Department of Electrical and Computer Engineering
University of Massachusetts Amherst

ECE 213: Continuous-Time Signals and Systems, Spring 2019

Description
Continuous-time signal and system representations. Linear time invariant systems, impulse responses, convolution. Frequency-domain analysis of continuous-time signals and systems: Fourier series, Fourier Transforms, frequency responses, filtering. Laplace Transforms for systems analysis: transient responses, transfer functions, stability. Sampling, aliasing, reconstruction. Applications: modulation, filter design, feedback systems. (4 credits)

Prerequisites
ECE 201, ECE 202, ECE 210

Course Format
Lectures: Monday, Wednesday, Friday, 10:10 – 11 AM, Goessmann 64.
Discussion: One 50-minute session on Monday. Sections: 12:20 – 1:10 PM, 1:25 – 2:15 PM, 4 – 4:50 PM, ELab 304

Objectives
Students completing this course will be able to:
1. Describe and analyze continuous-time signals in time and frequency domains.
2. Use time domain techniques to characterize responses of continuous-time systems.
3. Use transform domain techniques to analyze and specify properties of continuous-time systems.
4. Use sampling and reconstruction techniques to convert between continuous-time and discrete-time signals.
5. Apply signals and systems theory to the design of frequency-selective filters, modulators, and feedback systems.

Instructors
Patrick A. Kelly (Lectures); email: pkelly@umass.edu
Office Hours: Tuesday, 11 AM – noon; Friday, 2:30 – 3:30 PM, Marcus 215B

Nazanin Takbiri (Discussions); email: ntakbiri@umass.edu
Office Hours: Tuesday, 2 – 4 PM, Marcus 215F

Siwei Feng (TA); email: siwei@umass.edu
Office Hours: TBD

Bo Guan (TA); email: boguan@umass.edu
Office Hours: TBD

Textbook .
Signals and Systems: Theory and Applications, F. Ulaby and A. Yagle, Michigan, 2018.
(available as free pdf download at https://www.publishing.umich.edu/publications/ee/)

Additional References
Linear Systems and Signals (3rd ed.), B.P. Lathi, Oxford, 2017.
Signals and Systems (3rd ed.), H. Hsu, Schaum's Outline Series, McGraw-Hill, 2014.

Tentative weekly topics outline (may be adjusted as needed)

Week	Topics	Readings from text	Assignment
1	Introduction; review of complex numbers and complex exponentials; classes of signals.	Appendix B; Sec. 1.1	Homework 1
2	Operations on signals; signal properties; introduction to continuous-time LTI systems.	Sec. 1.2-1.5, 2.1	Homework 2
3	Time domain analysis of LTI systems: impulse response, convolution; System properties: causality, stability.	Sec. 2.2-2.6	Homework 3
4	Time domain analysis of LTI systems (cont.): differential equation representations, response to complex exponential inputs, canonical (direct form) implementations.	Sec. 2.7-2.8, class notes	Exam 1 Practice Pre-Exam Quiz 1
5	Laplace Transform: poles and zeros, properties, transient responses of linear circuits.	Sec. 3.1-3.3	Exam 1 (covers up to Week 4)
6	Laplace Transform: partial fraction expansions, transfer functions, system stability, invertible systems.	Sec. 3.4-3.8	Homework 4
7	Laplace Transform applications: op-amp circuits, system synthesis, feedback control.	Sec. 4.5-4.8	Homework 5
8	Fourier Series: representations of periodic signals, application to circuit analysis.	Sec. 5.1-5.6	Exam 2 Practice Pre-Exam Quiz 2
9	Fourier Transform: definition, properties.	Sec. 5.7-5.10	Exam 2 (covers up to week 8)
10	Fourier Transform for systems analysis: frequency response, magnitude and phase, frequency-selective filters.	Sec. 5.11-5.13, 6.2	Homework 6
11	Fourier Transform applications: filter design, amplitude modulation.	Sec. 6.3, 6.6, 6.9, 6.12	Homework 7
12	Sampling theorem: sampling of bandlimited signals, reconstruction from samples, aliasing.	Sec. 6.13	Homework 8
13	Applications of sampling: Discrete Fourier Transform (DFT), discrete-time implementations of continuous-time processing.	Class notes	Homework 9 Pre-Exam Quiz 3
Final Exam (comprehensive)			

Grading Policy: The course grade will be based on the following components:

1. Homework assignments - 10% of total grade. (*Note*: Some homework assignments will require the use of MATLAB or other mathematical software.)
2. Discussion Quizzes – 10% of total grade.
3. Midterm Exam 1 (Thurs., Feb. 21, 7-9 PM, Marston 131) – 25% of total grade.
4. Midterm Exam 2 (Thurs., March 28, 7-9 PM, Marcus 131) – 25% of total grade.
5. Final Exam (Wed., May 8, 8-10 AM, Goessmann 64) – 30% of total grade.

(Please see topics outline for assignment schedule.)

The letter grades corresponding to numerical grade ranges are as follows:

If total course grade is in the range:	The letter grade will be at least:	If total course grade is in the range:	The letter grade will be at least:
88 - 100	A	68 - 71	C+
84 - 87	A-	64 - 67	C
80 - 83	B+	60 - 63	C-
76 - 79	B	55 - 59	D
72 - 75	B-	< 55	F

Academic Honesty: It is expected that all students will abide by the Academic Honesty Policy, available at the Academic Honesty Office (Ombud's Office), or online at http://www.umass.edu/dean_students/codeofconduct/acadhonesty/. Acts of academic dishonesty (such as taking or giving answers in an exam, use of extra crib sheets, submitting another person's work as your own, etc.) will result in a grade of F in the course, and possibly additional sanctions including being placed on probation or suspension for a period of time or being dismissed from the University. All students have the right of appeal through the Academic Honesty Board.

Accommodation Policy: The University of Massachusetts-Amherst is committed to providing an equal educational opportunity for all students. If you have a documented physical, psychological or learning disability on file with Disability Services (DS), Learning Disability Support Services (LDSS) or Psychological Disabilities Services (PDS), you may be eligible for reasonable academic accommodations to help you succeed in this course. If you have a documented disability that requires an accommodation, please notify the instructors within the first two weeks of the semester so that we may make appropriate arrangements.

Inclusivity and Diversity: The diversity of the participants in this course is a valuable source of ideas, problem solving strategies, and engineering creativity. If you feel that your contribution is not being valued or respected for any reason, please speak with me privately. If you wish to communicate anonymously, you may do so in writing, speak with Assistant Dean Paula Rees (rees@umass.edu , 413.545.6324, Marston 128), or submit your concern through the College or Engineering Climate Concerns and Suggestions on-line form (tinyurl.com/UMassEngineerClimate). We are all members of an academic community with a shared responsibility to cultivate a climate where all students/individuals are valued and where both they and their ideas are treated with respect.