CPE381 Fundamentals of Signals and Systems for Computer Engineers

Instructor: Rahul Bhadani

Day/Time: MW 11:20 AM -12:40 PM
Location: ENG 240
https://uah.instructure.com/courses/77162

Instructor:	Rahul Bhadani
Office:	ECE 217-H
Office Hours:	Tuesday 2:00 PM - 4:00 PM, Wednesday, 12:45 PM - 2:00 PM
Email:	rahul.bhadani@uah.edu
Reference(s):	Required: *Signals and Systems using Matlab*. Luis F. Chaparro. Elsevier, 3rd Edition, 2019. ISBN: 978-0-12-814204-2, eBook ISBN: 9780128142059
	Suggested Reading: *Linear Systems and Signals*, B. P. Lathi, Roger Green, Oxford University Press, 2017, 3rd Edition
Prerequisites:	EE 213 – Electrical Circuit Analysis I MA 238 – Applied Differential Equations
Mid Term 1:	September 30, Monday
Mid Term 2:	November 06, Wednesday
Final Exam:	December 13, Friday

Course Description

The course introduces fundamental concepts of signals and systems. We introduce system organization and methods for signal and system analysis. The course offers hands-on experience with signal analysis using Matlab and C programming which is very useful for skill development in careers in Controls, Robotics, and Computer Engineering in general.

Objectives

- Identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics

- Use Laplace transform to analyze systems and Fourier transform to analyze signals

- Implement custom signal processing procedures in Matlab and C/C++

Summary of your responsibilities as an active participant in this course

Commit to taking part in every single class meeting. Commit to being engaged by switching off your mobile devices. Commit to learning the material in advance by performing the reading assignments without distraction. Commit to starting your homework and quizzes early by reading the homework descriptions before you start working on the code. Commit to helping everyone in the class by actively engaging in all the in-class exercises — even if you don't understand the topic, and even if you understand the topic better than everyone (including the instructors).

Commit to being an engaged member of this class, and your reward will be a deeper understanding of your own abilities and a deeper appreciation of how you can succeed in your career through committing to do better.

Academic Topics

The set of topics and areas covered by this course, and upon which you may be tested, include:

- Introduction, Mathematical Preliminaries: Trigonometry, Complex Numbers, Calculus

- Continuous and Discrete Signals: Types of Signals and Their Usage, Sketching Signals, Transformation of Signals

- Linear-time Invariant (LTI) Systems: Continuous Time Systems. System concept. LTI continuous-time systems, Linearity. Time invariance. Convolution integral. Causality. BIBO stability

- Laplace Transform: The Laplace Transform. Two-sided Laplace. One-sided Laplace, Analysis of LTI systems, Inverse Laplace Transform, The Transfer Function of LTI Systems, Analysis of LTI Systems Represented by Differential Equations, Inverse of Two-Sided Laplace Transforms

- Fourier Series for Frequency Analysis: The Fourier Series, Eigenfunctions, Complex exponential Fourier Series, Time and Frequency Shifting, Response of LTI Systems to Periodic Signals,

- Fourier Transform: Fourier Transform from Laplace Transform, Inverse Proportionality of Time and Frequency, Applications of Fourier transform, Spectral Representation, Convolution and Filtering

- Sampling Theory: Uniform sampling, Nyquist-Shannon sampling theorem, Quantization and Coding

- **Discrete-Time Signals and Systems:** Basic Discrete-time Signals, Recursive and Non-recursive Discrete-time Systems, Convolution Sum

- **Z-transform:** Z-Transform and Discrete Fourier Transform, Two-sided Z-transform, Inverse Z transforms, Fourier Analysis of Discrete-time Signals and Systems, Discrete-time Fourier transform, Discrete Fourier transform

- **Discrete Fourier Analysis:** The Discrete-Time Fourier Transform, Fourier Series of Discrete-time Periodic Signals, Complex and Exponential Discrete Fourier Series, Discrete Fourier Transform

Course Outline:

The listing of weekly course lecture topics may be found on the course webpage and is subject to change without notice due to class progress. In the event of a class cancellation, advance notice *via email* will be given, but any homework due that day will still be due unless otherwise notified via email.

