

University of Hawaii Maui College ETRO 450 - Signal Processing

1. **Course Alpha.** Please click on the ? to the right for help.

ETRO

2. **Course Number.** Please click on the ? to the right for help.

450

3. **Course Title/Catalog Title.** Please click on the ? to the right for help.

Signal Processing

4. **Number of Credits.** Please click on the ? to the right for help.

4

5. **Contact Hours/Type.** Please click on the ? to the right for help.

- Hour lecture/lab (6)

6. **Course Description.** Please click on the ? to the right for help.

Introduces digital signal processing, discrete-time signals and systems, z-transform, linear shift-invariant systems, discrete Fourier transform (DFT) and fast Fourier transform (FFT) algorithms, and design of digital filters. Provides laboratory hands-on applications of concepts and theories.

7. **Pre-Requisites.** Please click on the ? to the right for help.

ETRO 360 Signals & Systems (with grade C or better); OR consent

ETRO 360 with grade C or better, or consent.

8. **Co-requisites.**

None

9. **Recommended Preparation.**

None

10. **Is this a cross-listed course?** Please click on the ? to the right for help.

NO

11. **Reason for Proposal.** Why is this course being proposed or modified? This question requires specific information as part of the explanation. Please click on the ? to the right for help.

The credits and contact hours are modified to reflect the content of the course.

12. Effective Semester and Year. For new or modified courses, the effective year is one year from the semester proposed. For example, if proposed in Spring 2012, the effective semester is Spring 2013. Please click on the ? to the right for help.

Fall 2015

13. Grading Method. What grading methods may be used for this course? Please click on the ? to the right for help.

- Standard (Letter,Cr/NCr,Audit) (0)

14. Is this course repeatable for credit? How often can this course be counted toward a degree or certificate? Please click on the ? to the right for help.

NO

15. Course Student Learning Outcomes (SLOs). DO NOT ENTER TEXT IN THE TEXT BOX BELOW. Click on the yellow button "COURSE LEARNING OUTCOMES" and enter in that screen. Please click on the ? to the right for help.

Course SLO/Competency	A	B	C	D	E	F	G	H	I	J	K
utilize basic concepts of discrete-time signal processing and systems	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>									
analyze advanced signal processing technologies		<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>						
solve the problems related to analysis of discrete-time signals and systems and compute the system output				<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
use software such as MATLAB to represent digital signals and systems and to compute the system output.									<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>

LEGEND

- A. determine whether systems are linear or nonlinear, causal or noncausal, shift-invariant, or shift varying
- B. model systems with difference equations and compute their solutions
- C. visualize and compute discrete-time convolution
- D. determine unit-pulse response and convolution using the concept of transfer function
- E. demonstrate an understanding of the discrete-time Fourier transform and the concept of digital frequency
- F. choose the sampling rate for a digital system and understand the effects of aliasing
- G. determine the discrete Fourier transform (DFT) of an aperiodic sequence
- H. draw signal flow graphs representing the computation stages in the decimation-in-time and decimation-in-frequency FFT algorithms
- I. convert an analog lowpass filter into an equivalent digital filter
- J. demonstrate knowledge of parameter quantization effects
- K. utilize MATLAB programs to process filter sequences and display results

Course SLO/PSLO	A	B	C	D
utilize basic concepts of discrete-time signal processing and systems	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>		
analyze advanced signal processing technologies				

	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
solve the problems related to analysis of discret-time signals and systems and compute the system output		<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
use software such as MATLAB to represent digital signals and systems and to compute the system output.			<input checked="" type="checkbox"/>

LEGEND

- A. analyze, design, and implement electro-optic systems, control systems, instrumentation systems, communication systems, computer systems, or power systems
- B. utilize integral and differential calculus, or other appropriate mathematics above the level of algebra and trigonometry to solve technical problems
- C. demonstrate critical engineering technology skills and experiences such as: making existing technology operate, creating/selecting new technology, troubleshooting, calibrating, characterizing, and optimizing
- D. demonstrate engineer's way of thinking, analyzing technology as systems

16. Course Competencies. DO NOT ENTER TEXT IN THE TEXT BOX BELOW. Click on the yellow button "COURSE COMPETENCIES/ISSUES/SKILLS" and enter text in that screen. Course competencies are smaller, simpler tasks that connect to and facilitate the SLOs.

Competency
determine whether systems are linear or nonlinear, causal or noncausal, shift-invariant, or shift varying
model systems with difference equations and compute their solutions
visualize and compute discrete-time convolution
determine unit-pulse response and convolution using the concept of transfer function
demonstrate an understanding of the discrete-time Fourier transform and the concept of digital frequency
choose the sampling rate for a digital system and understand the effects of aliasing
determine the discrete Fourier transform (DFT) of an aperiodic sequence
draw signal flow graphs representing the computation stages in the decimation-in-time and decimation-in-frequency FFT algorithms
convert an analog lowpass filter into an equivalent digital filter
demonstrate knowledge of parameter quantization effects
utilize MATLAB programs to process filter sequences and display results

17. Recommended Course Content and Timeline. The course content facilitates the course competencies. Course content may be organized by weeks, units, topics or the like.

