

Introduction to Signals and Systems

EEL 3135

Class Periods: Section 11711: TR | Period 3-4 (9:35 AM – 11:30 AM), LAR 0310
Section 11710: TR | Period 9-10 (4:05 PM – 6:00 PM), MAEB 0211

Academic Term: Spring 2023

Canvas: <https://ufl.instructure.com/courses/471610/>

Instructors

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Teaching Assistants / Supervised Instructors

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|---------------------|---|-------------------|
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Course Description

Continuous-time and discrete-time signal analysis including Fourier series and discrete-time and discrete Fourier transforms; sampling; discrete-time linear system analysis with emphasis on FIR and IIR systems: impulse response, frequency response, and system function; MATLAB-based programming for Signals and Systems.

Course Pre-Requisites / Co-Requisites

Prerequisite: MAC 2313 (Calculus 3) or equivalent

Course Objectives

At the conclusion of this course, you should be able to:

- understand basic concepts of discrete-time signals and linear time invariant (LTI) systems
- provide time-domain and frequency-domain descriptions of these signals and systems
- employ Fourier analysis to design and analyze simple LTI systems
- proficiently use MATLAB as a programming and numerical analysis tool
- implement simple discrete-time systems, such as linear filters, in MATLAB
- program MATLAB to numerically perform Fourier analysis of signals and LTI systems.

Recommended / Required Materials

- **Textbook:** DSP First, 2nd edition (Recommended)
 - **Authors:** James H. McClellan, Ronald W. Schafer, and Mark A. Yoder
- **Software:** MATLAB (Required)
 - Available on UFApps (requires using a VPN)
 - Student Version (\$99 for student edition with toolboxes, \$50 without toolboxes)

Course Schedule (First Half)

Date	Lecture Topics	Text	Quizzes	Homework	Labs
Mon Jan 9					
Tue Jan 10	Introduction	1			
Wed Jan 11					
Thu Jan 12	Sinusoids, Complex Sinusoids	2			
Mon Jan 16				HW 0	Lab 0
Tue Jan 17	Sums and Products of Sinusoids	2,3			
Wed Jan 18			L Quiz 1		
Thu Jan 19	Fourier Series 1	2,3			
Mon Jan 23				HW 1	Lab 1
Tue Jan 24	Fourier Series 2	3,4	B Quiz 1		
Wed Jan 25			L Quiz 2		
Thu Jan 26	Sampling and Reconstruction 1 & 2	3,4			
Mon Jan 30				HW 2	Lab 2
Tue Feb 31	Interpolation, Discrete-Time Systems	4,5	B Quiz 2		
Wed Feb 01			L Quiz 3		
Thu Feb 02	FIR Filters, Convolution	4,5			
Mon Feb 06				HW 3	Lab 3
Tue Feb 07	LTI Systems 1 & 2	5	B Quiz 3		
Wed Feb 08			L Quiz 4		
Thu Feb 09	Frequency Response 1	5			
Mon Feb 13				HW 4	Lab 4
Tue Feb 14	Frequency Response 2 & 3	6	B Quiz 4		
Wed Feb 15			L Quiz 5		
Thu Feb 16	Transient Response	6			
Mon Feb 20				HW 5	Lab 5
Tue Feb 21	Discrete-Time Fourier Transform 1	6	B Quiz 5		
Wed Feb 22			L Quiz 6		
Thu Feb 23	Discrete-Time Fourier Transform 2	6			
Mon Feb 27				HW 6	Lab 6
Tue Feb 28	Review	--	B Quiz 6		
Wed Mar 01					
Thu Mar 02	Midterm	--			

Course Schedule (Second Half)

