Prerequisites/corequisites:
ELEC 309, ELEC 330

Course Description:
Introduction to the characteristics, design, and applications of discrete-time systems. Continuous
time and discrete time Fourier Transforms. FIR and IIR Systems. Design of FIR and IIR filters.
Design of Chebyshev and Butterworth filters. Introduction to DSP architecture

Instructor:
Professor Siripong Potisuk
Office: GRIMS 329
Phone: (843) 953-4895
E-mail: siripong.potisuk@citadel.edu
Office hours: 1500 – 1700 TR, 1100 – 1200 MWF. Others by appointment

Class schedule: (Three Credit Hours)
Section 01: 1300 – 1415, TR Room: GRIMS 328

Required Text:
John Leis, Digital Signal Processing Using MATLAB for Students and Researchers, Wiley & Sons,

References:
(ISBN: 978-0-12-374090-8)

Course Webpage:
http://faculty.citadel.edu/potisuk

Course Objectives:
This course is aimed at the study of the fundamentals of discrete-time signals, systems and modern
digital signal processing including spectral analysis and filter design. Real-time implementation is
to provide hands-on design experience. Applications in communications, speech, and image
processing will also be discussed in order to strengthen students’ understanding of the foundations
of DSP and their ability to apply linear system analysis to engineering problems.

Course Outcomes:
A student who successfully fulfills the course requirements will have demonstrated
1. Describe the Sampling Theorem and how it relates to Aliasing and Folding.
2. Understand the relationship between poles, zeros, and stability of discrete-time systems
3. Determine the spectrum of a signal using the DFT, FFT, and spectrogram.
4. Determine the frequency response of FIR and IIR filters.
5. Be able to design, analyze, and implement digital filters in MATLAB
6. Be able to implement filters and DSP algorithms on a digital signal processor.
Grading Policy:

Homework/Laboratory Exercises 20%
Two In-class Tests 40%
Computer/Hardware Projects 40%
The following grading system will be adopted as a guideline for assigning a letter grade. This
guideline is subject to change depending upon the overall class performance as well.

A : 90 – 100%  B : 80 – 89.9%  C : 70 – 79.9%  D : 60 – 69.9%  F : 0 – 59.9%

Homework:
1) Homework will be assigned on a weekly basis and must be turned in at the beginning of class on
the due date. Only neat and legible work will be accepted. Thus, it is recommended that all homework
be written in pencil and only on one side of engineering paper. Late homework will incur a 50%
penalty and be accepted no later than one week from the due date.
2) Homework will be graded for effort and correctness. Solutions will be distributed in class or
uploaded to the course webpage one week after the due date. It is imperative that student periodically
check the course webpage for updates and important news pertaining to the class.

Computer/Hardware Projects:
MATLAB/LabView computer projects form an integral part of this course and will be assigned
throughout the semester. Students are expected to be well versed in MATLAB programming.
Hardware laboratories/projects based on Texas Instruments’ digital signal processors may be
designed to reinforce DSP concepts through real-time implementation.

Attendance:
Class attendance is mandatory. Student is required to notify the instructor, if possible, in advance
should it be necessary to miss a class for any reason and will be responsible for any material missed.
Absences in excess of 20% of the class meetings will result in a failing grade for the course. It is
noted that the date of the final exam is set by the Registrar’s office and cannot be changed.
Unexcused absence from a test or final exam will result in a zero for that test or exam. Excused
absence will be granted under extreme circumstances only (guard duty is not considered an extreme
circumstance).

Classroom Policy
Classroom environment is an important factor for effective learning. Students are expected to strictly
follow certain rules and regulations so as not to create unnecessary distractions and interruptions
during class.
1) Food and drinks are strictly prohibited in the classroom.
2) All electronic devices with audible alarms (cell phones, pagers, watches etc.) must be turned off.
3) Students are expected to show up to class on time. Attendance will be called at the beginning of
every class, and the results reported via the Citadel’s electronic class absence system.
4) Students are to refrain from talking to other students during class. Extraneous conversation creates
noise and diminishes one’s ability to concentrate and pay attention.

Special Accommodations:
Any students requiring special accommodations for learning disabilities should provide the instructor
with verifiable written documentation of their needs as early in the semester as possible (i.e., within
the first two weeks of the semester). This will ensure that the students have ample opportunity to
succeed in their academic pursuits.

Academic Honor Policy:
While it is permissible and recommended to rely on fellow students for assistance outside of
classroom, it is not permissible to copy any portion of another student's work and pass it off as your
own. Cheating and/or plagiarism in any form will be fully prosecuted under the Citadel honor code.
**Important Dates:**
- Tuesday, September 3rd: SCCC Drop/Add ends
- Thursday, October 3rd: Test I
- Wednesday, October 23rd: Leadership Development day (No SCCC classes, CGC classes held)
- Tuesday, October 29th: SCCC Last day to withdraw with a “W”
- Friday, November 22nd: Fall Break Begins After Last Class
- Sunday, December 1st: Fall Break Ends
- Wednesday, December 11th: SCCC Last Day of Class