Grade Policy:

As your instructor, I do not "give" grades: I assign the grade that you earn—based on your individual performance. You will not be competing with other students for your grade for all assignments in this course: your grade is solely based on the points you earn, in the below-weighted categories:

Homework:	25%
Quizzes:	5%
Attendance/In-Class Participation:	10%
Mid-term Exam 1:	15%
Mid-term Exam 2:	15%
Final Exam:	30%

Grading Scale	
Percentage	**Grade**
90% - 100%	A
75% - 89%	B
60% - 74%	C
45% - 59%	D
0% - 44%	F

Percent score will be rounded to nearest integer before assigning the final grade.

Assignment of grades is done according to a "modified-contract" method. The above scale represents a minimum guarantee. However, the instructor reserves the right to "upward curve" the final grade of the entire class, or of one or more individuals whose objective performance improves as the term progresses.

Students with Disabilities:

The University of Alabama in Huntsville will make reasonable accommodations for students with documented disabilities. If you need support or assistance due to a disability, you may be eligible for academic accommodations. Apply here or contact Disability Support Services (256.824.1997 or Wilson Hall 128) as soon as possible to coordinate accommodations.

Technology Statement

This course will use UAH's learning management system, Canvas, as well as other technology tools. Students will be expected to have access to a computer with internet capabilities in order to fully participate in this course.

Course Websites

Main Website: https://uah.instructure.com/courses/77162

Homework Submission Policy

You must submit all of the code, data, and pdf files in a zip folder (i.e., not rar, 7z, etc) on Canvas. If the submission requires only a single file, it doesn't need to be zipped. Assignments must be submitted as a zip file with code and a pdf document with your solutions! You must include a single PDF file (not doc, docx, or multiple JPEG figures of the pages from your homework) with

the solutions. Failure to follow any/all of these policies leaves the instructor the option not to grade the homework based on a failure to follow the homework submission policy. Your zip and pdf should be named as follows LastFirst-HW-X.zip and LastFirst-HW-X.pdf, where Last is your last name as it appears on Canvas, First is your first name as it appears on Canvas and X is the homework number.

Missed Assignments/Make-Ups/Extra Credit

No late homework assignments or quizzes will be accepted. Students are expected to start working on their assignments as soon as it is posted. Homework solutions will be posted within one week of their due date. There will not be extra credit assignments, however, individual homework may have bonus questions constituting not more than 10% of the individual assignment.

Attendance, Participation, and Quizzes:

Attendance is mandatory. Although the class roll will be taken every day, pop quizzes or class handouts *may* be given without notice. Pop quizzes may not be made up, though a certain number may be dropped. In-class exercises will serve as objective measures of your participation and attendance, and may not be made up. Expected absences for valid reasons (e.g., travel to a conference) *must be cleared in advance* to avoid penalty for missing participation.

Attendance Policy

All students are expected to arrive on time and attend lectures. If there are extenuating circumstances, please email the instructor. If you are absent, you are responsible for learning the material covered in class. If you are absent when an assignment is due, you must have submitted the assignment before the due date to receive credit. Please contact your instructor if you have specific questions or concerns.

Class Disruptions:

Please silence your cell phone, and do not use it during the class. The use of a phone in class will adversely affect your attendance grade*.

Academic Integrity:

Students are expected to do all work by themselves, except when specified by the instructor in writing. All exceptions will be plainly marked in the requirements for that exercise or project. Any violations of this policy will be dealt with to the full extent permitted by the University of Alabama in Huntsville, and *may result in suspension or expulsion from the university, in*

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*Uh, um, unless you are programming it as part of an in-class exercise. But please no talking or texting. Unless, uh, that is part of the class exercise too.

addition to a failing grade. Please familiarize yourself with the Code of Academic Integrity if you have any questions.

Communication & Instructional Continuity

In this class, the official mode of communication is through the Slack channel. During the week, students can expect a response from the instructor within a 24-48 hour timeframe. Messages sent during the weekend may not be answered until the following week. On occasion, response times may vary due to domestic and international travel for conferences or meetings.

In the event a regularly scheduled course is unexpectedly interrupted, course requirements, due dates, and grading policy are subject to change when necessitated by revised course delivery, semester calendar, or other instances. Information about changes in this course can be obtained from the Canvas course webpage or by contacting me. If, under these circumstances, I do not respond within 72 hours, please contact my department at ece@uah.edu.