Content
Overview of signals and systems. 1-2 weeks
Discrete signals, discrete systems, unit sample response, discrete convolution. 2-3 weeks

Discrete time Fourier transform, z-transform. 2-3 weeks
Discrete Fourier Transform (DFT). 2-3 weeks
Fast Fourier Transform (FFT) algorithms. 1-2 weeks
Digital filter design. 1-2 weeks
Realization of digital filters: applications of digital signal processing. 1-2 weeks

18. Program Learning Outcomes. DO NOT ENTER TEXT IN THE TEXT BOX BELOW. Click on the yellow button "PLOs" and enter text in that screen. Program Student Learning Outcomes (PLOs) supported by this course. If you are not a "program" use the Liberal Arts PLOs, view them by clicking on ? icon to the right.

Program SLO
analyze, design, and implement electro-optic systems, control systems, instrumentation systems, communication systems, computer systems, or power systems
utilize integral and differential calculus, or other appropriate mathematics above the level of algebra and trigonometry to solve technical problems
demonstrate critical engineering technology skills and experiences such as: making existing technology operate, creating/selecting new technology, troubleshooting, calibrating, characterizing, and optimizing
demonstrate engineer's way of thinking, analyzing technology as systems

19. College-wide Academic Student Learning Outcomes (CASLOs). FIRST, fill out the CASLO grid located in the UHMC tab above. Click on the HELP icon for tips on determining support for the CASLOs and indicate your choices below by clicking on the box in front of each supported CASLO. NOTE: Our campus does not use the Preparatory Level, Level 1 and Level 2 designations in the chart below.

<input checked="" type="checkbox"/>	Creativity - Able to express originality through a variety of forms. <input checked="" type="checkbox"/> Preparatory Level
<input checked="" type="checkbox"/>	Critical Thinking - Apply critical thinking skills to effectively address the challenges and solve problems. <input checked="" type="checkbox"/> Preparatory Level
	Information Retrieval and Technology - Access, evaluate, and utilize information effectively, ethically, and responsibly.
	Oral Communication - Practice ethical and responsible oral communications appropriately to a variety of audiences and purposes.
<input checked="" type="checkbox"/>	Quantitative Reasoning - Synthesize and articulate information using appropriate mathematical methods to solve problems of quantitative reasoning accurately and appropriately.

<input checked="" type="checkbox"/> Preparatory Level
Written Communication - Write effectively to convey ideas that meet the needs of specific audiences and purposes.

GenED SLO
Creativity - Able to express originality through a variety of forms.
Critical Thinking - Apply critical thinking skills to effectively address the challenges and solve problems.
Quantitative Reasoning - Synthesize and articulate information using appropriate mathematical methods to solve problems of quantitative reasoning accurately and appropriately.

20. Linking. CLICK ON CHAIN LINK ICON IN UPPER RIGHT HAND CORNER TO BEGIN LINKING. Please click on the ? to the right for help.

21. Method(s) of delivery appropriate for this course. Please click on the ? to the right for help.

- Classroom/Lab (0)

22. Text and Materials, Reference Materials, and Auxiliary Materials. Please click on the ? to the right for help.

Richard Newbold, Pactical Applications in Digital Signal processing, Prentice Hall Publishers, 2013, ISBN-10: 0-13-303838-6

Reference materials:

S. K. Mitra, Digital Signal Processing, 3rd, McGraw Hill, 2006, ISBN-10: 0072865466

J. G. Proakis, O. G. Manolakis, Digital Signal Processing: Principles, Algorithms, and Applications, 4th, Prentice-Hall, 2007.

Auxilliary materials:

Software such as MATLAB

23. Maximum enrollment. Please click on the ? to the right for help.

24

24. Particular room type requirement. Is this course restricted to particular room type? Please click on the ? to the right for help.

YES

Laboratory with computers.

25. Special scheduling considerations. Are there special scheduling considerations for this course? Please click on the ? to the right for help.

YES

This course must fit the BAS ENGT course scheduling.

26. Are special or additional resources needed for this course? Please click on the ? to the right for help.

No

27. Does this course require special fees to be paid for by students? Please click on the ? to the right for help.

NO

28. Does this course change the number of required credit hours in a degree or certificate? Please click on the ? to the right for help.

No

29. Course designation(s) for the Liberal Arts A.A. degree and/or for the college's other associate degrees. Please click on the ? to the right for help.

Degree	Program	Category
Associate in Arts:		LE - Elective LE - Elective
AS:		PE - Program Elective
AAS:		
BAS:	ET	CR - Core Course/Requirement - BAS
Developmental/ Remedial:		

30. Course designation(s) for other colleges in the UH system.

This course transfers as an elective.

31. Indicate the year and page # of UHMC catalog referred to. For new or modified courses, please indicate the catalog pages that need to be modified and provide a sheet outlining those changes.

