Cleveland State University  
Department of Electrical Engineering and Computer Science  

EEC 510 Linear Systems  

Catalog Data:  
EEC 510 Linear Systems (4-0-4).  
Prerequisite: MTH284: Matrices for Engineers or MTH288: Linear Algebra; EEC310 and EEC311: Electrical circuits EEC440: Control Systems  

Textbook:  

References:  

Coordinator:  
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Office Hours: MW 1:30PM- 3:30PM or by appointments.

Content:  
The following topics will be covered in this course.  
- Review of matrix theory and linearization  
- State-space modeling of dynamic systems  
- Solutions of state equations and impulse response  
- Control system design: separation theorem, linear observer design and feedback controller design.

Objectives:  
After taking this course, students should be able to  
- derive state-space models of linear/linearized physical systems;  
- design state feedback controllers and state observers;  
- be well prepared to take more advanced control courses;  
- gain experiences of using Matlab/Simulink software for control system design, simulation, and analysis.
Course Outline:
(Chapter 2, Chapter 14, and Chapter 15 of the textbook will not be covered in the course.)
Please note that the course outline is subject to change during the academic semester.

Week Reading Materials:
1. Definition of linear systems, introduction to physical system modeling, introduction to state variable (1.1-1.3)
2. State variables and state equations (3.1-3.4)
3. State equation modeling (12.1-12.3) linearization of nonlinear systems
5. Vectors and linear vector spaces (5.1-5.6)
6. Orthonormalization and linear operators (5.7-5.13)
7. Simultaneous linear equations (6.1, 6.2, 6.3, 6.6, 6.7, 6.8)
8. Eigenvalues and eigenvectors (7.1-7.5)
9. Midterm Exam (Lectures of weeks 1-7)
10. Functions of square matrices (8.1-8.6) Solutions of linear state equations (9.1-9.4)
11. Stability I (10.1-10.3)
12. Stability II (10.4-10.6)
13. Controllability and observability II (11.1-11.5)
15. Design of a state observer (13.6, 13.7)
16. Final Exam (comprehensive)

*Please note that university holidays and other important dates are listed in http://www.csuohio.edu/enrollmentservices/registrar/calendar/

Grading:
Three Quizzes: 40%
Four Projects: 40%
Final Exam: 20%

Grading Scale:
A………………………… 93-100
A minus………………….. 90-92
B plus…………………… 87-89
B………………………….. 83-86
B minus…………………... 80-82
C………………………….. 70-79
D…………………………..60-69
F……………………………<60

Homework: Homework is a major learning tool in this course. Homework assignment will be passed out and collected on every other Wednesday. NO LATE HOMEWORK will be accepted. The homework will be graded. However, the homework grade will NOT be counted towards final grade.

Project: Students are required to complete four Matlab/Simulink-based class projects.
• NO late projects will be accepted.
• All projects must be strictly individual efforts. Identical project reports will be graded zeros.

• Programming codes (or Simulink model) and simulation results must be
included into project reports.
- Carefully print and sign your name on the first page of your report.
- The hardcopies of projects are required. No email submissions will be accepted.

Tests:
- There are three one-hour quizzes, and one two-hour final exam.
- Quizzes and exams will be closed book and closed notes with time limits strictly enforced.
- The date of each test will be announced in class at least one week before the test.
- NO MAKEUP QUIZZES OR EXAMS will be given unless an approval is obtained from the instructor BEFORE the test. Students are obliged to show up at the scheduled time of a test or make-up test. Otherwise, he/she would receive a zero for the exam.

Attendance:
- STUDENTS ARE REQUIRED TO ATTEND ALL CLASSES! If a student must be absent due to university business or illness, the student is obliged to contact the instructor PRIOR TO the absence or tardiness. The instructor reserves the right to limit the quality/quantity of out-of-class assistance to the students with excessive absences. If a student misses one fourth of classes (7 classes), he/she will automatically FAIL this course.

Classroom Policies:
- Classroom behavior will be governed by the following four policies that will help produce a tolerant, cooperative classroom.
  - Students will NOT be allowed to LEAVE A CLASS unless it is an extreme emergency.
  - Students are required to come to class ON TIME or early. If a student has to be a bit late (within 30 minutes) for a class due to a legitimate reason, he/she will have to choose a seat close to the door and get into the classroom quietly. If a student arrives 30 minutes (or more) late, he/she will have to wait outside for the second part of the class.
  - Everyone, including the instructor, will be treated with respect.
  - Putdowns and purposely hurtful comments or actions will not be tolerated.
  - No one will be allowed to disrupt the learning process of anyone else.
  - NO CHATTING is allowed in classes.

Others:
- All major class materials will be uploaded to Blackboard. All important notices from instructor will be announced in Blackboard as well.