Date	Lecture Topics	Text	Quizzes	Homework	Labs
Mon Mar 06					
Tue Mar 07	Z-Transform 1 & 2	7			
Wed Mar 08			L Quiz 7		
Thu Mar 09	Poles & Zeros 1	7			
Mon Mar 13	Spring Break				
Tue Mar 14	Spring Break				
Wed Mar 15	Spring Break				
Thu Mar 16	Spring Break				
Mon Mar 20				HW 7	Lab 7
Tue Mar 21	Poles & Zeros 2	8	B Quiz 7		
Wed Mar 22			L Quiz 8		
Thu Mar 23	IIR Filters 1 & 2	8			
Mon Mar 27				HW 8	Lab 8
Tue Mar 28	IIR Filters 3	8	B Quiz 8		
Wed Mar 29			L Quiz 9		
Thu Mar 30	Inverse Z-Transform	8			
Mon Apr 03				HW 9	Lab 9
Tue Apr 04	Analysis in Three Domains	--	B Quiz 9		
Wed Apr 05			L Quiz 10		
Thu Apr 06	Discrete Fourier Series 1 and 2	13			
Mon Apr 10				HW 10	Lab 10
Tue Apr 11	Discrete Fourier Transform 1 and 2	13	B Quiz 10		
Wed Apr 12			L Quiz 11		
Thu Apr 13	Fast Fourier Transform 1	13			
Mon Apr 17				HW 11	Lab 11
Tue Apr 18	Fast Fourier Transform 2	13	B Quiz 11		
Wed Apr 19			L Quiz 12		
Thu Apr 20	Fast Fourier Transform 3	13			
Mon Apr 24				HW 12	Lab 12
Tue Apr 25	Review	--	B Quiz 12		
Wed Apr 26					
Thu Apr 27	No class (Reading Day)	--			
Mon May 01	Final Exam (3:00 PM – 5:00 PM)	--			
Thu May 04	Final Exam (8:00 PM – 10:00 PM)	--			

Course Structure

Attendance & Participation:

Attendance is graded through classwork (due 15 minutes after each class). Classwork will be completed in groups during the class period and graded based on your participation.

Slack Page:

We have a Slack page for the course: TBA. This is an *optional* resource for students to discuss the course amongst each other and occasionally with the Professors and UPIs. This resource is intended to supplement office hours and student interactions. It also serves as an additional communication medium in class. **No official communications / submissions happen over Slack. No assignment submissions will be accepted over Slack.**

Evaluation Methods and Criteria

The following section discusses the policies for each of the graded assessments in this course. You should look here first for answers to any general, course-related inquiries. **TIP:** Pay attention to the workflow: There will be one quiz every class day except midterm week; one weekly big quiz, one weekly little quiz. Homework and labs will generally be due every week. **Do not fall behind.**

Classwork Questions (1 per class)

When: Assigned roughly every class.

What: Analytical problems that can be solved by hand.

Why: Classwork is intended to guide you through material and present you with questions that will require time to think and complete. Classwork assignments are not meant to be completed in a single day.

Mid-term Exam & Final Exam (1 mid-term and 1 final in total)

When: The midterm is half-way thru the course. The final is at the end of the course during the standard block

What: Analytical problems that can be solved by hand. Similar to the homework and big quizzes.

Why: Exams are an opportunity to show what you know about signals and systems.

Grading: Exam is graded on a 100-point scale.

Make-up Exams: There are no make-up exams, but the final exam may be used place of the mid-term exam.

Little Quizzes (12 in total)

When: Occur roughly once every week (except for midterm week). The quiz will take roughly 5-10 minutes.

What: The quizzes are low stack questions about lecture videos.

Why: These quizzes are to ensure that you watched the lectures for the current week.

Grading: Little quizzes are graded based on completion

Big Quizzes (13 in total)

When: Occur roughly once every week (except for midterm week). The quiz will take roughly 20 minutes.

What: Three or four short analytical problems similar to examples on the course website.

Why: These quizzes are intended (1) to help you, the teaching assistants, and me assess your current understanding of material and (2) to broaden the course's grading and lower the stakes of each exam.

Grading: Big quizzes are graded on a 25-point scale.

Re-grades: You may submit a regrade request no later than **one week** after the respective quiz grade has been unmuted. No additional regrades will be accepted.

E-mail or speak in class to the TA who graded your quiz to receive a regrade. You can appeal the regrades decision by going to the lead instructor, but only after you have spoken to the TA.

