SAN JOSE STATE UNIVERSITY  
COLLEGE OF ENGINEERING  
DEPARTMENT OF ELECTRICAL ENGINEERING  

EE210-01, Linear Systems Theory  
Spring 2018  

Instructor: Khosrow Ghadiri  
Office Location: ENGR 255  
Telephone: (408) 924-3916  
Fax: (408) 924-3925  
Email: k.ghadiri@sjsu.edu  
Website URL: TBA  
Office Hours: MW 14:00-15:00, Thursday 12:00-13:00  
Class Days/Time: TR 16:30-17:45  
Classroom: DMH. 135  
Prerequisites: Graduate student standing  

Course Description  

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 (FFT) 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:

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” 

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 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: 10%
- Quizzes: 15%
- Midterm: 35%
- Final exam: 40%
- 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.

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.
<table>
<thead>
<tr>
<th>WEEK</th>
<th>DATE</th>
<th>TOPICS</th>
<th>READING</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Thurs. 01/25/18</td>
<td>Signals and sequences Classification</td>
<td>Ch. 2,1,2</td>
</tr>
<tr>
<td>2</td>
<td>Tues. 01/30/18</td>
<td>Basic Signals and sequences and their operation</td>
<td>Ch. 2,1,2</td>
</tr>
<tr>
<td></td>
<td>Thurs. 02/01/18</td>
<td>Periodic Signals Decomposition (CTFS)</td>
<td>C:Ch. 4,1,2</td>
</tr>
<tr>
<td>3</td>
<td>Tues. 02/06/18</td>
<td>Periodic Signals Decomposition (CTFS)</td>
<td>Ch. 2,3-6</td>
</tr>
<tr>
<td></td>
<td>Thurs. 02/08/18</td>
<td>A periodic signals Decomposition (CTFT)</td>
<td>C:Ch. 4,3-6</td>
</tr>
<tr>
<td>4</td>
<td>Tues. 02/13/18</td>
<td>Periodic Sequence decomposition (DTFS)</td>
<td>Ch. 8,6,5-7</td>
</tr>
<tr>
<td></td>
<td>Thurs. 02/15/18</td>
<td>Aperiodic Sequence decomposition (DTFT)</td>
<td>Ch. 2,9</td>
</tr>
<tr>
<td>5</td>
<td>Tues. 02/20/18</td>
<td>(DFT)</td>
<td>Ch. 8,4-6,4</td>
</tr>
<tr>
<td></td>
<td>Thurs. 02/22/18</td>
<td>The DFT: Circular and linear convolutions</td>
<td>Ch. 9,1,1, 9,2</td>
</tr>
<tr>
<td>6</td>
<td>Tues. 02/27/18</td>
<td>The DFT: Circular and linear convolutions</td>
<td>Ch. 9,1,1, 9,2</td>
</tr>
<tr>
<td></td>
<td>Thurs. 03/01/18</td>
<td>Fast Fourier Transform (Algorithm)</td>
<td>Ch. 9,4</td>
</tr>
<tr>
<td>7</td>
<td>Tues. 03/06/18</td>
<td>Analog and Digital Systems</td>
<td>Ch. 2,3-6</td>
</tr>
<tr>
<td></td>
<td>Thurs. 03/08/18</td>
<td>Analog and Digital Systems</td>
<td>Ch. 2,3-6</td>
</tr>
<tr>
<td>8</td>
<td>Tues. 03/13/18</td>
<td>Z-transform</td>
<td>Ch. 3,1-3</td>
</tr>
<tr>
<td></td>
<td>Thurs. 03/15/18</td>
<td>z-transform</td>
<td>Ch. 3,4-5</td>
</tr>
<tr>
<td>9</td>
<td>Tues. 03/20/18</td>
<td>MIDTERM EXAM</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Thurs 03/22/18</td>
<td>DT LTI System Cascade and Parallel Structure</td>
<td>Ch. 6,1-5</td>
</tr>
<tr>
<td>10</td>
<td>Tues. 03/27/18</td>
<td>Spring Recess</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Thurs. 03/29/18</td>
<td>Spring Recess</td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>Tues. 04/03/18</td>
<td>DT LTI System Poles and Zeros</td>
<td>Ch. 5,3-5</td>
</tr>
<tr>
<td></td>
<td>Thurs. 04/05/18</td>
<td>DT LTI System Linear Phase FIR filters</td>
<td>Ch. 5,7</td>
</tr>
<tr>
<td>12</td>
<td>Tues. 04/10/18</td>
<td>DT LTI System State Space Representation</td>
<td>C: Ch. 7,6</td>
</tr>
<tr>
<td></td>
<td>Thurs. 04/12/17</td>
<td>CT LTI System State Space Representation</td>
<td>Chapter 10</td>
</tr>
<tr>
<td>13</td>
<td>Tues. 04/17/18</td>
<td>Modulation</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Thurs. 11/19/18</td>
<td>Sampling of Continuous-time signal</td>
<td>Ch. 4,1-2</td>
</tr>
<tr>
<td>14</td>
<td>Tues. 04/24/18</td>
<td>Sampling of Continuous-time signal</td>
<td>Ch. 4,3,4,8,4</td>
</tr>
<tr>
<td></td>
<td>Thurs. 04/26/18</td>
<td>CT LTI Systems: Review of the 1-and 2-sided Laplace transform</td>
<td>Ch. 8,1-2, 8,2-7</td>
</tr>
<tr>
<td>15</td>
<td>Tues. 05/01/18</td>
<td>CT LTI Systems: Convolution and the Transfer function</td>
<td>Ch. 8,3-5, 8,9-12</td>
</tr>
<tr>
<td></td>
<td>Thurs. 05/03/18</td>
<td>Poles &amp; zeros; Steady-state and transient responses</td>
<td>Ch. 9,4</td>
</tr>
<tr>
<td>16</td>
<td>Tues. 05/08/18</td>
<td>Stability; Frequency response</td>
<td>Ch. 9,5,7</td>
</tr>
<tr>
<td></td>
<td>Thurs.05/10/18</td>
<td>Stability; Frequency response</td>
<td>Ch. 9,8,10</td>
</tr>
<tr>
<td></td>
<td>Thurs. 05/17/18</td>
<td>COMPREHENSIVE FINAL EXAM 14:45-17:00</td>
<td></td>
</tr>
</tbody>
</table>