Syllabus for ECEN 3300
Linear Systems
Fall 2016

Catalog Description
Characterization of linear and time-invariant systems in time and frequency domains. Continuous time systems are analyzed using differential equations and Laplace and Fourier transforms. Discrete time systems, which can be implemented using a modern digital signal processing framework, use difference equations, z-transforms and discrete time Fourier transforms for their analysis and design. Applications of linear systems include communications, signal processing, and control systems.

Particulars
Instructor: Alan Mickelson
Office: ECEE 130
Office Hours: M 9:00 - 9:50 a.m. and Thursday 3:00 p.m. - 3:50 p.m.
Phone: (303)492-7539
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Grader: Keyon Janani
Office for Office Hours: ECEE 128
email: keyon.janani@gmail.com
Office Hours: M 12:00 p.m. - 1:50 p.m. and Th 2:00 - 2:50 p.m.
Lecture: MWF 2:00 -2:50 p.m. in ECCE 1B32
Homework: There will be weekly homework assignments. The homework will be due before class on Monday beginning Monday January 25, 2016. There will be 10 assignments that are due on 1/25/16, 2/1/16, 2/8/16, 2/15/16, 2/29/16, 3/7/16, 3/14/16, 4/4/16, 4/11/16 and 4/25/16.
Exams: Three will be 3 in-class midterm exams (2/19/15, 3/18/15 and 4/15/15) and one one-hour in-class final exam scheduled in the regular period for finals for this class time (May 5, 2016 7:30 p.m.).

Website: The website is [http://ecee.colorado.edu/~ecen3300/](http://ecee.colorado.edu/~ecen3300/).

Text: The primary text will be:


A good reference is:


Objectives

For the student to:

1. Understand and use the benefits of analyzing and designing systems at a higher level that is independent of a particular hardware implementation.

2. Understand how mathematical transformations can yield insight and simplify the design and analysis of linear systems.

3. Understand the differences, similarities, limitations, and benefits of continuous and discrete time systems.

Objectives

After taking this course students will be able to recognize and use the following concepts, ideas, and/or tools:

1. Linearity and time-invariance, including impulse response, step response, and convolution.

2. Continuous-time (CT) versus discrete-time (DT), including CT and DT signals and systems, differential and difference equations, and sampling and interpolation.

3. Time domain versus transformed domain, including Laplace and z-transforms, system functions, Fourier transforms, frequency response, and filter analysis/design.

Grading

There will be weekly homework, three exams and a project. Each of the exams and project will have equal weight. The final grade will be based on a total of 20% homework grades and 80% exam grades (20% per one hour in-class exam).
Schedule

Topical Overview
1. Linear Systems (6 weeks) Chapters 1 and 2 in text
2. Convolution and Fourier Transform (5 weeks) Chapters 3 and 4 in text
3. Sampling of Waveforms (5 weeks) Chapters 5 and 7 in text

Week 1 (Signals): January 11, 13, and 15
1. Syllabus and Class Overview
2. Section 1.1 (Signal Representations)
3. Section 1.2 (Independent Variable Transformations)

Week 2 (Systems): January 20, and 22
1. Section 1.3 (Complex Sinusoidal Signals)
2. Section 1.4 (Steps and Impulses)

Week 3 (Basic System Properties): January 25, 27, and 29
1. Section 1.5
2. Section 1.6
3. Section 1.7

Week 4 (Convolution): February 1, 3 and 5
1. Section 2.1
2. Section 2.2
3. Section 2.2

Week 5 (Properties of LTI): February 8, 10, and 12
1. Section 2.3
2. Section 2.3
3. Section 2.3
Week 6 (Wrap of chapter 2 and first midterm): February 15, 17 and 19

1. Section 2.4
2. Section 2.5
3. in-class exam 1

Week 7 (Fourier Analysis of Continuous Time Signals): February 22, 24, and 26

1. Section 3.1- 3.3
2. Section 3.4
3. Section 3.5

Week 8 (Fourier Analysis of Discrete Time Signals): February 29, March 2, and 4

1. Section 3.6
2. Section 3.7 - 3.9
3. Section 3.10 - 3.11

Week 9 (Properties of the Continuous Time Fourier Transform): March 7, 9 and 11

1. Section 4.1
2. Section 4.2
3. Section 4.3

Week 10 (Fourier Convolution and second midterm): March 14, 16 and 18

1. Section 4.4 - 4.5
2. Section 4.6
3. In class exam 2
Week 11 (Spring Break): March 21, 23 and 25
   1. no class
   2. no class
   3. no class

