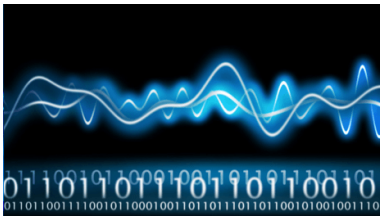


ELC 4351: Digital Signal Processing

8:00 – 9:15 AM Tuesday, Thursday

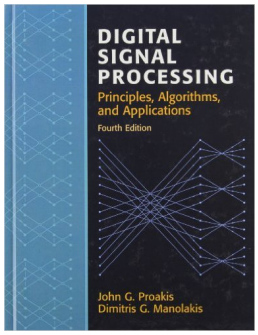
Rogers ECS Building 204

Dr. Liang Dong

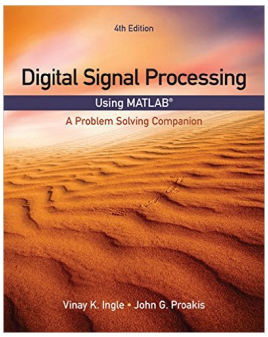
E-mail: liang_dong@baylor.edu
Phone: (254) 710-4589
Website: http://www.profdong.com/
Office Location: Room 301B (Rogers ECS Building)
Office Hours: TR 2:30 – 4:30 PM; Other by appointment

Course Description:
This course is a senior-level engineering course. It presents the fundamentals of discrete-time signals, systems, and modern digital processing and applications. Topics include discrete-time signals and systems, sampling theory, discrete Fourier transforms, z-transforms, linear system analysis, spectral analysis, digital filter design, adaptive filtering, and digital signal processing applications. In addition, the course explores basic concepts of advanced topics such as signal processing for communication and networking, multimedia signal processing, and signal processing for big data and artificial intelligence. The theories are validated through extensive computer simulations and classroom demonstrations.

Prerequisite(s):	ELC 3335 – Signals and Systems STA 3381 – Probability and Statistics
Credit Hours:	3
Textbook 1:	*Digital Signal Processing* Pearson Prentice Hall, 4th Edition, 2006
Author(s):	John G. Proakis and Dimitris K Manolakis
ISBN-13:	9780131873742



Textbook 2: *Digital Signal Processing Using MATLAB: A Problem Solving Companion*
Cengage Learning, 4th Edition, 2016
Author(s): Vinay K. Ingle and John G. Proakis
ISBN-13: 9781305635128



Note: Textbooks are recommended. There will be handouts in the classroom.

Course Objectives:

At the completion of this course, you will be able to:

1. Apply digital signal processing fundamentals.
2. Understand the processes of analog-to-digital and digital-to-analog conversion.
3. Master the representation of discrete-time signals in the frequency domain, using z-transform and discrete Fourier transform (DFT).
4. Understand the implementation of the DFT in terms of the fast Fourier transform (FFT), as well as some of its applications (computation of convolution sums, spectral analysis).
5. Learn the basic forms of FIR and IIR filters, and how to design filters with desired frequency responses.
6. Appreciate relationships between first order low pass, and high pass filters, and between second-order Peaking and Notching filters. Design digital filters using Matlab.
7. Use appropriate windows to diminish the effect of leakage.
8. Learn the design procedures for filter bank.
9. Do a time-frequency analysis of a signal.
10. Become aware of some applications of digital signal processing.
11. Understand concepts of signal processing for communication and networking, multimedia, big data, and artificial intelligence.

Computer Usage:

Matlab and Simulink Signal Processing Toolbox (available on computers of College of Engineering and Computer Science)

We will use computers extensively to program and verify homework assignments. Various software tools are available at the Baylor Engineering Computer Center. To effectively implement and analyze digital communications algorithms, we will program in Matlab (or Python, C if you so prefer).

Classroom Demonstration:

Classroom demo will be carried out with the NI/Ettus Research's USRP (Universal Software Radio Peripheral) testbed. It is a flexible transceiver that connects to a standard PC and makes a wireless

prototyping system.

Reading Assignment, Homework, and Quiz:

There will be biweekly reading assignments. Reading assignments include textbook reading and technical paper reading. The outcome of your reading assignments will be evaluated through classroom discussions and quizzes.

There will be homework assignments every two to three weeks. Homework may include written problems and computer programming problems.

There will be frequent in-class quizzes. Each quiz has a few questions that are related to the knowledge covered in the previous classes and/or the current class. The quiz is designed to measure your classroom involvement and learning effectiveness.

Midterm Exams:

There will be three in-class midterm exams. The dates for the midterm exams are as follows.

- Midterm Exam 1: Thursday, Sept. 21, 2017
- Midterm Exam 2: Tuesday, Oct. 17, 2017
- Midterm Exam 3: Thursday, Nov. 16, 2017

Final Exam:

The final exam will be a take-home comprehensive exam. The exam problems will be given to you at the last class meeting (Thursday, Nov. 30, 2017). You can use any textbooks and any lecture notes to work on your final exam problems. However, it needs to be done independently.
It is due by the University scheduled final exam time of this class.

