

University of Massachusetts Amherst
Department of Electrical and Computer Engineering
ECE 213 – Continuous-Time Signals and Systems
Spring 2024

COURSE OBJECTIVES

This course focuses on the study of continuous-time signals and linear continuous-time systems. The focus will be on time- and frequency-domain analysis of linear, time-invariant systems and signals, including Fourier transforms, Laplace transforms, an introduction to sampling, and applications in communications and signal processing. Upon successful completion of this course, you should be able to:

- identify continuous-time signals and systems and their properties,
- compute and apply the Laplace transform for purposes of system and circuit analysis,
- compute and apply the continuous-time Fourier transform and the continuous-time Fourier series for purposes of system analysis and filter design, and
- understand the role of sampling in signal acquisition and processing.

INSTRUCTION TEAM

Prof. Do-Hoon Kwon, Marcus Hall 215A, 413-545-3851, dhkwon@umass.edu
Responsibilities: Lectures, Homework, and Exams

Prof. Bill Leonard, Marcus Hall 8B, leonard@ecs.umass.edu
Responsibilities: Discussions, Computing Exercises, and Exams

Graduate Teaching Assistants (TAs):

- Ivan N. Williams, inwilliams@umass.edu
- Bo Guan, boguan@umass.edu
- Shivani Bhat, sbhat@umass.edu

Responsibilities: Homework administration, grading, piazza.com Q&A's

Undergraduate Instructional Assistants (UIAs):

- Ritvik Verma, ritvikverma@umass.edu
- Daniel Lis, daniellis@umass.edu

Responsibilities: Office Hours, piazza.com Q&A's

Supplemental Instruction leader (SI leader):

- TBD

Responsibilities: SI sessions, piazza.com Q&A's

PREREQUISITES

ECE 201 Analytical Tools, ECE 202 Computational Tools, and ECE 210 Circuits and Electronics I

COURSE FORMAT

Lectures: 10:10–11:00 AM on Monday, Wednesday, and Friday in Marcus 131

- In-person lectures will be recorded using Echo 360
- Zoom on snow days with an advance notice: <https://umass-amherst.zoom.us/j/98945110840>

Discussions: Mondays

- Section A: Mondays, 12:20–1:10 PM in E-Lab 304
- Section B: Mondays, 1:25–2:15 PM in E-Lab 304
- Section C: Mondays, 4:00–4:50 PM in E-Lab 304
- Section D: Tuesdays, 4:00–4:50 PM in E-Lab 304

OFFICE HOURS

- Instructors
 - Prof. Kwon: Tuesdays, 2:00–3:00 PM and Thursdays, 3:00–4:00 PM in Marcus 215F
 - Prof. Leonard: Wednesdays, 3:00–4:00 PM in Marcus 8B
- TAs
 - Ivan Williams: Tuesdays, 3:00–4:00 PM, online only
 - Bo Guan: Fridays, 2:00–4:00 PM in Marcus 205
 - Shivani Bhat: Fridays, 1:00–2:00 PM in Marcus 205
- UIAs
 - Ritvik Verma
 - Mondays, 5:00–6:00 PM in Marcus 214
 - Wednesdays, 4:00–6:00 PM in Marcus 205
 - Daniel Lis: Tuesdays, 5:00–6:00 PM and Thursdays 4:00–6:00 PM in Marcus 205
- SI help sessions
 - Pending
- Zoom when necessary (common to all sessions): <https://umass-amherst.zoom.us/j/96884970061>
- If attending the office hours does not resolve your questions, office hours conflict significantly with your schedule, and the piazza.com discussions are not sufficient, then do reach out to the instructors for additional help.

TEXTBOOK

“Signals and Systems: Theory and Applications” by F. Ulaby and A. Yagle, <http://ss2.eecs.umich.edu> (available for free PDF download; a physical copy can be purchased for ~\$70).

REFERENCES

- H. Hsu, “[Signals and Systems](#),” Schaum’s Outline Series, McGraw Hill, 2014.
- B. P. Lathi, “[Linear Systems and Signals](#),” Oxford, 2018.
- M. L. Roberts, “[Fundamentals of Signals & Systems](#),” McGraw Hill, 2012.
- A. V. Oppenheim, A. S. Willsky, S. H. Nawab, “[Signals and Systems](#),” Prentice Hall, 1997.

LEARNING MANAGEMENT SYSTEM

Moodle at <https://umass.moonami.com>.