Week 12 (Sampled Aperiodic Signals): March 28, 30 and April 1
   1. Section 5.1
   2. Section 5.1
   3. Section 5.2

Week 13 (Properties of Discrete Time Fourier Transform): April 4, 6 and 8
   1. Section 5.3
   2. Section 5.3
   3. Section 5.4 - 5.5

Week 14 (Finish up chapter 5 and third midterm): April 11, 13 and 15
   1. Section 5.6 - 5.7
   2. Section 5.8
   3. in-class exam 3

Week 15 (The sampling Theorem): April 18, 20 and 22
   1. Review Chapter 6
   2. Review Chapter 6
   3. Section 7.1

Week 16 (Sampling of Continuous Signals): April 25, 27 and 29
   1. Section 7.2
   2. Section 7.3 - 7.4
   3. Section 7.5
Final Exam week

1. 1 hour in-class exam May 5 at 7:30 p.m.

Disability

If you qualify for accommodations because of a disability, please submit to me a letter from Disability Services in a timely manner so that your needs may be addressed. Disability Services determines accommodations based on documented disabilities. Contact: 303-492-8671, Willard 322, and [http://www.colorado.edu/disabilityservices/](http://www.colorado.edu/disabilityservices/)

Religious Observance

Campus policy regarding religious observances requires that faculty make every effort to reasonably and fairly deal with all students who, because of religious obligations, have conflicts with scheduled exams, assignments or required attendance. In this class, students with religious obligations that may cause conflicts with the course proceeding are requested to talk to the instructor within the first two weeks of the semester. See full details at [http://www.colorado.edu/policies/fac_relig.html](http://www.colorado.edu/policies/fac_relig.html)

Classroom Behavior

Students and faculty each have responsibility for maintaining an appropriate learning environment. Students who fail to adhere to such behavioral standards may be subject to discipline. Faculty have the professional responsibility to treat all students with understanding, dignity and respect, to guide classroom discussion and to set reasonable limits on the manner in which they and their students express opinions. Professional courtesy and sensitivity are especially important with respect to individuals and topics dealing with differences of race, culture, religion, politics, sexual orientation, gender variance, and nationalities. Class rosters are provided to the instructor with the student’s legal name. I will gladly honor your request to address you by an alternate name or gender pronoun. Please advise me of this preference early in the semester so that I may make appropriate changes to my records. See policies at [http://www.colorado.edu/policies/classbehavior.html](http://www.colorado.edu/policies/classbehavior.html) and at [http://www.colorado.edu/studentaffairs/judicialaffairs/code.html#student_code](http://www.colorado.edu/studentaffairs/judicialaffairs/code.html#student_code)

Honor Code

All students of the University of Colorado at Boulder are responsible for knowing and adhering to the academic integrity policy of this institution. Violations of this policy may include: cheating, plagiarism, aid of academic dishonesty, fabrication, lying, bribery, and threatening behavior. All incidents of academic misconduct shall be reported to the Honor
Code Council (honor@colorado.edu; 303-725-2273). Students who are found to be in violation of the academic integrity policy will be subject to both academic sanctions from the faculty member and non-academic sanctions (including but not limited to university probation, suspension, or expulsion). Other information on the Honor Code can be found at [http://www.colorado.edu/policies/honor.html](http://www.colorado.edu/policies/honor.html).

**Discrimination & Sexual Harrassment**

The University of Colorado at Boulder policy on Discrimination and Harassment ([http://www.colorado.edu/odh](http://www.colorado.edu/odh)), the University of Colorado policy on Sexual Harassment and the University of Colorado policy on Amorous Relationships applies to all students, staff and faculty. Any student, staff or faculty member who believes she/he has been the subject of discrimination or harassment based upon race, color, national origin, sex, age, disability, religion, sexual orientation, or veteran status should contact the Office of Discrimination and Harassment (ODH) at 303-492-2127 or the Office of Judicial Affairs at 303-492-5550. Information about the ODH and the campus resources available to assist individuals regarding discrimination or harassment can be obtained at [http://www.colorado.edu/odh](http://www.colorado.edu/odh).