ECE 792-069
Advanced Digital Signal Processing

Instructor(s): Gregory Bottomley, gebottom@ncsu.edu

Objective or Description: To provide students with an understanding of advanced digital signal processing concepts, including the design and analysis of advanced digital signal processing systems.

Prerequisites: ECE 410 or ECE 510 or equivalent. Though not required, a background in linear algebra (MA 305 or MA 405 or equivalent) and probability/random variables (ST 371 or ECE 514 or equivalent) is helpful.

Textbook: J. G. Proakis and D. G. Manolakis, *Digital Signal Processing, fifth edition*. Hoboken, NJ: Pearson, 2022. Estimated cost: $75 to rent hardcopy, $150 to own hardcopy, $10/month to rent electronic copy.

Topics: Digital signal processing (DSP) fundamental concepts are reviewed, providing additional depth in certain areas. The following advanced DSP concepts are covered: digital filter design, sample rate conversion, filter banks, wavelets, power spectrum estimation, and adaptive filtering. Additional topics are introduced at the instructor's discretion.

Special note: Credit will not be given both this course and ECE 513 offered in Fall 2022

Grading:

> 5 – 25 % - Homework assignments: problems that go along with lectures.

> 0 – 40 % - Project(s): individual software project(s) that go along with lectures.

> 0 – 10 % - Quizzes: short quizzes to ensure engagement in lectures

> 20 – 50 % - Tests: one or more tests to provide intermediate evaluation of learning outcomes.

> 20 – 40 % - Final exam: comprehensive evaluation of learning outcomes.

Cross-listing in other departments: not applicable

Include anything else that is unique to the course - this information will be posted on the ECE Current Graduate/Undergraduate Student Portals for all students to view

This course consists of weekly lectures, homework assignments, tests/quizzes, and a final exam. A project may be assigned at the instructor's discretion. Resources and assignments are provided through Moodle, an online learning platform.

Upon completion of this course, students will be able to:

1. Design and analyze linear-phase finite impulse response (FIR) filters using the windowing and frequency-sampling approaches.

2. Design and analyze infinite impulse response (IIR) filters by designing analog filters and translating them to a digital filter design.

3. Design a system to increase or decrease the sampling rate.

4. Design discrete Fourier transform (DFT) and quadrature mirror filter (QMF) banks.

5. Explain the basic approaches to power estimation and adaptive filtering.

Minimum Computer and Digital Literacy Skills

> Obtain regular access to a reliable internet connection

> Ability to use online communication tools, such as email (create, send, receive, reply, print, send/receive attachments).

> Download and upload attachments

> Basic MATLAB® programming