Available on moodle are

- Echo 360 lecture videos
- Homework assignments and solutions
- Exams and solutions
- In-class examples as needed

- Discussion notes as needed
- Zoom recordings
 - Lectures on snow days

COURSE GRADING

- Two Midterm Exams: 28% each
 - Midterm 1: Wednesday, March 6, 7:00–9:00 PM in ELab 323 and Marcus 131
 - Midterm 2: Wednesday, April 10, 7:00–9:00 PM in ELab 305 and Marcus 131
- Final Exam: 28%
 - Wednesday, May 15, 8:00–10:00 AM in Marcus 131
- Homework Assignments: 12%
- Computing Exercises: 4%

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:
90-100	A	68-71	C+
85-89	A-	64-67	C
80-84	B+	60-63	C-
76-79	B	55-59	D
72-75	B-	<55	F

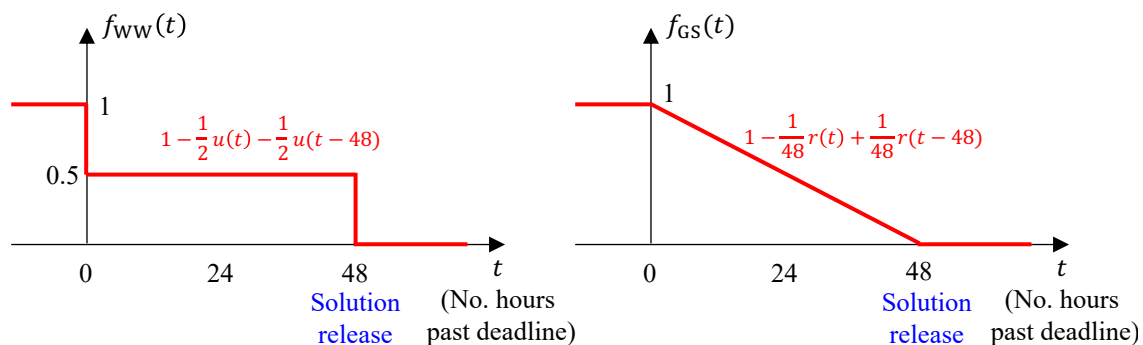
EXPECTATIONS AND REQUIREMENTS

Exams: Exams will be closed-book and closed-notes; calculators are not allowed. A single-sided handwritten formula sheet will be allowed in midterm exams. Midterm exams are not cumulative. The final exam will be cumulative, and a double-sided handwritten formula sheet will be allowed. Each exam will be 2-hours long.

Homework: There will be approximately ten homework assignments (one every week, except for exam weeks) that will be posted on Moodle. Homework submission deadline will be indicated on the assignment sheet. Typically, it will be 5:00 PM on Friday. It is encouraged to discuss the problem sets with others, but each student must turn in a unique personal write-up or code implementation. Some homework problems may require Matlab.

- Format: Each homework set will have a combination of questions for online answer submission and for scan-and-upload
 - WeBWorK questions for online answer submission
 - An in-house WeBWorK service for the course has been established at https://dhkpc.ecs.umass.edu/webwork2/ece213_spring2024
 - Immediate feedback on the correctness of the submitted answers is provided. Multiple attempts are permitted.
 - WeBWorK questions are automatically graded.
 - Your account has already been created on the server. The username is the NET ID, and the initial password is your Student ID number. Change your password upon first log-in.
 - Questions for scan-and-upload

- Work for these questions should be submitted online via Gradescope, available at <http://www.gradescope.com>. You will need to use entry code XX4V6W to add the course to your Gradescope account.
 - Gradescope questions will be graded later manually.
- Total homework credit
The maximum credit that can be received for homeworks will be capped at $100 \text{ points/assignment} \times (\text{number of assignments} - 1)$. Effectively, this allows you to drop one homework assignment, yet still receive full credit assigned to homework in the course grading.
- Excused late submissions
A note from UHS or equivalent will allow late submission without penalty. A new deadline should be arranged with the instructor *prior to* the original deadline.
- Unexcused late submissions
An unexcused late submission will be accepted up to 48 hours past due and graded, but penalties will be applied to the graded score before being credited. Specifically, graded scores of WeBWorK questions and Gradescope questions will be multiplied by $f_{WW}(t)$ and $f_{GS}(t)$ to calculate credit, respectively.



