San José State University
Electrical Engineering Department
EE132-01 Theory of Automatic Controls, Fall 2021

Course and Contact Information
Instructor: Anindita Bhattacharya, PhD
Office Location: Online Via Zoom.
Email: anindita.bhattacharya@sjsu.edu
Office Hours: 7.00PM to 7.30PM on Tuesdays and Thursdays (Check canvas to find the zoom link.)
Class Days/Time: Tu/Th 5:45PM to 7:00PM
Classroom: Hybrid class.
For Online classes via Zoom, check canvas to find the zoom link. Classroom number will be provided to you for the in person classes.
Prerequisites: EE110 with a grade of “C-” or better and EE112 with a C- or better (Differential Equations; La Place Transforms; Transfer Functions; Bode Plots). Also Basic Matrix Algebra; Mechanics and Dynamics.

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

Course Goals (Optional)
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 Learning Outcomes (CLO) (Required)
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 (Required)

Textbook

Other Readings

Other technology requirements / equipment / material
- MATLAB

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 midterms in addition to the final exam. Final exam is cumulative. There will be no make-ups for midterms. If you have three finals in the same day, you can take the final on the final exam make up day as per the university calendar. But notify me before.

Assessment methods

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

Final Examination or Evaluation

Final exam is a comprehensive test covering the entire syllabus of the course.
Final exam date is Thursday, December 9, 5:15-7:30 PM PST

Grading policy

Homework/Quiz - 20%
Midterm #1 - 25%
Midterm #2 - 25%
Final Exam - 30%
TOTAL - 100%

Grading

94% and Above A
93% - 90% A Minus
89% - 87% B Plus
86% - 84% B
83% - 80% B Minus
79% - 77% C Plus
Proctoring Software and Exams
Exams will be proctored in this course through Respondus Monitor and LockDown Browser. Please note it is the instructor's discretion to determine the method of proctoring. If cheating is suspected the proctored videos may be used for further inspection and may become part of the student's disciplinary record. Note that the proctoring software does not determine whether academic misconduct occurred, but does determine whether something irregular occurred that may require further investigation. Students are encouraged to contact the instructor if unexpected interruptions (from a parent or roommate, for example) occur during an exam.

Recording Zoom Classes
This course will be recorded for instructional or educational purposes. The recordings will only be shared with students enrolled in the class through Canvas. The recordings will be deleted at the end of the semester. If, however, you would prefer to remain anonymous during these recordings, then please speak with the instructor about possible accommodations (e.g., temporarily turning off identifying information from the Zoom session, including student name and picture, prior to recording).

Students are not allowed to record without instructor permission
Students are prohibited from recording class activities (including class lectures, office hours, advising sessions, etc.), distributing class recordings, or posting class recordings. Materials created by the instructor for the course (syllabi, lectures and lecture notes, presentations, etc.) are copyrighted by the instructor. This university policy (S12-7) is in place to protect the privacy of students in the course, as well as to maintain academic integrity through reducing the instances of cheating. Students who record, distribute, or post these materials will be referred to the Student Conduct and Ethical Development office. Unauthorized recording may violate university and state law. It is the responsibility of students that require special accommodations or assistive technology due to a disability to notify the instructor.

Zoom Classroom Etiquette
- **Mute Your Microphone**: To help keep background noise to a minimum, make sure you mute your microphone when you are not speaking.
- **Be Mindful of Background Noise and Distractions**: Find a quiet place to “attend” class, to the greatest extent possible.
  - Avoid video setups where people may be walking behind you, people talking/making noise, etc.
  - Avoid activities that could create additional noise, such as shuffling papers, listening to music in the background, etc.
- **Position Your Camera Properly**: Be sure your webcam is in a stable position and focused at eye level.
- **Limit Your Distractions/Avoid Multitasking**: You can make it easier to focus on the meeting by turning off notifications, closing or minimizing running apps, and putting your smartphone away (unless you are using it to access Zoom).
- **Use Appropriate Virtual Backgrounds**: If using a virtual background, it should be appropriate and professional and should NOT suggest or include content that is objectively offensive or demeaning.

Technology Requirements:
Students are required to have an electronic device (laptop, desktop or tablet) with a camera and built-in microphone. SJSU has a free equipment loan program available for students. Students are responsible for ensuring that they have access reliable Wi-Fi during tests. If students are unable to have reliable Wi-Fi, they must inform the instructor, as soon as possible or at the latest one week before the test date to determine an alternative.

Online Exams Testing Environment: Setup
- No earbuds, headphones, or headsets visible.
- The environment is free of other people besides the student taking the test.
● If students need scratch paper for the test, they should present the front and back of a blank scratch paper to the camera before the test.
● No other browser or windows besides Canvas opened.
● A workplace that is clear of clutter (i.e., reference materials, notes, textbooks, cellphone, tablets, smart watches, monitors, keyboards, gaming consoles, etc.)
● Well-lit environment. Can see the students’ eyes and their whole face. Avoid having backlight from a window or other light source opposite the camera.
● Personal calculator is permitted for this course.

