EE 310: Linear Systems & DSP I

Fall 2017
Classroom: KC101
Days: MWF
Time: 2:00-2:50 P.M.
Website: http://csserver.evansville.edu/~richardson

Course Structure: This is a flipped classroom. Students are expected to watch the relevant video lectures prior to class. Each class period will begin with a short quiz over topics covered in the video lectures. Class time will be spend working homework problems.

Grading: There will be three midterm exams and a comprehensive final exam. The project assignments will typically require the use of one of the software packages listed above. Homework assignments will be given on an approximately weekly basis. Short quizzes will be given at the beginning of almost every lecture period. Quizzes are used to encourage regular and on-time attendance.

<table>
<thead>
<tr>
<th>Item</th>
<th>Weight</th>
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<tbody>
<tr>
<td>Three Midterm Exams</td>
<td>45%</td>
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<tr>
<td>Final Exam</td>
<td>20%</td>
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<tr>
<td>Projects</td>
<td>15%</td>
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<tr>
<td>Homework</td>
<td>10%</td>
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<tr>
<td>Quizzes</td>
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Credit Hour Policy: This course meets the federal requirements of 15 in-class hours plus an expected 30 hours of out-of-class work per credit hour over a semester. (At least 135 hours total; 9 per week)

Text:

Software:
- MATLAB/Octave: Numerical Analysis Software Package
- LTSpice Circuit Simulator

Class Policies: Students are expected to abide by the Academic Honor Code. No aid should be given or requested on any examination. Students may collaborate on homework (in fact, this is encouraged), but each student must submit their own work. Each student is expected to be able to recreate any homework solutions submitted.

Disability Policy: It is the policy and practice of the University of Evansville to make reasonable accommodations for students with properly documented disabilities. Students should contact the Office of Counseling and Health Education at 488-2663 to seek services or accommodations for disabilities. Written notification to faculty from the Office of Counseling and Health Education is required for academic accommodations.
Class Communication: To receive notifications (class reminders, assignment hints and corrections, answers to exam questions, etc) from the instructor related to this course do one (or both) of the following: (1) text @ue-ee310 to 81010 (or 812-301-1469) to receive notifications by text, (2) send email (empty subject and body are ok) to ue-ee310@mail.remind.com to receive notifications by email. Alternatively, browse to remind.com/join/ue-ee310 to join OR install the Remind app or your smart phone/pad (Apple, Android) to join and receive notifications. To receive more general notifications from Dr. Richardson (class cancellations, departmental event reminders, winning lottery numbers, etc) please also text @ue-rich to 81010 (or 812-301-1469) or send email to ue-rich@mail.remind.com. Note that I remove all participants from all of my Remind classes at the end of the every semester, so you will need to rejoin the ue-rich class even if you have previously been a member.

Topics:
• Characterization and composition of continuous-time (CT) and discrete-time (DT) signals.
• Characterization of CT and DT systems (linear, time-invariant, causal, memory, stable).
• Finding the output of CT and DT systems via convolution.
• Finding the Fourier, Laplace and z transforms of signals.
• Finding the output of CT and DT systems via transform methods.
• Determine the signal spectra of CT and DT signals.
• Frequency response of CT and DT systems.
• Modeling of systems using Laplace transforms.
• Sampling of CT signals.

Course Objectives
• Students will be able to characterize continuous time (CT) and discrete time (DT) signals as even, odd, or periodic.
• Students will be able to apply common time and amplitude transformations to CT and DT signals.
• Students will be able to model finite duration CT and DT polynomial signals using a sum of singularity functions.
• Students will be able to characterize CT and DT systems as being: memoryless, invertible, causal, stable, time invariant, or linear.
• Given an input signal and the system impulse or step response students will be able to use convolution to determine the system output for both CT and DT systems.
• Student will be able to determine the output of a CT or DT system given the system transfer function and a complex-exponential input.
• Given a differential (CT) or difference (DT) equation model for a system, students will be able to represent the system using simulation diagrams.
• Students will be able to determine the Fourier series of common periodic CT signals.
• Students will be apply to apply common CT signal transformations to extend the applicability of tables of Fourier series representations.
• Given a Fourier series representation of a system input and the system transfer function, students will be able to determine the Fourier series representation of the output.
• Students will be able to apply the Fourier transform to determine the frequency spectra of common CT signals.
• Given a frequency spectrum, students will be able to find the corresponding magnitude and phase spectrum.
• Students will be able to determine the output of a CT system using Fourier transform techniques.
• Students will be able to explain the relationship between the impulse and frequency responses.
• Students will be able to find energy and power spectra of common CT signals.
• Students will be able to find the Laplace transform of common engineering CT signals.
• Students will be able to apply Laplace transform methods to determine the output of a given CT system.

University Objectives
• Students will acquire a depth of knowledge in one or more disciplines of their choice.
• Students will master communication, organizational and critical thinking skills.
• Students will develop skills and competencies to be productive team members and leaders.
• Students will seek and use available resources, including technology, to answer questions and solve problems.
Lecture Schedule
This schedule is tentative. The instructor reserves the right to change it.

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<thead>
<tr>
<th>Monday</th>
<th>Wednesday</th>
<th>Friday</th>
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<tbody>
<tr>
<td>Period 4 (Aug 30)</td>
<td>S 1.8: Diff. Equation Models of Systems</td>
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<tr>
<td>Sep 4</td>
<td>Period 6 (Sep 6)</td>
<td>S 2.3-2.4: Impulse Response, The Zero-State Response</td>
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<td>Period 8 (Sep 11)</td>
<td>Period 9 (Sep 13)</td>
<td>S 2.6-2.7: System Stability, System Behavior</td>
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<tr>
<td>Sep 18</td>
<td>Period 12 (Sep 20)</td>
<td>S 3.7-3.8: Impulse Response, Zero-State Response</td>
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<tr>
<td>Sep 25</td>
<td>Period 15 (Sep 27)</td>
<td>EXAM I Chapters 1 - 3</td>
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<tr>
<td>Oct 2</td>
<td>Period 18 (Oct 4)</td>
<td>S 4.3: Solution of Differential Equations</td>
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<tr>
<td>Oct 16</td>
<td>Period 23 (Oct 18)</td>
<td>S 5.1-5.2: The z-Transform</td>
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<tr>
<td>Oct 23</td>
<td>Period 26 (Oct 25)</td>
<td>S 5.7-5.8: Digital Processing of Analog Signals</td>
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<td>Oct 30</td>
<td>Period 29 (Nov 1)</td>
<td>S 6.3: Exponential Fourier Series</td>
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<td>Oct 31</td>
<td>Period 32 (Nov 8)</td>
<td>S 7.3: Properties of the Fourier Transform</td>
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<td>Oct 20</td>
<td>Period 37 (Nov 20)</td>
<td>S 8.3-8.4: Analog-to-Digital Conversion, Spectral Sampling</td>
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<td>Nov 4</td>
<td>Period 41 (Dec 4)</td>
<td>S 9.4: System Analysis Using the DTFT</td>
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The Final Exam is on Monday, December 11th at 2:00 PM