Attendance: An extra credit of 1% will be assigned for the entirety of lecture attendance. We will use the smartphone app Acadly, which is available for iOS (<https://apps.apple.com/us/app/acadly>) and Android (<https://play.google.com/store/apps/details?id=co.acetone.acadly>). Use the JPCV74 to join the course on Acadly. The app is free for the first course, and there is a cost of \$3 per additional course. It uses a Bluetooth-based mesh network. Hence, with the Bluetooth function turned on, physical presence in proximity to the instructor at a designated time during a lecture will automatically register attendance. For those who decide not to use Acadly for the course attendance, name and signature will be collected at the end of each lecture on the way out.

Depending on the ease and effectiveness of Acadly, an alternative method may be tried for attendance, such as a simple Moodle quiz.

Quizzes: Depending on the course progress, quizzes during lectures and/or discussions may be introduced. Quizzes will count as extra credit.

Computing Exercises: Computing exercises will be assigned in this course. The purpose of the exercises is to give you practice with computational aspects and implementations of course topics. The computing exercises will be assigned and administered by Prof. Leonard.

Piazza: We will be using Piazza for online discussion. The system is highly catered to getting you help fast and efficiently from classmates and the instruction team. Rather than emailing questions to the instruction team, we encourage you to post your questions on Piazza. Typically, most questions are

responded to within an hour of posting. The Piazza site of the course is <https://piazza.com/umass/spring2024/ece213>.

ACADEMIC HONESTY

Maintaining the integrity of scholarship and research within institutions of higher education requires a cultural and individual commitment. The University Academic Honesty Policy Applies in this and all courses. This policy can be found on the University Web Page (<https://www.umass.edu/honesty>). Academic dishonesty includes but is not limited to cheating, fabrication, plagiarism, and abetting or facilitating dishonesty. Since students are expected to be familiar with this policy and the commonly accepted standards of academic integrity, ignorance of such standards is not normally sufficient evidence of lack of intent. Concerns about academic dishonesty may be reported to the course instructor, another trusted faculty or staff member, the department head, or anonymously through the department (refer to departmental webpage) or College's classroom experience form (<https://tinyurl.com/UMassEngineerClassroom>).

In this class, the following are specifically considered allowed/not allowed as indicated:

Encouraged

- Discussing course content
- Discussing/brainstorming proper approach to homework problems
- Comparing final answers

Not allowed

- Use of Chegg and similar software for solution of homework/exam questions
- Use of AI software such as ChapGPT for essays or short answer prompts
- Copying homework solutions or steps from other students

ACCESSIBILITY SUPPORT SERVICES

Your success in this class is important to me. We all learn differently and bring different strengths and needs to the class. The University of Massachusetts Amherst is committed to making reasonable, effective, and appropriate accommodations to meet the needs of all students and help create a barrier-free campus.

If you have a documented disability on file with Disability Services, **please login to Clockwork and select this class if you believe you will need accommodations**. Disability Services staff will then provide you note access. Please share that with me ASAP. This is your responsibility.

If you have a disability but are not yet affiliated with Disability Services, please [register](#) and let me know.

EITHER:

If you are eligible for exam accommodations, I will ask you to use the Disability Services exam proctoring center. Contact Disability Services immediately and comply with their exam scheduling policies, including the ***requirement that you book your exams at least seven days in advance of the exam date***. Anticipated exam dates for this class are noted in this syllabus.

OR:

If you are eligible for exam accommodations, I will work with you directly to meet these needs.

Beyond disability accommodations, if there are aspects of the course that prevent you from being fully included in the class, please let me know as soon as possible. Together we'll develop strategies to meet both your needs and the requirements of the course.

INCLUSIVITY

We are all members of an academic community with a shared responsibility to cultivate a climate where all individuals are valued and where both they and their ideas are treated with respect. Everyone should feel that they are an integral part of this community. A diversity of perspective and experience provides 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 with someone else in the College or University, there are several ways to do so anonymously or to provide contact information if you so choose. A summary of these options is available [here](#).

HEALTH AND WELLBEING

You are not alone at UMass – many people care about your wellbeing and many resources are available to help you thrive and succeed. The College recognizes that coursework is challenging and that classes are not the only demand in your life. Success in this course and the College of Engineering depends heavily on your personal health and wellbeing. Recognize that while stress is an expected part of the college experience, it can be compounded by unexpected setbacks or life changes outside the classroom. Strive to reframe challenges as an unavoidable pathway to success. Reflect on your role in taking care of yourself throughout the term, before the demands of exams and projects reach their peak. Please feel free to reach out to me about any difficulty you may be having that may impact your performance as soon as it occurs and before it becomes too overwhelming.

