EEE 678 – DIGITAL SIGNAL PROCESSING

Instructor: Dr. Eli Saber
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Course Structure: Lecture Hours = 2.5 hrs/wk, Total Credits = 3
Pre-requisites: EEEE-353: Linear Systems

Course Description:
Topics Covered Include: Z-Transforms, Sampling, Sampling Rate Conversion, Multi-rate Signal Processing; Transform Analysis of LTI Systems; Design of Digital IIR Filters; Design of Digital FIR Filters with emphasis on Linear Phase Response; Discrete Fourier Transform (DFT); Fast Fourier Transform (FFT) Algorithms for implementing the DFT including Radix 2, Radix 4 and Mixed Radix Algorithms; Quantization Effects in Discrete Systems; and applications of Digital Signal Processing.

Required Textbook:

Course Objectives: A student who successfully fulfills the course requirements will be able to:
1) Utilize the concepts of sampling to process 1D & 2D continuous-time signals, change the sampling rates using discrete-time processing, and develop an understanding of multi-rate signal processing.
2) Define the class of ideal, frequency selective filters and deduce their system function.
3) Understand phase response / phase distortion and its relationship to the magnitude response.
4) Design IIR Filters using impulse invariance and bilinear transformation techniques.
5) Design FIR filters using windowing techniques, and the Parks-McClellan algorithm.
6) Utilize the Discrete Fourier Transform (DFT), comprehend its properties and relationship to the Continuous Fourier Transform, the Fourier Series and the Discrete-Time Fourier Transform.
7) Understand how to compute the DFT using Fast Fourier Transform (FFT) type-Algorithm.
8) Utilize the above techniques for signal and image processing examples & applications.

Reference Books:
6) Schilling and Harris, “Digital Signal processing”, Thomson
7) Signal Processing Magazine – 6 issues per year on Signal Processing Applications.

Grading Policy:
<table>
<thead>
<tr>
<th>Component</th>
<th>Weight</th>
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<tbody>
<tr>
<td>Homework</td>
<td>10%</td>
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<tr>
<td>Matlab Projects</td>
<td>5%</td>
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<tr>
<td>Short Quizzes</td>
<td>15%</td>
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<tr>
<td>Midterm I</td>
<td>30%</td>
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<tr>
<td>Midterm II</td>
<td>40%</td>
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**Course Grade Evaluation Criteria:**

1) **Homework:**
   a. Weekly **mandatory** homework will be assigned and collected on the agreed upon due date. Please follow the format discussed in class. In general, the homework is due when the next homework is assigned.
   b. Solutions will be made available in a timely manner.

2) **Projects:**
   a. **Mandatory** Matlab projects will be assigned throughout the course and will be collected on the agreed upon due date. In general, the project is due when the next one is assigned.
   b. Please provide a 1-2 page write-up showing/discussing results, graphs, etc. and answering questions as requested in the assignment. Please attach your code in the Appendix.

3) **Exams:**
   a. A midterm and a final exam will be given during the quarter.
   b. The exams will be based on the homework, lectures, projects, and assigned reading.

**General Guidelines:**

1) Please do not wait to the last minute to do the homework, projects or study for the exams.
2) It is highly recommended that you make every effort to attend every lecture. The material covered in the lecture is designed to focus on the most pertinent concepts of the course. If you should miss a lecture, please make every effort to get a copy of the lecture material from your fellow students.
3) If you are having trouble with the material or need more personal attention, please do not hesitate to make use of my office hours as early as possible. Please do not wait to the last minute.

**Special Needs:**
Students that have special needs that go beyond those of the usual student – aside from students who are already classified as deaf or hearing-impaired and are listed as such on the class roster – must present documentation to the instructor to certify the nature of his/her needs at the beginning of the quarter. This will allow the instructor to plan ahead in order to assist the student(s) meet his/her course objectives.