ECE 480
Introduction to Digital Signal Processing (4 credit hours)
Spring/Summer 2024

Course Meeting Times and Formats

Lecture:
Monday/Wednesday
3:30 – 5:15 PM

Lab: 2034 ELB
Instructor: Swetha Kasimalla (tentative)
Section 001: Friday, 8:00 – 10:45 AM
Section 002: Online

Contact Information:

- Professor Selim Awad
- Email: sawad@umich.edu
- Phone Number: (313) 5935523
- Office Hours Wednesday from 10 to 11:30 am, and by appointment online
- Office Location: 2055 ELB

Course Description:
Fundamentals of discrete-time signals and systems. Introduction to z-transform and its applications. The design of digital filters. Characteristics of analog-to-digital and digital-to-analog converters. Fourier transform of sequences, DFT, and FFT algorithms. An introduction to software tools for the simulation and design of real-time digital filters. Implementation of digital systems using digital signal processing boards. Three hours of lecture and three hours of laboratory experiments per week.

Learning Goals:

Learning Goals (Student Outcomes) for ECE 480:

1. an ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics.

Course Outcomes:

1. Ability to solve difference equations using Z-transform. (*Related to student outcome 1*)
2. Ability to relate poles and zeros of the transfer function to the time-domain response. (*Related to student outcome 1*)

3. Ability to solve the output of discrete-time system using both convolution and Z-transform. (*Related to student outcome 1*)
4. Ability to derive spectral properties of discrete filters. (*Related to student outcome 1*)
5. Ability to apply a bilinear transform to transform analog filters to their discrete-time equivalents. (*Related to student outcome 1*)
6. Ability to design digital filters to meet stated performance specifications. (*Related to student outcome 1*)
7. Ability to use software tools for analysis and design of discrete-time systems. (*Related to student outcome 1*)

Course Objectives:

1. A good understanding of the fundamentals of discrete-time signals and systems.
2. An awareness of the importance of DSP in engineering applications.
3. Familiarity with techniques of analysis of discrete-time signals and the use of Z-transforms.
4. Knowledge of spectral properties of discrete-time systems using Discrete Fourier transform (FFT) of sequences.
5. Skills in the design of digital filters.
6. Mastering computer simulation tools to simulate and design digital filter-based systems.

Program Learning Goals:

Learning Goals (Student Outcomes) for ECE 480:

1. an ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics.

Course Outcomes:

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Program Goals / Student Outcomes:
PROGRAM EDUCATIONAL OBJECTIVES
https://umdearborn.edu/cecs/departments/electrical-and-computer-engineering/undergraduate-programs/bse-electrical-engineering/program-educational-objectives

PROGRAM STUDENT OUTCOMES
https://umdearborn.edu/cecs/departments/electrical-and-computer-engineering/undergraduate-programs/bse-electrical-engineering/student-outcomes

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Required Materials and/or Technology:

- A. Oppenheim, R. Schafer, and J. Buck," Discrete-time signal processing," Prentice Hall, 2010
- MATLAB, Simulink, and Toolboxes (software).

Assignments and Grading Distributions:

2 Midterm tests	40% (20% each)
Final test	30%
Lab. assignments	30%

- Tests and Exams are open-book and notes.
- Using a cell phone is prohibited.
- No make-up will be given unless for a documented emergency.

- **Tentative Course Outline and Schedule:**
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Date or Week	Activity, Content, Assignments
Week one- 5/6 & 5/8	Introduction, Syllabus, review of continuous-time signals, and systems.
Week two- 5/13 & 5/15	Discrete-time signals: properties and definitions. Periodic and aperiodic signals.
Week three- 5/20 & 5/22	Intro. to discrete-time systems, LTI systems, and their properties: stability, causality, difference equations, etc.

Week four- 5/29 & 6/3	Description of discrete-time signals in the frequency domain: The Fourier transform and its properties.
Week five- 6/5 & 6/10	Discrete-time systems in the frequency domain: The frequency response of discrete-time systems (magnitude, phase, and group-delay responses).
Week six- 6/12 & 6/17	Simple discrete-time systems (digital filters): IIR and FIR.
6/21 (tentative)	First mid-term test.
Week seven- 7/1 & 7/3	The z-transform of sequences: properties and theorems.
Week eight- 7/8 & 7/10	Finding the inverse z-transform and solving systems.
Week nine- 7/15 & 7/17	Review of analog filter design using Matlab, Into. To digital filter design.
Week ten- 7/22 & 7/24	Design of IIR digital filters using the bilinear transformation.
7/26 (tentative)	Second mid-term test.
Week eleven- 7/29 & 7/31	Design of IIR digital filters using the bilinear transformation.
Week twelve- 8/5 & 8/7	Intro. to spectral analysis methods as applied to cont.-time signals.
Week thirteen- 8/12 & 8/14	Examples of spectral analysis of continuous-time signals using DSP methods using Matlab. Solving miscellaneous problems and reviewing for the final Test with Q &A.
8/21	Final test (tentative)

Food Pantry

The pantry exists to support individuals on their journey as they work toward achieving their goals. We are committed to increasing access to food as a key to success, by assisting any

student in need! If you need access or have questions, please contact the Office of Student Life by phone at 313-593-5390, by email at umdearbornpantry@umich.edu.

Vaccination & Face Covering Policy

To protect our classes, campus, and community from COVID-19 infections, please review Dearborn's COVID Response website for the latest policies regarding vaccination requirements and optional masking on campus.

University-Wide Policies or Statements Relevant to Courses:

Please see the 'Course Policies' Menu on Canvas for information on the following topics. To find the 'Course Policies' Menu on Canvas, log into any course in Canvas, and then on the blue ribbon on the far-left scroll down to 'Course Policies' and click on it. This opens a white ribbon with individual links to UM-Dearborn websites on the following topics:

- University Attendance Policy
- Academic Integrity Policy
- Counseling
- Disability and Accessibility Services
- Safety Statement
- Harassment, Sexual Violence, Bias, and Discrimination