You can learn about the confidential mental health services available on campus by calling the Center for Counseling and Psychological Health (CCPH) by visiting their website at umass.edu/counseling. They provide a lot of resources beyond individual therapy. Check-out some of their great, free resources, including Togetherall and Welltrack. There are many other resources on campus for students facing personal, financial or life challenges to find support, stay in school, and graduate (<https://www.umass.edu/studentlife/single-stop>).

Within the College, you may reach out to myself, your academic advisor, the [Office of Student Affairs](#) (coeadvising@umass.edu) the [Office of Diversity, Equity, and Inclusion](#) (engindiversity@umass.edu). I encourage you to contact support services on campus that stand ready to assist you. Remember that as your instructor, I am here to help you find the resources you need.

GENDER RESPECT

The University of Massachusetts Amherst aspires to be a university environment that is free of discrimination, sexual harassment, and sexual violence. If you or someone you know has experienced sexual assault, sexual misconduct, or sexual discrimination please see <https://www.umass.edu/titleix/> for information about resources and reporting options. UMass Amherst is committed to supporting community members who report concerns of prohibited conduct. Please reach out to me if you would like assistance connecting with any of these resources/options.

TITLE IX STATEMENT

In accordance with Title IX of the Education Amendments of 1972 that prohibits gender-based discrimination in educational settings that receive federal funds, the University of Massachusetts Amherst is committed to providing a safe learning environment for all students, free from all forms of discrimination, including sexual assault, sexual harassment, domestic violence, dating violence, stalking, and retaliation. This includes interactions in person or online through digital platforms and social media. Title IX also protects against discrimination on the basis of pregnancy, childbirth, false pregnancy, miscarriage, abortion, or related conditions, including recovery. There are resources here on campus to support you. A summary of the available Title IX resources (confidential and non-confidential) can be found at the following link: <https://www.umass.edu/titleix/resources>. You do not need to make a formal report to access them. If you need immediate support, you are not alone. Free and confidential support is available 24 hours a day / 7 days a week / 365 days a year at the SASA Hotline 413-545-0800.

PRONOUNS AND NAMES

Everyone has the right to be addressed by the name and pronouns that they use for themselves. Students can indicate their preferred/chosen first name and pronouns on SPIRE, which appear on class rosters. Please let me know what name and pronouns I should use for you if they are not on the roster. Please kindly correct me and fellow classmates when we make mistakes. To learn more, please see this resource: https://www.umass.edu/stonewall/sites/default/files/pronouns_intro.pdf

LECTURE AND ASSIGNMENT SCHEDULE

Week	Topics	Textbook Readings	Assignment due
1 (1/29)	Introduction; review of complex numbers and complex exponentials; classes of signals.	Appendix B; Sec. 1-1	
2 (2/5)	Operations on signals; signal properties.	Sec. 1-2 – 1-4	Homework 1
3 (2/12)	The impulse signal. Energy and Power. Linear and Time-Invariant (LTI) systems.	Sec. 1-4 – 2-1	Homework 2
4 (2/19)	Time domain analysis of LTI systems: impulse response, convolution.	Sec. 2-2 – 2-5	Homework 3
5 (2/26)	Time domain analysis of LTI systems (Continued): System properties: causality, stability. Differential equation representations, response to complex exponential inputs.	Sec. 2-6 – 2-7	Homework 4
6 (3/4)	Laplace Transform: definition and properties, poles and zeros	Sec. 3-1 – 3-3	Midterm 1
7 (3/11)	Laplace Transform: transient responses of linear circuits, inverse transform by partial fraction expansions, transfer functions, system stability.	Sec. 3-4 – 3-7	Homework 5
8 (3/25)	Laplace Transform Applications: s-domain circuit analysis, system synthesis.	Sec. 4-2, 4-7	Homework 6
9 (4/1)	Laplace Transform Applications: feedback control.	Sec. 4-8	Homework 7
10 (4/8)	Fourier Series: phasor analysis, representations of periodic signals, application to circuit analysis.	Sec. 5-1 – 5-5	Midterm 2
11 (4/15)	Fourier Transform: definition, properties, important transform pairs.	Sec. 5-7 – 5-8	Homework 8
12 (4/22)	Fourier Transform: signal energy, systems analysis, frequency response (magnitude and phase).	Sec. 5-9 – 5-10	Homework 9
13 (4/29)	Fourier Transform applications: filters, filter design, amplitude modulation.	Sec. 6-5, 6-9, 6-12	Homework 10

14 (5/6)	Sampling theorem: sampling and reconstruction.	Sec. 6-13.1 – 6.13.7	
Finals (5/13)			Final exam (cumulative)