ECE4270 Course Syllabus

ECE4270

Fundamentals of Digital Signal Processing (3-0-0-3)

CMPE Degree
This course is Elective for the CMPE degree.

EE Degree
This course is Elective for the EE degree.

Lab Hours
0 supervised lab hours and 0 unsupervised lab hours

Course Coordinator
Barnes,Christopher F

Prerequisites
ECE 2026 [min C] and (ECE 3077 [min C] or ISYE/MATH/CEE 3770 [min C] or MATH

Corequisites
None

Catalog Description
Introduction to Digital Signal Processing. Sampling Theorem,Discrete-time Fourier transform,power spectrum,discrete Fourier transform and the FFT algorithm,z-Transform, digital filter design and implementation.

Textbook(s)
Oppenheim, Schafer & Buck, *Discrete-Time Signal Processing* (3rd edition), Prentice Hall, 2009. ISBN 0131988425, ISBN 9780131988422 (required)

Course Outcomes
Upon successful completion of this course, students should be able to:

1. Analyze, exploit and create signal and systems with digital signal processing techniques.
2. Express signal processing systems in mathematical form.
3. Write computer codes describing a signal processing system.
4. Analyze signals in terms of their frequency content.
5. Analyze mixed analog-digital systems with sampling operations and digital filters.
6. Design and implement digital filters.
7. Implement FFT.
8. Express a complex signal via a dimensionality reduction algorithm such as PCA and ICA.
9. Estimate the spectrum of a measured signal.
10. Model a signal using parametertic modeling technique.
11. Describe how signal processing is used in applications (e.g., audio and digital image processing).

Student Outcomes

In the parentheses for each Student Outcome:
"P" for primary indicates the outcome is a major focus of the entire course.
“M” for moderate indicates the outcome is the focus of at least one component of the course, but not majority of course material.
“LN” for “little to none” indicates that the course does not contribute significantly to this outcome.

1. (P) An ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics
2. (LN) 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. (LN) An ability to communicate effectively with a range of audiences
4. (LN) 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. (LN) 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. (M) An ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions
7. (M) An ability to acquire and apply new knowledge as needed, using appropriate learning strategies.

Topical Outline

Discrete-Time Fourier Transform
Bilateral z Transform
Sampling of Continuous-Time Signals
Transform Analysis of FIR and IIR Filters
Digital Filter Implementation
Digital Filter Design
Discrete Fourier Transform
Computation of DFT via the FFT Algorithm
Spectrum-Estimation
Parametric Signal Modeling
Example DSP Applications