SAN JOSE STATE UNIVERSITY
COLLEGE OF ENGINEERING
DEPARTMENT OF ELECTRICAL ENGINEERING

EE210-03, Linear Systems Theory, Fall 2017

Instructor:	Khosrow Ghadiri
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Office Hours:	MW 17:00-18:00, TuTh 15:30-16:30
Class Days/Time:	MW 18:00-19:15
Classroom:	ENGR. 343
Prerequisites:	Graduate student standing

Course Description

Comprehensive overview of signals and sequences and linear systems of continuous and discrete time. System attribute. Fourier transform families and properties. Convolution and correlation. Efficient computations. The z-transform. FIR and IIR filter analysis. Cascade and parallel structures. State variable modeling. Sampling, Filtering, and other selected application.

Specific topics covered in EE 210-02 include:

1- Discrete-time signals and systems
2- Linear and time-invariant (LTI) systems.
3- The Discrete-time Fourier transform and properties
4- Convolution and correlation
5- The Z-transform & properties.
6- Frequency response and pole/zero relationship
7- Example FIR & IIR filters; linear-phase filters
8- Cascade, parallel, and state space system realization.
9- The Discrete Fourier Transform (DFT) and properties
10- The Fast-Fourier Transform(DFT) and properties
11- Models of continuous-time signals; impulse and impulse arrays.
12- Fourier transform of continuous-time signals and properties.
13- Measures of signal width in the time and frequency domains
14- Sampling & reconstruction of continuous time and frequency domains
15- Overview of continuous-time linear systems
16- Selected application.

Course Goals and Student Learning Objectives (LO):

LO1: To learn how to analytically and numerically calculate spectra of continuous-time and discrete-time signals from various Fourier transform definitions and transform properties.
LO2: To learn how to infer from signals and their spectra basic attributes including energy, power, width, moments, among others.
LO3: To learn how to analytically and numerically perform basic signal operations such as convolutions, and correlations in either the time or frequency domain and to relate such operations to real-life applications.
LO4: To learn how to assess various system attributes such as linearity, shift invariance, causality, and stability, and to understand their relationship to the system function.
LO5: To learn how to analyze the time and frequency responses of linear shift invariant systems to aperiodic and periodic temporal or spatial input signals both in the real-frequency and complex-frequency domains.
LO6: To relate the developed analysis methodologies to real-life applications such as filtering, sampling, imaging, control, communications, bio, signal processing, among others.

Required & Recommended Texts/Software

Required Textbook:

Oppenheim, and Schafer, "Discrete-time Signals Processing", Third edition, Pearson/Prentice Hall, 2010.
Supplemented by Bracewell "selected chapters from the Fourier transform and its applications", Third edition. McGraw-Hill 2000,
Chi Tsong Chen "Signal and System: A Fresh Look"
http://web.itu.edu.tr/hulyayalcin/Signal_Processing_Books/2009_Chi_Tsong_Chen__SignalsAndSystems.pdf
Software:

None is required. The Student Version of Matlab is recommended for supporting numerical computations when needed. It's available at the bookstore or directly from the Mathworks Inc (http://www.mathworks.com/academia/student_version/). Matlab and many of its "toolboxes" are available on the EE Department PC's in room ENG387 (an open lab; open times are posted on the door). Matlab may be used to demonstrate some topics in the class. However, use of Matlab is *optional*; no Matlab-specific problems will be part of the homework or the exams.

Other Readings

Handouts either posted on the web page or distributed in class.

Classroom Protocol

Students will turn their cell phones off or put them on vibrate mode while in class. They will not answer their phones in class. Students whose phones disrupt the course and do not stop when requested by the instructor will be referred to the Judicial Affairs Officer of the University**.**

Assignments and Grading Policy

Homework

Homework assignments represent a minimum number of suggested practice problems for the students to solve for the purposes of testing their understanding of the material covered in lecture. Homework assignments will not be picked up

and graded. They should be treated as an invaluable tool for getting a good grasp of the material covered in this course. Working out additional appropriate problems available to the student for practice purposes is highly recommended. Its relationship to exams is like batting practice before a baseball game.

Course Grading

Letter grade will be assigned based on the distribution curves for each exam. Using the following schedule of weights, the weighted sum of these numerical scores (rounded to the nearest integer) will be used to determine the course grade:

97% and above	A+
94% - 96%	A
90% - 93%	A-
87% - 89%	B+
83% - 86%	B
80% - 82%	B-
77% - 79%	C+
73% - 76%	C
70% - 72%	C-
67% - 69%	D+
63% - 66%	D
60% - 62%	D-
Below 59%	F

Using the following schedule of weights, the weighted sum of these numerical scores (rounded to the nearest integer) will be used to determine the course grade:

Homework & Quizzes	20%
Exam 1	25%
Exam 2	25%)
Final exam	30%
Total	100%

Note that except for extraordinary, documented situations, make-up exams will not be allowed. Thus, at the beginning of the semester make sure that you have no exam conflicts. Students having disabilities, which require special exam conditions are urged to consult the Disabled Students Office immediately and are asked to inform the instructor of any special needs

Classroom Protocol

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

Dropping and Adding

Students are responsible for understanding the policies and procedures about add/drop, grade forgiveness, etc. Refer to the current semester's Catalog Policies section at http://info.sjsu.edu/static/catalog/policies.html. Add/drop deadlines can be found on the current academic calendar web page at http://www.sjsu.edu/provost/Academic_Calendars/. The Late Drop Policy is available at http://www.sjsu.edu/aars/policies/latedrops/policy/**.** Students should be aware of the current deadlines and penalties for dropping classes.