Grade Distribution:

Reading Assignment	5%
Homework Assignments	20%
Quizzes	10%
Midterm Exam I	20%
Midterm Exam II	20%
Final Exam	25%

Letter Grade Distribution:

>= 93.00	A	73.00 - 76.99	C
90.00 - 92.99	A-	70.00 - 72.99	C-
87.00 - 89.99	B+	67.00 - 69.99	D+
83.00 - 86.99	B	63.00 - 66.99	D
80.00 - 82.99	B-	60.00 - 62.99	D-
77.00 - 79.99	C+	<= 59.99	F

Course Policies:

- **Quizzes and Exams**
  - Quizzes and exams are closed book, closed notes.

- The two lowest quiz scores will be dropped.
- The lowest midterm exam score will be dropped.
- No "collaboration" in the final take-home exam.
- **No makeup quizzes or exams will be given.**

- **Homework Assignments**
  - You are expected to work independently. **Offering** and **accepting** solutions from others is an act of **plagiarism**, which is a serious offense and **all involved parties will be penalized according to the Academic Honesty Policy**. Discussion amongst students is encouraged, but when in doubt, direct your questions to the professor and the teaching assistant.
  - **No late assignments will be accepted**.

- **Attendance and Absences**
  - This course relies heavily on peer critique and discussion, so it really helps to have the entire class present and ready to engage with the material. I also understand that some conflicts are unavoidable, which is why each of you are being given three (3) free absences. There is no judgment or direct impact on grades from these absences.
  - You are responsible for all missed work, regardless of the reason for absence. It is also the absentee's responsibility to get all missing notes or materials.
  - In the event that you accrue four (4) absences (two full weeks of classes), your final grade will automatically be lowered a full 10 points. Two tardy marks will be considered the same as an absence and will count towards your allotted amount.

Academic Honesty Policy Summary:

Introduction

In addition to skills and knowledge, Baylor University aims to teach students appropriate Ethical and Professional Standards of Conduct. The Academic Honesty Policy exists to inform students and faculty of their obligations in upholding the highest standards of professional and ethical integrity. All student work is subject to the Academic Honesty Policy. Professional and Academic practice provides guidance about how to properly cite, reference, and attribute the intellectual property of others. Any attempt to deceive a faculty member or to help another student to do so will be considered a violation of this standard.

Unauthorized/Excessive Assistance

The student may not give or get any unauthorized or excessive assistance in the preparation of any work.

Authorship

The student must clearly establish authorship of a work. Referenced work must be clearly documented, cited, and attributed, regardless of media or distribution. Even in the case of work licensed as public domain, the student must provide attribution of that work in order to uphold

the standards of intent and authorship.

Declaration

Online submission of, or placing one's name on an exam, assignment, or any course document is a statement of academic honor that the student has not received or given inappropriate assistance in completing it and that the student has complied with the Academic Honesty Policy in that work.

Consequences

An instructor may impose a sanction on the student that varies depending upon the instructor's evaluation of the nature and gravity of the offense. Possible sanctions include but are not limited to, the following: (1) Require the student to redo the assignment; (2) Require the student to complete another assignment; (3) Assign a grade of zero to the assignment; (4) Assign a final grade of "F" for the course. A student may appeal these decisions according to the Academic Grievance Procedure. Multiple violations of this policy will result in a referral to the Conduct Review Board for possible additional sanctions.

Title IX:

TITLE IX OFFICE — If you or someone you know would like help related to an experience of sexual violence including sexual assault, harassment, domestic violence, dating violence, stalking or other type of non-consensual sexual conduct, please contact Patty Crawford, the Title IX Coordinator at Baylor University, by email (Patty_Crawford@baylor.edu) or phone (254-710-8454).

Anonymous reporting for students or third parties is also available on the Title IX website, www.Baylor.edu/TitleIX.

The Title IX office understands the sensitive nature of these situations and can provide information about available on- and off-campus resources, such as counseling and psychological services, medical treatment, academic support, university housing and other forms of assistance. Staff members at the office will also explain your rights and the judicial process options, if you choose to file a complaint with the University. You will not be required to share your experience, and the Title IX Office will keep any information private. The Title IX Office exists to support and empower students, while allowing them to remain in control. If you or someone you know feels unsafe or may be in imminent danger, please call the Baylor Police Department (254-710-2222) or Waco Police Department (9-1-1) immediately.

Tentative Course Outline:

The weekly coverage may change as it depends on the progress of the class.

Week	Content
Aug 22, 24	• Introduction to digital signal processing
Aug 29, 31	• Discrete-time signals and systems
Sep 5, 7	• The z-transform
Sep 12, 14	• Analysis of linear time-invariant systems
Sep 19, 21	• Analysis of linear time-invariant systems • Midterm Exam 1
Sep 26, 28	• Frequency analysis of signals • Frequency-domain analysis of linear time-invariant systems
Oct 3, 5	• Sampling and reconstruction of signals
Oct 10, 12	• The discrete Fourier transform • Fast Fourier transform algorithms
Oct 17, 19	• Midterm Exam 2 • FIR filter design
Oct 24, 26	• IIR filter design
Oct 31, Nov 2	• Adaptive filtering
Nov 7, 9	• Digital signal processing applications
Nov 14, 16	• Digital signal processing applications • Midterm Exam 3
Nov 21	• Signal processing for multimedia and communication
Nov 28, 30	• Signal processing for big data and artificial intelligence