course, the students should be able to:

- 1- Derive the transfer function models for mechanical and electrical systems.
- 2- Determine the time response of first-order and second-order systems.
- 3- Understand reduction of multiple subsystems.
- 4- Use Routh-Hurwitz Criterion to analyze the stability of a linear system.
- 5- Calculate steady-state errors for control systems.
- 6- Sketch the root-locus and design control systems via root locus.
- 7- Sketch Bode Plots and Nyquist Diagrams.
- 8- Determine stability, gain margin and phase margin via Bode Plots and Nyquist Diagrams.
- 9- Understand PID control and how to tune a PID controller.
- 10- Use MATLAB/Simulink to analyze linear control systems.

Course Outcome Measures and Assessment:

Measures and assessment of the outcomes will be made by:

- 1- Periodic homework assignments and quizzes.
- 2- Two one hour tests during the semester.
- 3- One 2-hour final exam.
- 4- Five labs and the corresponding lab reports.
- 5- Course and instructor evaluation at the end of the semester to provide student feedback on the quality of the course and effectiveness of the instructor.

Topics Covered

- 1) Laplace transform and transfer functions
- 2) Transfer functions
- Test 1**
- 3) Time response of first-order systems
- 4) Time response of second-order systems
- 5) Block diagrams, signal-flow graphs and Mason's Rule
- 6) Routh-Hurwitz Criterion
- 7) MATLAB/Simulink and Control Tool Box
- Test 2**
- 8) Stead-state error and sensitivity
- 9) Root locus
- 10) Design via root locus
- 11) Bode plots and Nyquist diagrams
- 12) Gain margin, phase margin and stability
- 13) PID controller
- Final Exam** (Cover all above topics)

Grading:

1. Two Tests	30.0 %
2. Homework and Quiz	20.0 %
3. Attendance (Lectures and Labs)	10.0 %
4. Lab reports	15.0 %
5. Final exam (during finals week)	25.0 %

Homework / Lab Reports Preparation Guideline:

- **Only hard-copy homework/reports will be accepted. No email submission.**
- Printed homework is preferred but not necessary.
- Lab reports must be printed.
- Submit your homework/reports directly to the instructor or insert them into the door of Q342.
- **Late homework and reports will NOT be accepted for credit.**

- Homework/reports must be bounded or stapled
- Show all your work for full credit! Write your name on every page. Present your work neatly!

Class/Lab Attendance Policy:

“ ... The instructor may reduce the course grade of any student who fails to meet the attendance requirements as set forth in the instructor’s attendance policy. Students should understand they are responsible for all course material covered and that they are responsible for the academic consequences of their absences.” (SPSU Student’s handbook)

Class attendance policy

# of Absence	0 - 3	More than 3
Point Deduction	0	1.5 points per absence

Disruptive Behavior and Academic Dishonesty

SPSU has an Honor Code and a new procedure relating to when academic misconduct is alleged. All students should be aware of them. Information about the Honor Code and the misconduct procedure may be found at <http://spsu.edu/honorcode/>.

A faculty member reserves the right to remove any student from his or her course if the student’s behavior is of a disruptive nature or where there is evidence of academic dishonesty. In instances of disruptive behavior and/or academic dishonesty, the faculty member will discuss the circumstances with the student(s) before taking final action. In the event the student cannot be reached, he/she will be given the grade of "Incomplete" until such time as he/she can be reached. The student shall have the right of appeal of the faculty member’s decision first to the faculty member’s department head and then to the appropriate college or school dean and, if necessary, to the Vice President for Academic Affairs. Removal of a student from a course under this provision will result in the faculty member’s issuing a grade of "F". A grade of "F" issued under these circumstances shall not be superseded by a voluntary withdrawal and will be included in the student’s cumulative grade point average calculated for graduation purposes. (SPSU Student’s Handbook)