Testing Environment: Scan

Before students can access the test questions, they are expected to conduct a scan around their testing environment to verify that there are no materials that would give the student an unfair advantage during the test. The scan will include:

- the desk/work-space
- a complete view of the computer including USB ports and power cord connections
- a 360-degree view of the complete room

Students must:
- Remain in the testing environment throughout the duration of the test.
- Keep full face, hands, workspace including desk, keyboard, monitor, and scratch paper, in full view of the webcam

Technical difficulties

Internet connection issues:
Canvas autosaves responses a few times per minute as long as there is an internet connection. If your internet connection is lost, Canvas will warn you but allow you to continue working on your exam. A brief loss of internet connection is unlikely to cause you to lose your work. However, a longer loss of connectivity or weak/unstable connection may jeopardize your exam.

Other technical difficulties: Immediately email the instructor a current copy of the state of your exam and explain the problem you are facing. Your instructor may not be able to respond immediately or provide technical support. However, the copy of your exam and email will provide a record of the situation. Contact the SJSU technical support for Canvas:
- Email: ecampus@sjsu.edu
- Phone: (408) 924-2337
- https://www.sjsu.edu/ecampus/support/

University Policies (Required)
Per University Policy S16-9 (http://www.sjsu.edu/senate/docs/S16-9.pdf), relevant information to all courses, such as academic integrity, accommodations, dropping and adding, consent for recording of class, etc. is available on Office of Graduate and Undergraduate Programs’ Syllabus Information web page at http://www.sjsu.edu/gup/syllabusinfo/".
## EE132-02 Theory of Automatic Controls, Fall 2020

### Course Schedule

<table>
<thead>
<tr>
<th>Week (Optional)</th>
<th>Date</th>
<th>Topics, Readings, Assignments, Deadlines</th>
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</thead>
<tbody>
<tr>
<td>1</td>
<td>8/19/21</td>
<td>Introduction, Concept of Control Systems, Open Loop, Closed Loop System</td>
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<tr>
<td>2</td>
<td>8/24/21</td>
<td>Concept of Feedback control, Mathematical Foundation, Modeling</td>
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<tr>
<td>2</td>
<td>8/26/21</td>
<td>Mathematical Foundation, Modeling, Examples using Matlab Simulink</td>
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<tr>
<td>3</td>
<td>8/31/21</td>
<td>Block Diagram, Manipulation</td>
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<td>3</td>
<td>9/2/21</td>
<td>Review of Laplace Transformation</td>
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<tr>
<td>4</td>
<td>9/7/21</td>
<td>Transfer Functions, Time domain Analysis</td>
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<tr>
<td>4</td>
<td>9/9/21</td>
<td>Time domain analysis</td>
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<tr>
<td>5</td>
<td>9/14/21</td>
<td>State Space Representation</td>
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<tr>
<td>5</td>
<td>9/16/21</td>
<td>State space Representation of Electrical Network</td>
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<td>6</td>
<td>9/21/21</td>
<td>Performance Specifications</td>
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<tr>
<td>6</td>
<td>9/23/21</td>
<td>*Midterm 1  *Date may change</td>
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<tr>
<td>7</td>
<td>9/28/21</td>
<td>First Order and Second Order Systems</td>
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<td>7</td>
<td>9/30/20</td>
<td>Transient Response of a First Order System, Poles, Zeros, behavior</td>
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<tr>
<td>8</td>
<td>10/5/21</td>
<td>Transient Response of a Second Order System, Poles, Zeros, behavior</td>
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<td>8</td>
<td>10/7/21</td>
<td>Stability Analysis – Examples Matlab Simulation</td>
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<td>9</td>
<td>10/12/21</td>
<td>Stability Analysis - Routh-Hurwitz Criterion</td>
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<td>9</td>
<td>10/14/21</td>
<td>Concept of Controllers – P, PI, PD (Examples with Matlab Simulink)</td>
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<tr>
<td>10</td>
<td>10/19/21</td>
<td>Concept of Controllers – PID (Examples with Matlab Simulink)</td>
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<td>10</td>
<td>10/21/21</td>
<td>Controllers examples and tuning of a PID controller with Matlab Simulink</td>
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<tr>
<td>11</td>
<td>10/26/21</td>
<td>Root Locus techniques</td>
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<tr>
<td>11</td>
<td>10/28/21</td>
<td>Root Locus techniques</td>
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<tr>
<td>12</td>
<td>11/2/21</td>
<td>*Midterm 2  *Date may change</td>
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<tr>
<td>12</td>
<td>11/4/21</td>
<td>Concept of Frequency Response</td>
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<td>13</td>
<td>11/9/21</td>
<td>Bode Plot, Gain Margin, Phase Margin</td>
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<td>11/11/21</td>
<td>Veteran's day – Campus Closed</td>
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<tr>
<td>13</td>
<td>11/16/21</td>
<td>Bode Plot Examples with concept of stability (In-person)</td>
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<td>Week (Optional)</td>
<td>Date</td>
<td>Topics, Readings, Assignments, Deadlines</td>
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<td>14</td>
<td>11/18/21</td>
<td>Nyquist Criterion (In-person)</td>
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<td>14</td>
<td>11/23/21</td>
<td>Nyquist Criterion with examples (In-person)</td>
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<td>15</td>
<td>11/30/21</td>
<td>PID compensators with stability, gain, phase margin examples in Matlab Simulink (In-person)</td>
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<td>16</td>
<td>12/2/21</td>
<td>Final Review (In-person)</td>
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<tr>
<td>12/9/21</td>
<td></td>
<td>Final Exam 5:15-7:30 PM PST (In-person)</td>
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