**Lesson Plan:**

<table>
<thead>
<tr>
<th>Week</th>
<th>Date</th>
<th>Topics</th>
<th>References</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>08/28 − 08/30</td>
<td>Introduction to Digital Signal Processing</td>
<td>Chapter 1</td>
</tr>
<tr>
<td>2</td>
<td>09/02 − 09/06</td>
<td>Frequency Domain Representation of Continuous-time Signals, CTFS, CTFT</td>
<td>Sections 7.3 – 7.6</td>
</tr>
<tr>
<td>3</td>
<td>09/09 − 09/13</td>
<td>Discrete-time Signals, Sampling Continuous-time Signals, A/D Conversion</td>
<td>Sections 3.3 – 3.9</td>
</tr>
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<td></td>
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<td>Aliasing, and Reconstruction</td>
<td>5.3</td>
</tr>
<tr>
<td>4</td>
<td>09/16 − 09/20</td>
<td>Frequency Domain Representation of Discrete-time Signals, Spectral</td>
<td>Sections 7.7 – 7.12</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Analysis, Fast Fourier Transform (FFT), STFT</td>
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</tr>
<tr>
<td>5</td>
<td>09/23 − 09/27</td>
<td>Random Signals</td>
<td>Chapter 4</td>
</tr>
<tr>
<td>6</td>
<td>09/30 − 10/04</td>
<td>Characterization and Analysis of LTID Systems Using the z-Transform</td>
<td>Section 3.10 – 3.12</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Transfer Function, Impulse Response and Convolution, System Realization, System Stability, Test I</td>
<td>5.4 – 5.9</td>
</tr>
<tr>
<td>7</td>
<td>10/07 – 10/11</td>
<td>Temporal and Spatial Signal processing, Correlation, Linear Prediction</td>
<td>Sections 6.3 – 6.5</td>
</tr>
<tr>
<td>8</td>
<td>10/14 – 10/18</td>
<td>Digital Filter Specifications and Structures, Implementation of Digital Filters</td>
<td>Sections 8.3 – 8.5</td>
</tr>
<tr>
<td>9</td>
<td>10/21 – 10/25</td>
<td>FIR (Nonrecursive) Digital Filter Design, Linear Phase Filters</td>
<td>Sections 8.6 – 8.8</td>
</tr>
<tr>
<td>10</td>
<td>10/28 – 11/01</td>
<td>Classical Analog Filters, Butterworth Filters</td>
<td>Sections 9.3 – 9.5</td>
</tr>
<tr>
<td>11</td>
<td>11/04 – 11/08</td>
<td>IIR (Recursive) Digital Filter Design, Scaling and Transformation of Continuous Filters</td>
<td>Sections 9.6 – 9.9</td>
</tr>
<tr>
<td>12</td>
<td>11/11 – 11/15</td>
<td>Introduction to DSP Architecture, Texas Instrument Code Composer Studio (CCS)</td>
<td>Notes</td>
</tr>
<tr>
<td>13</td>
<td>11/18 – 11/22</td>
<td>Test II</td>
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</tr>
<tr>
<td>14</td>
<td>11/25 – 11/29</td>
<td><strong>FALL BREAK</strong></td>
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</tr>
<tr>
<td>15</td>
<td>12/02 – 12/06</td>
<td>DSP Integration Examples</td>
<td>Notes</td>
</tr>
<tr>
<td>16</td>
<td>12/09 – 12/11</td>
<td>DSP System Design: Hybrid Programming of Dual Tone Multi-Frequency System</td>
<td>Notes</td>
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Telling the Truth to Students

Based on an article by Stephen Zucker, John Hopkins University, published in the AMS Notices.

I hear it over and over from college professors: “One of the biggest stumbling blocks holding my students back is the mistaken impression that college is simply a continuation of high school.”

It is essential that the difference between high school and college be explained to students early in their coursework.

There are two primary differences between college and high school.

1. In college, learning no longer takes place primarily in the classroom.

2. The student, and not the instructor, is now primarily responsible for how much is learned.

Where does learning take place at a college or university? Think about it. In dorm rooms? The library? Computer labs? Group meetings? In quiet, out-of-the-way places of individual study, reflection, and practice?

Yes, some learning may still take place in the classroom. But the majority must now take place in other environments, especially at the upper division. There simply isn’t time in three hours per week for fifteen weeks to learn even a significant minority of the material that must be mastered in a college course.

So, given point number one, point number two is obvious. The student must now assume primary responsibility for seeing that learning takes place.

From these two primary differences, we can derive four operational postulates for functioning in the college environment.

A New Level of Responsibility: While guided by instructors and advisors, the student is responsible from now on for his or her own education. The student determines how much study time to devote, how much effort to expend, and how much repetition, practice, and review is needed for mastery of the material. The student must periodically self-assess and adjust the amount of time and effort accordingly. The student can not expect the instructor to assign enough, and only enough, reading & homework to facilitate learning and mastery.

New Use of Peer Group: Most students are no longer well above the majority of their classmates, as they were back in high school. This initially might disappoint some high-ego students, but they should realize that this new peer group can contribute significantly to the educational process. These new peers, if properly utilized, can be a powerful tool in achieving a good education.

New Level of Learning: The goal of college is to learn flexibly, so that you can judge what applies in new situations, and be able to use your learning. It is no longer sufficient just to acquire new knowledge, although that will still be expected. You must also learn to apply knowledge & understanding to new situations, situations never encountered before. A good college exam will surprise you by asking for a solution to a problem that has not been demonstrated in the classroom, the textbook, or anywhere else for that matter. It is this new level of learning that gives the college education its worth in the world.

New Roles for the Student and Instructor: In college, the instructor’s role is to guide the students’ learning. It is not to “cover the material”. It is not to “go over everything you need to know”. It is not to show students how to solve all the problems. It is not to teach everything to the student. Teaching in college becomes a cooperative effort between the instructor and the student. Thus, there is a corresponding change in what is expected of the student. Students must recognize that they are now expected to take the initiative. Instructors no longer “hound” students to study, do homework, do extra out-of-class reading, etc. If a student doesn’t take the initiative, then the student doesn’t pass. Discovery, repetition, practice, and mastery move out of the classroom and into the students’ individual purview. A student who recognizes this can truly tailor and optimize the learning process.

By understanding the fundamental differences between high school and college, students can better adjust, take charge of their education, make the best use of their time, and get more for their education investment.