

ABET COURSE SYLLABUS**ECSE-4560 Signal Processing Design**

- Course Catalog Description:** A capstone design course (A capstone design course provides a curriculum-culminating major design experience. Students work in teams of three or more on open-ended projects with realistic constraints. The course is designated as writing intensive. Oral and written presentations are required. Course grade is based on team performance and individual contributions.). Supervised design projects in digital signal processing. Project areas include receivers, synchronizers, parameter estimators, digital filters, voice and image processors.
- Pre-Requisite Courses:** ECSE-4510 Discrete Time Systems
- Co-Requisite Courses:** ECSE-4520 Communication Systems
ENGR-4010 Professional Development III
- Prerequisites by Topic:**
1. Properties of continuous and discrete-time signals
 2. Fourier series and transforms; Laplace and Z transforms
 3. Time- and frequency-domain linear systems analysis
 4. Transfer functions, impulse response, step response
 5. Matlab programming ability
- Textbook:** (and/or other required material) There is no required text. *Mastering Matlab 7* by D. Hanselman and B. Littlefield (Prentice Hall, 2004) is an optional text.
- References:** *Discrete-Time Signal Processing* by A. Oppenheim, R. Schafer, and J. Buck (2nd edition, Prentice Hall, 1999) and *Pattern Classification* by R. Duda, P. Hart, and G. Stork (Wiley, 2001) have historically been useful for some projects (but are not required).
- Course Coordinator:** Richard Radke
- Overall Educational Objective:** The main objective of this course is to provide a capstone design experience by asking students to work in teams to solve an open-ended signal processing design problem. The emphasis is on applying knowledge obtained in previous courses, as opposed to learning a large body of new material in lecture format.
- Course Learning Outcomes:**
1. Define and describe an open-ended signal processing design problem
 2. Devise and implement a solution to the proposed design problem
 3. Critically evaluate and explore design alternatives
 4. Present intermediate progress reports and final reports both in oral and written form
 5. Learn to work together effectively in 3-person teams
- How Course Outcomes are Assessed:** The class grade is based on the design project only; there are no quizzes or additional homeworks. Students work in groups of three. Students are graded both on an individual (36% overall) and group (64% overall) basis. The final grade is made up as follows: Project proposal (13%), Written progress report 1 (5%), Design review (5%), Written progress report 2 (5%), Written final report technical component (23%), Written final report English component (13%), Oral final presentation (11%), Lab notebook (11%), Teamwork statements (7%), Class participation and preparedness (7%).

Relation to EE/CSE/EPE Outcomes

Outcome	Level	Demonstrate Proficiency
	N, M, H	e.g. Exams, projects, HW
Mathematics, science and engineering	H	Project

N = none
M = moderate
H = high

Basic disciplines in Electrical Engineering	M	Project
Depth in Electrical Engineering	H	Project
Basic disciplines in Computer & Sys. Eng.	M	Project
Depth in Computer and Systems Eng.	H	Project
Electromagnetics, electromechanics, power semiconductors	N	
Power system behavior	N	
Electrical energy conversion	N	
Conduct experiments and interpret data	H	Project
Identify, formulate and solve problems	H	Proposal, project
Design a system, component or process	H	Project
Communicate in written and oral form	H	Progress/final reports
Function as part of a multi-disciplinary team	H	Project, reports
Preparation for life-long learning	M	Overall course
Ethical issues; safety, health, public welfare	M	Proposal, reports
Humanities and social sciences	M	Project (some)
Laboratory equipment and software tools	H	Project
Variety of instruction formats	M	Project, design review

Topics Covered:
(number of hours or classes for each)

Course topics vary from year to year and depend on the project proposals submitted by the students. Projects in previous years include: audio watermarking, automatic techno music DJ, pill identification, instrument classification, accent/gender classification of speech, query-by-humming, automatic counter melody generation, and others. Topics generally related to the projects include digital filter design, spectrogram creation and analysis, morphological image processing operations, time- and frequency-domain peak detection, and others.

1. Overall design methodology and project selection (2 weeks)
2. Design review and discussion of progress reports (2 weeks)
3. Detailed weekly discussion of team projects (9 weeks)
4. Final oral reports (1 week)

Computer Usage:

Matlab is used extensively throughout the design experience. Some students also design algorithm components in C++, Java, or MAX-MSP.

Laboratory Experiences:

None

Design Experiences:

1. The course project constitutes a semester-long design experience.

Independent Learning Experiences:

None

Class/Lab Schedule:

Tuesdays 4-6 PM

Contribution to the Professional Component:

- | | |
|---|----------------|
| (a) College-level mathematics and basic sciences: | 0 credit hours |
| (b) Engineering Topics (Science and/or Design): | 3 credit hours |
| (c) General Education: | 0 credit hours |

Prepared by:	Richard Radke
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