ECE 161A - Introduction to Digital Signal Processing

Fall 2024 - Syllabus

Digital signal processing is a key subject in electrical engineering, with applications in wireless communication, medical analytics, ocean sciences, seismology, and related areas. In this introductory course, we will discuss the z-transform, fast Fourier transform (FFT), design of finite impulse response (FIR) and infinite impulse response (IIR) digital filters and their implementations as well as finite precision effects.

Time and place: Lectures are on Tuesdays and Thursday 3:30PM – 4:50PM in FAH 1450. A discussion session will be held on Wednesdays 2:00 PM – 2:50 PM in CENTR 113.

Instructor:

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Teaching Assistant (TA):

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Course Website: Handouts and homework assignments will be posted on the Canvas website.

Bibliography: This course is based on lecture notes developed by Prof. Bhaskar Rao. Our main textbook will be

> *Discrete-Time Signal Processing*, Alan V. Oppenheim and Ronald W. Schafer, Prentice Hall, 2009.

In particular, the course will cover the following sections in the main textbook.

- Chapter 3: 3.1 – 3.5 (Z-transforms)
- Chapter 5: 5.1, 5.5, 5.7 (Group delay, All-Pass Filters, linear phase filters)
- Chapter 6: 6.1 – 6.5, 6.7, 6.8 (Filter implementation and finite precision effects)
- Chapter 7: 7.1 – 7.7 (Filter design: IIR and FIR)
- Chapter 8: 8.1 – 8.7 (DFT and linear convolutions using DFT)
- Chapter 9: 9.2, 9.3 (FFT)

This textbook will be on reserve at the UCSD library. Additional references are the following textbooks.

- *Digital Signal Processing*, John Proakis and Dimitris Manolakis, Pearson, 2007

- *Digital Signal Processing using Matlab*, Vinay Ingle and John Proakis, Cengage Learning, 2016.

Prerequisites: A required prerequisite for this course is ECE 101A. In particular, you must be familiar with discrete-time systems, the Fourier transform of discrete signals, and the sampling theorem. These concepts are covered by the following sections in the textbook.

- Chapter 2: 2.1 – 2.9 (LTI systems, Fourier transform of discrete-time signals)
- Chapter 4: 4.1 – 4.5 (Sampling theorem)
- Chapter 5: 5.2 – 5.3 (Difference equations, transfer functions, poles and zeros)

Grades: Grades will be assigned based on the weekly homework problems and the mid-term/final exams. The homework assignments count 25%, the mid-term exam counts 25%, and the final exam counts 50%.

Homework: Theoretical problems and problems to be solved in Matlab will be posted every week on the course website and will be due one week later.

Office Hours: Office hours are every Friday at 2 PM via Zoom.