ECE 4624 Digital Signal Processing and Filter Design

Index: 91550, Class: Tue. & Thu. 12:30 PM - 1:45 PM, Hutcheson Hall 310
(Only for Graduate Students)
Web: http://www.ee.vt.edu/ha/courses/ece4624

Instructor:
Dr. Dong s. Ha
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Phone: 231-4942 (office) 552-1965 (home)
E-mail: ha@vt.edu
Office Hours: Tue. & Wed.: 3-5 PM or by appointment

Class Description:
Analysis, design, and realization of digital filters, discrete Fourier transform algorithms, filter design procedures, coefficient quantization, finite wordlength arithmetic, fixed point implementation, decimation, and interpolation

Prerequisite:
ECE 3704 Continuous and Discrete System Theory

Textbook:

Software:
Student edition of Matlab, Release 11 or later

Homework:
The main purpose of the homework is for your edification and practice. Homework is due at the beginning of the class period. Late homework will not be accepted.

Midterm:
October 9 (Tuesday), Closed book and note. You are permitted to use two 8.5"x11", two-sided formula sheets during the exam.

Projects:
Three projects will be assigned to provide you with an opportunity to further explore the course material. It is team work, and each team comprises of two students. Each team will submit one report, so that both you and your partner will receive the same grade. Projects are due at the beginning of the class period. No late project reports will be accepted. An oral presentation is required for the final project. Expectations for the project reports and the final oral presentation will be discussed in class.

Oral presentation:
Date: December 8 (Saturday)
9 AM – Noon, 1 PM – 5 PM, 7 – 10 PM
The location will be announced later in class.

Final Exam:
There is no final exam.
Final Course Grading:

Homework: 10 %
Midterm: 25 %
Projects:
  Project 1 20 %
  Project 2 20 %
  Project 3 25 %

The course grade will be based on both absolute and relative performance measured according to the above weights. Letter grades will not be determined by a fixed curve or a fixed range.

Honor Code Requirements:

Honor code adherence is expected in all phases of this course. It is recommended to familiarize yourself with the Honor Code of Virginia Tech; the web address is http://fbox.vt.edu:10021/studentinfo/gradhonor/ for graduate students.

All graded work is expected to be the original work of the individual, or of the team, unless otherwise directed by the instructor. In working on homework and projects, discussion and cooperative learning is encouraged. However, copying or using another person or team’s designs, or solutions is an honor code violation. Please discuss any questions that you may have about what is permitted or not permitted with the instructor. It behooves you to cultivate an ethical and professional attitude.
# Tentative Course Schedule

<table>
<thead>
<tr>
<th>Wk</th>
<th>Date</th>
<th>Topics</th>
<th>Reading</th>
<th>Special Event</th>
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<tbody>
<tr>
<td>1</td>
<td>Aug. 28 - Aug. 30</td>
<td>Introduction, Sampling Theorems</td>
<td>Ch 1</td>
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<tr>
<td>2</td>
<td>Sept. 4 - Sept. 6</td>
<td>Discrete Time Signals and Systems, Z-Transform</td>
<td>Ch 2 and Ch. 3</td>
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<tr>
<td>3</td>
<td>Sept. 11 - Sept. 13</td>
<td>Frequency Analysis of Signals</td>
<td>Ch. 4</td>
<td>No class on Sept. 13</td>
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<td>4</td>
<td>Sept. 18 - Sept. 20</td>
<td>Frequency Analysis of Signals, Fourier, Properties of DFT</td>
<td>Ch. 4, 5. 1-5.2</td>
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<td>5</td>
<td>Sept. 25 - Sept. 27</td>
<td>Circular Convolution, Linear Filtering with DFT and Radix-2 FFT Algorithm</td>
<td>5.2 – 5.3, 6.1</td>
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<td>6</td>
<td>Oct. 2 - Oct. 4</td>
<td>Radix-2 FFT and Other Algorithms, Ideal and Practical Filters</td>
<td>6.1</td>
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<td>7</td>
<td>Oct. 9 - Oct. 11</td>
<td>Linear Phase FIR Filter Design Using Windows</td>
<td>8.1 – 8.2</td>
<td>Midterm on Oct. 9</td>
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<td>8</td>
<td>Oct. 16 - Oct. 18</td>
<td>Linear Phase FIR Filter Design by Frequency Sampling Method, Equipripple, Linear Phase FIR Filter Design</td>
<td>8.2</td>
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<td>10</td>
<td>Oct. 30 - Nov. 1</td>
<td>IIR Filter Design from Various Analog Filters, Frequency Transformations, IIR Filter Design Using Least Squares Methods</td>
<td>8.3 - 8.5</td>
<td>No class on Oct. 30, Makeup Class at 7 PM, Nov. 4</td>
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<td>11</td>
<td>Nov. 6 - Nov. 8</td>
<td>IIR Filter Design Using Least Squares Methods</td>
<td>8.5</td>
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<td>12</td>
<td>Nov. 13 – Nov. 15</td>
<td>FIR and IIR Filter Structures</td>
<td>7.1 – 7.3</td>
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<td>13</td>
<td>Nov. 27 – Nov. 29</td>
<td>A/D Conversion, Rounding/Truncation Errors, Quantization of Filter Coefficients</td>
<td>1.4, 7.5 – 7.6</td>
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<td>14</td>
<td>Dec. 4 – Dec. 6</td>
<td>Multirate Digital Signal Processing</td>
<td>10.1 – 10.4, 10.6</td>
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<td>Dec. 8 (Saturday)</td>
<td>Project Presentation</td>
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<td>15</td>
<td>Dec. 11</td>
<td>Review</td>
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It is easier to keep up than catch up. Hope you work hard, learn a lot and enjoy the course.