If our regular scheduled class meeting is interrupted or the campus should unexpectedly close, students should immediately log onto Canvas and read any course announcements. Students are encouraged to continue the readings and other assignments as outlined on the course syllabus until otherwise advised. Any student who does not could fall behind in the course.

Course Conduct

All students must treat others with civility and respect and conduct themselves in a way that does not unreasonably interfere with the opportunity of other students to learn. All communication between student/instructor and between student/student should be respectful and professional.

Academic Honesty

Your written assignments and examinations must be your own work. Academic misconduct will not be tolerated. Examples of unacceptable behavior include plagiarism/use of prior work/use of Chegg and other online problem-solving sites/etc. To ensure that you are aware of what is considered academic misconduct, you should review carefully the definitions and examples provided in the Student Handbook. If you have questions in this regard, please contact me without delay.

Course Artificial Intelligence (AI) Policy

You are allowed to use a generative model-based AI tool for your assignment. However, you must submit an accompanied reflection report on how you use the AI tool, what was the query for the tool and how it improved your understanding of the subject. You must also add your thoughts on how you would tackle the assignment if there was no such tool available. Failure to provide a reflection report for every single assignment where an AI tool was used may result in a penalty and subsequent actions will be taken in line with plagiarism policy.

Safety Instructions

The frequent operation of a computer, such as will be required in this course, may have long-term disabling effects if you do not appropriately consider your ergonomic interaction with the computer, desk, chair, and light sources. Poorly designed workstations/practices can lead to musculoskeletal disorders and may result in chronic pain, inability to sleep, or expensive surgery decades from today. The habits you form in your university years may well impact your future performance, and it is highly recommended that you consult with the office risk management and compliance https://www.uah.edu/rmi.

Disability Statement

The University of Alabama in Huntsville will make reasonable accommodations for students with documented disabilities. If you need support or assistance due to a disability, you may be eligible for academic accommodations. Apply here or contact Disability Support Services (256.824.1997 or Wilson Hall 128) as soon as possible to coordinate accommodations.

Mental Health Statement

As a student you may experience a range of issues that can cause barriers to learning, such as strained relationships, increased anxiety, alcohol/drug problems, feeling down, difficulty concentrating and/or lack of motivation. These mental health concerns or stressful events may lead to diminished academic performance or reduce a student's ability to participate in daily activities.

The University of Alabama in Huntsville offers services to assist you with addressing these and other concerns you may be experiencing. If you or someone you know are suffering from any of the aforementioned conditions, you can learn more about the broad range of confidential mental health services available on campus via the Department of Student Affairs located under the Health and Wellness or the UAH Counseling Center by calling 256.824.6203.

24-hour emergency help is also available through the 24/7 National Suicide Prevention Hotline at 1.800.273.TALK or at suicidepreventionlifeline.org or a student who lives on-campus can reach out to the UAH PD dispatch to contact an on-call counselor by calling 256.824.6596. If you find yourself in a mental health emergency, call 6911 on-campus or 911 off-campus.

Pertinent UAH Policies & Guidelines

- UAH Student Handbook

- Academic Misconduct Policy

- Complete listing of UAH Policies and Procedures

- AI and the Classroom

Campus Resources

The University of Alabama in Huntsville offers a range of student services to enhance the experience of students.

- Academic Support Services – ASAP, Student Success Center, Tutoring, PASS, Academic Support Centers by College

- Student Support Services – Counseling Center, Disability Support Services, Student Health Services, Office of International Services, Multicultural Affairs, etc.

- UAlert—Sign up for UAH's emergency notification system to receive urgent messages from the university

- Registrar's Office – Academic Calendars, Course Registration, Student Records, Commencement

- M. Louis Salmon Library – Printed and Online Resources, Reference Services, Group Study Rooms, AV Resources, Printing

- Canvas Support – Call 844-219-5802 to report an issue with Canvas.

- OIT Help Desk – For technical support, contact the OIT Help Desk (helpdesk@uah.edu; 256.824.3333)

NOTE: When submitting a support ticket include your name, your class, the element/assignment being affected, and a detailed description of the issue. Providing a screenshot is often very helpful in diagnosing an issue.

Important Dates

Review the semester dates and deadlines and the academic calendar.

Subject to Change

Every effort is made to follow the guidelines in the syllabus; however, if needed, the syllabus will be amended. You will be notified if changes are made.

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