Department of Electrical and Computer Engineering

EEE 4510 – Introduction to Digital Signal Processing
Fall 2022 (China Program)

Instructor	:	Dr. Nonnarit O-larnnithipong
Office Hours	:	Monday & Wednesday 11:00 am - 12:30 pm (By Appointment)
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Class Time	:	Monday-Friday 7:30 pm - 09:05 pm (Beijing Time)
Website	:	Course content is available through FIU Canvas

Catalog Description:
Introduction to the basic concepts in Digital Signal Processing, Z-transform, Algorithms for convolution, Discrete Fourier Transform (DFT), and Fast Fourier Transform (FFT) computation. Digital filters design, and engineering applications. (3 Credits)

Textbook:
Digital Signal Processing: Fundamentals and Applications (3rd Edition)
by Lizhe Tan and Jean Jiang

ISBN-10: 0128150718
ISBN-13: 978-0128150719

Course Objectives:
Through successful completion of the course, the student will be able to:

1. Understand the significance of Digital Signal Processing (DSP) technology and its impact in diverse fields of applications.
2. Understand the concepts of signal sampling, discrete transforms and their applications
3. Calculate the direct and inverse Discrete Fourier Transform (DFT). Interpret the meaning of the DFT coefficients.
4. Apply Fast Fourier Transform (FFT) as an optimized algorithm for the calculation of the DFT.
5. Calculate the direct and inverse Z-Transform of discrete-time sequences.
6. Apply the Z-Transform properties to ease with Z-transform calculations.
7. Understand the concept and meaning of poles and zeros.
8. Evaluate the frequency response of Discrete Time-LTI systems from their zero-pole plot.
9. Identify and understand the general characteristics, specifications and benefits of Finite Impulse Response (FIR) digital filters.
10. Identify and understand the general characteristics, specifications and benefits of Infinite Impulse Response (IIR) digital filters.

Topic Covered:

1. Introduction to Digital Signal Processing
2. Signal Sampling and Quantization
3. Linear Time-Invariant Systems
4. Discrete Fourier Transform
5. The Z-Transform its properties
6. DSP Systems and Basic Digital Filtering, FIR, and IIR Filter Designs

Course Requirement:

Students are required to install MATLAB on their personal computers. MATLAB will be used as a tool to implement digital signal processing algorithms learned in this course.

ABET Relationship of Course to Program Outcomes:

☒ 1. an ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics.
☒ 2. an ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors.
☐ 3. an ability to communicate effectively with a range of audiences.
☒ 4. an ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts.
☐ 5. an ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives.
☒ 6. an ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions.
☐ 7. an ability to acquire and apply new knowledge as needed, using appropriate learning strategies.

Grading Scale	
A	94-100
A-	90-93
B+	87-89
B	83-86
B-	80-82
C	60-79
F	0-59

"Florida International University is a community dedicated to generating and imparting knowledge through excellent teaching and research, the rigorous and respectful exchange of ideas, and community service. All students should respect the right of others to have an equitable opportunity to learn and honestly to demonstrate the quality of their learning. Therefore, all students are expected to adhere to a standard of academic conduct, which demonstrates respect for themselves, their fellow students, and the educational mission of the University. All students are deemed by the University to understand that if they are found responsible for academic misconduct, they will be subject to the Academic Misconduct procedures and sanctions, as outlined in the Student Handbook."

Department Regulations Concerning Incomplete Grades

To qualify for an Incomplete, a student:

1. Must contact (e.g., phone, email, etc.) the instructor or secretary before or during missed portion of class
2. Must be passing the course prior to that part of the course that is not completed
3. Must make up the incomplete work through the instructor of the course
4. Must see the Instructor. All missed work must be finished before last two weeks of the following term.

Course Policies:

1. **Academic Misconduct:** For work submitted, it is expected that each student will submit their own original work. Any evidence of duplication, cheating or plagiarism will result at least a failing grade (F) for the course. Please DO NOT SHARE your assignments/classwork with other students. If the evidence of duplication is found, 0 point will be given, no exception.
2. **Deadlines:** Work is due on the date and time specified. Late submissions will not be accepted. Participation and submission deadlines are absolute. (Only emergency medical situations or extenuating circumstances are excused with proper documentation.)
3. **DO NOT** submit work by email.
4. Instructor reserves right to change course materials or dates as necessary.

Grading Scheme:

Topic	Percentage
Homework Assignments	35%
Project	20%
Final Exam	45%

Class Schedule:

Class	Date	Topic
1	Oct 4	• Course Introduction and Outlines **Chapter 1: Introduction to Digital Signal Processing** • Basic Concepts of Digital Processing
2	Oct 5	• Basic digital signal processing examples • Digital Signal Processing in Real-World Applications
3	Oct 6	• Digital Signal Processing in Real-World Applications (continued) **Chapter 2: Signal Sampling and Quantization** • Sampling of Continuous Signal
4	Oct 7	• Sampling of Continuous Signal (continued) • Signal Reconstruction
5	Oct 10	• Signal Reconstruction (continued)

6	Oct 11	• Analog-to-Digital Conversion, Digital-to-Analog Conversion, and Quantization
7	Oct 12	**Chapter 3: Digital Signals and Systems** • Digital Signals • Linear Time-Invariant (LTI) and Causal Systems
8	Oct 13	• Difference Equations and Impulse Response • Digital Convolution
9	Oct 14	• Digital Convolution (continued) • Bounded-input and Bounded -output stability
10	Oct 17	**Chapter 4: Discrete Fourier Transform and Signal Spectrum** • Fourier Series Coefficients of Periodic Signal • Discrete Fourier Transform
11	Oct 18	• Discrete Fourier Transform (continued)
12	Oct 19	• Inverse Discrete Fourier Transform • Frequency index k and its corresponding frequency • Amplitude, Phase and Power Spectrum
13	Oct 20	• Introduction to MATLAB
14	Oct 21	• DFT Implementation using MATLAB
15	Oct 24	**Chapter 5: The z-Transform** • Definition of z-Transform • Properties of the z-Transform
16	Oct 25	• Inverse z-Transform
17	Oct 26	• Solution of Difference Equation using the z-Transform
18	Oct 27	**Chapter 6: Digital Signal Processing Systems and Basic Filtering Types** (Selected Topics) • Difference Equation and Transfer Function
19	Oct 28	• The z-plane, Pole-Zero Plot and Stability
20	Oct 31	• Project: FIR Digital Filter Design (MATLAB implementation)
21	Nov 1	• Project: IIR Digital Filter Design (MATLAB implementation)
22	Nov 2	• Project: Signal Filtering (MATLAB implementation)
23	Nov 3	• Review before Final Exam
24	Nov 4	• **Final Exam (07:00pm-09:05pm)**
	Nov 7	• Project due