Information about the latest changes and news is available at the Advising Hub at http://www.sjsu.edu/advising/.

University Policies

Academic integrity

Your commitment as a student to learning is evidenced by your enrollment at San Jose State University. The University's Academic Integrity policy, located at http://www.sjsu.edu/senate/S07-2.htm, requires you to be honest in all your academic course work. Faculty members are required to report all infractions to the office of Student Conduct and Ethical Development. The Student Conduct and Ethical Development website is available at http://www.sjsu.edu/studentconduct/.
Instances of academic dishonesty will not be tolerated. Cheating on exams or plagiarism (presenting the work of another as your own, or the use of another person's ideas without giving proper credit) will result in a failing grade and sanctions by the University. For this class, all assignments are to be completed by the individual student unless otherwise specified. If you would like to include your assignment or any material you have submitted, or plan to submit for another class, please note that SJSU's Academic Integrity Policy S07-2 requires approval of instructors.

Campus Policy in Compliance with the American Disabilities Act

If you need course adaptations or accommodations because of a disability, or if you need to make special arrangements in case the building must be evacuated, please make an appointment with me as soon as possible, or see me during office hours. Presidential Directive 97-03 at http://www.sjsu.edu/president/docs/directives/PD_1997-03.pdf requires that students with disabilities requesting accommodations must register with the Disability Resource Center (DRC) at http://www.drc.sjsu.edu/ to establish a record of their disability.

EE Department Honor Code

The Electrical Engineering Department will enforce the following Honor Code that must be read and accepted by all students.
"I have read the Honor Code and agree with its provisions. My continued enrollment in this course constitutes full acceptance of this code. I will NOT:

- Take an exam in place of someone else, or have someone take an exam in my place
- Give information or receive information from another person during an exam
- Use more reference material during an exam than is allowed by the instructor
- Obtain a copy of an exam prior to the time it is given
- Alter an exam after it has been graded and then return it to the instructor for re-grading
- Leave the exam room without returning the exam to the instructor."

Measures Dealing with Occurrences of Cheating

Department policy mandates that the student or students involved in cheating will receive an "F" on that evaluation instrument (paper, exam, project, homework, etc.) and will be reported to the Department and the University. A student's second offense in any course will result in a Department recommendation of suspension from the University.

Schedule

WEEK	DATE	TOPICS	READING
1	Wed. 08/23/17	Discrete time systems	Ch. 2.3-6
2	Mon. 08/28/17	Signals and sequences Classification	Ch. 2.1,2
	Wed. 08/30/17	Discrete Time Fourier Transform (DTFT)	Ch. 2.7,8
3	**Mon. 09/04/17**	**Labor Day**	
	Wed. 09/06/17	Discrete Time Fourier Transform (DTFT)	Ch. 2.9
4	Mon. 09/11/17	Z-transform	Ch. 3.1-3
	Wed. 09/13/17	Z-transform	Ch. 3.4-5
5	**Mon. 09/18/17**	DT LTI System Frequency Response	Ch. 5.1-2
	Wed. 09/20/17	DT LTI System Poles and Zeros	Ch. 5.3-5
6	Mon. 09/25/17	**EXAM I**	
	Wed. 09/27/17	DT LTI System Linear Phase FIR filters	Ch. 5.7
7	Mon. 10/02/17	DT LTI System Cascade and Parallel Structure	Ch. 6.1-5
	Wed. 10/04/17	DT LTI System State Space Representation	C:Ch. 7.6
8	Mon. 10/09/17	CT Signals and The Continuous-time Fourier series and transform	C:Ch. 4.1-2
	Wed. 10/11/17	The Continuous-time Fourier transform	C:Ch. 4.3-6
9	**Mon. 10/16/17**	The Continuous-time Fourier transform	C:Ch. 4.3-6
	Wed. 10/18/17	Sampling of Continuous-time signal	Ch. 4.1-2
10	Mon. 10/23/17	Sampling of Continuous-time signal	Ch4.3,4.8.4
	Wed. 10/25/17	Discrete Fourier Series	Ch.8.1-2
11	**Mon. 10/30/17**	**EXAM II**	
	Wed. 11/01/17	Discrete Fourier Transform	Ch. 8.4-6.4
12	Mon. 11/06/17	The DFT: Circular and linear convolutions	Ch. 8.6.5-7
	Wed. 11/08/17	Fast computation of the DFT: The DIT-FFT	Ch. 9.1.1, 9.2
13	Mon. 11/13/17	Practical considerations; computational examples	Ch. 9.4
	Wed. 11/15/17	CT LTI Systems: Review of the 1-and 2-sided Laplace transform	Ch. 9.3
14	Mon. 11/20/17	CT LTI Systems: Convolution and the Transfer function	Ch. 8.1-2, 8.2-7
	Wed. 11/22/17	**Non-Instructional Day**	
15	Mon. 11/27/17	CT LTI Systems: State space modeling	C:8.3-5, 8.9-12
	Wed. 11/29/17	Poles & zeros; Steady-state and transient responses	C:Ch. 9.4
16	Mon. 12/04/17	Stability; Frequency response	C:Ch. 9.5,7
	Wed. 12/06/17	Stability; Frequency response	C: Ch 9.8,10
17	Mon. 1211/17	Review	
	Wed. 12/13/17	**COMPREHENSIVE FINAL EXAM 17:15-19:30**	