Page 114 in general catalog 2014-2015.

32. College-wide Academic Student Learner Outcomes (CASLOs). Please click on the HELP icon for more information.

Standard 1 - Written Communication Write effectively to convey ideas that meet the needs of specific audiences and purposes.		
Outcome 1.1 - Use writing to discover and articulate ideas.		1

Outcome 1.2 - Identify and analyze the audience and purpose for any intended communication.		1
Outcome 1.3 - Choose language, style, and organization appropriate to particular purposes and audiences.		1
Outcome 1.4 - Gather information and document sources appropriately.		2
Outcome 1.5 - Express a main idea as a thesis, hypothesis, or other appropriate statement.		2
Outcome 1.6 - Develop a main idea clearly and concisely with appropriate content.		2
Outcome 1.7 - Demonstrate a mastery of the conventions of writing, including grammar, spelling, and mechanics.		0
Outcome 1.8 - Demonstrate proficiency in revision and editing.		1
Outcome 1.9 - Develop a personal voice in written communication.		0
Standard 2 - Quantitative Reasoning Synthesize and articulate information using appropriate mathematical methods to solve problems of quantitative reasoning accurately and appropriately.		
Outcome 2.1 - Apply numeric, graphic, and symbolic skills and other forms of quantitative reasoning accurately and appropriately.		3
Outcome 2.2 - Demonstrate mastery of mathematical concepts, skills, and applications, using technology when appropriate.		3
Outcome 2.3 - Communicate clearly and concisely the methods and results of quantitative problem solving.		3
Outcome 2.4 - Formulate and test hypotheses using numerical experimentation.		3
Outcome 2.5 - Define quantitative issues and problems, gather relevant information, analyze that information, and present results.		3
Outcome 2.6 - Assess the validity of statistical conclusions.		3
Standard 3 - Information Retrieval and Technology. Access, evaluate, and utilize information effectively, ethically, and responsibly.		
Outcome 3.1 - Use print and electronic information technology ethically and responsibly.		1
Outcome 3.2 - Demonstrate knowledge of basic vocabulary, concepts, and operations of information retrieval and technology.		1
Outcome 3.3 - Recognize, identify, and define an information need.		2
Outcome 3.4 - Access and retrieve information through print and electronic media, evaluating the accuracy and authenticity of that information.		1
Outcome 3.5 - Create, manage, organize, and communicate information through electronic media.		1
Outcome 3.6 - Recognize changing technologies and make informed choices about their appropriateness and use.		2
Standard 4 - Oral Communication		

Practice ethical and responsible oral communications appropriately to a variety of audiences and purposes.		
Outcome 4.1 - Identify and analyze the audience and purpose of any intended communication.		0
Outcome 4.2 - Gather, evaluate, select, and organize information for the communication.		1
Outcome 4.3 - Use language, techniques, and strategies appropriate to the audience and occasion.		1
Outcome 4.4 - Speak clearly and confidently, using the voice, volume, tone, and articulation appropriate to the audience and occasion.		1
Outcome 4.5 - Summarize, analyze, and evaluate oral communications and ask coherent questions as needed.		2
Outcome 4.6 - Use competent oral expression to initiate and sustain discussions.		1
Standard 5 - Critical Thinking Apply critical thinking skills to effectively address the challenges and solve problems.		
Outcome 5.1 - Identify and state problems, issues, arguments, and questions contained in a body of information.		3
Outcome 5.2 - Identify and analyze assumptions and underlying points of view relating to an issue or problem.		3
Outcome 5.3 - Formulate research questions that require descriptive and explanatory analyses.		2
Outcome 5.4 - Recognize and understand multiple modes of inquiry, including investigative methods based on observation and analysis.		2
Outcome 5.5 - Evaluate a problem, distinguishing between relevant and irrelevant facts, opinions, assumptions, issues, values, and biases through the use of appropriate evidence.		3
Outcome 5.6 - Apply problem-solving techniques and skills, including the rules of logic and logical sequence.		3
Outcome 5.7 - Synthesize information from various sources, drawing appropriate conclusions.		3
Outcome 5.8 - Communicate clearly and concisely the methods and results of logical reasoning.		2
Outcome 5.9 - Reflect upon and evaluate their thought processes, value system, and world views in comparison to those of others.		2
Standard 6 - Creativity Able to express originality through a variety of forms.		
Outcome 6.1: Generate responses to problems and challenges through intuition and non-linear thinking.		2
Outcome 6.2: Explore diverse approaches to solving a problem or addressing a challenge.		2
Outcome 6.3: Sustain engagement in activities without a preconceived purpose.		1
Outcome 6.4: Apply creative principles to discover and express new ideas.		2
Outcome 6.5: Demonstrate the ability to trust and follow one's instincts in the absence		1

of external direction

Outcome 6.6: Build upon or adapt the ideas of others to create novel expressions or new solutions.

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33. Additional Information