Make-up Policy: If you need to make-up a quiz due to university events, family, or anything major, you must provide documentation to a **course instructor one week** before the due date unless it is something unpredictable, such as a death in the family. If approved the course instructor will forward you to a TA for scheduling. You will have **one week** after the quiz to make it up. Failure to provide proof or not asking for a make-up quiz on time will require the quiz to be taken at the scheduled time.

Labs / Homework (13 in total)

When: There are weekly homework / labs. There may not be assignment every week (e.g., during exam week). There are no dropped assignments.

What: All homework and labs are combined into a single assignment that is graded separately.

Always submit your complete code for an assignment, even if it's one line. Penalties will be marked off accordingly.

Commenting on code is very important for other classes and in the workforce. You will receive a penalty for not commenting your code.

Assignments will be submitted as PDFs, using the “publish” function in MATLAB. This will display all of your code and all of your outputs together. If you write a 40-line script, then change one line as an objective later, show both full scripts in your submission. **Do not screenshot your code and make sure to submit all code used in the lab (the MATLAB ‘type’ function is super helpful).**

Why: Homework is intended to guide you through material and present you with questions that will require time to think and complete. Homework assignments are not meant to be completed in a single day. In each lab portion, we apply signals and systems theory to a particular application. This gives you a better understanding about how signals and systems theory is applied in practice.

Late policy: Your late assignments have at maximum of **3 days** before receiving a 0. Every day late receives a 10% late penalty on the maximum possible value. For example, if the assignment is out of 50 points and is due 11:59pm February 2nd, turning it in at 12:00am February 3rd will result in a maximum of 45 points on the assignment.

Extension Policy: If you need an extension on an assignment due to university events, family, or anything major, you must provide documentation to the TA grading your lab **one week** before the due date unless it is something unpredictable, such as a death in the family. Failure to provide proof or not asking for an extension on time will require the assignment to be submitted on-time.

Re-grades: You may submit a regrade request no later than **one week** after the respective lab grade has been unmuted. No additional regrades will be accepted.

The re-grade be new PDF with comments that start with the word “RE-GRADE.” These comments should state what you want points and why. Submit the new document in the same manner you submitted the assignment. **DO NOT EMAIL OR MESSAGE** asking for a regrade. If you still don't like the regrade from a TA, you can go to the instructors and ask for an appeal to the regrade. **Do not** disturb them unless you have gone through your lab TA first.

Evaluation of Grades

Assignment	Percentage of Final Grade
Classwork	5%
Homework	10%
Graded Labs	20%
Midterm Exam	20%
Final Exam	20%
Little Quizzes	5%
Big Quizzes	20%
	100%

Grading: If the final exam score is greater than the midterm score, then the midterm will be dropped and the final will count for 40% of the grade.

Grading Policy

Percent	Grade	Grade Points
93.3 - 100.0	A	4.00
90.0 - 93.3	A-	3.67
86.6 - 90.0	B+	3.33
83.3 - 86.6	B	3.00
80.0 - 83.3	B-	2.67
76.6 - 80.0	C+	2.33
73.3 - 76.6	C	2.00
70.0 - 73.3	C-	1.67
66.6 - 70.0	D+	1.33
63.3 - 66.6	D	1.00
60.0 - 63.3	D-	0.67
00.0 - 60.0	E	0.00

More information on UF grading policy may be found at:

<http://gradcatalog.ufl.edu/content.php?catoid=10&navoid=2020#grades>

<https://catalog.ufl.edu/ugrad/current/regulations/info/grades.aspx>

Accreditation Information

Relation to Program Outcomes (ABET):

Outcome	Coverage
Outcome 1. An ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics	Students are assessed using: <ul style="list-style-type: none">- Focused exam questions on<ul style="list-style-type: none">o their ability to solve differential equationso using engineering techniqueso their ability to work with complex numbers and exponentials.- Exam questions target the use of<ul style="list-style-type: none">o impulse responses, frequency response, DTFT, and z-transform methods.- Using a MATLAB programming, the students are required to<ul style="list-style-type: none">o apply filtering concepts to design a piano octave detection system to meet specifications.
Outcome 6. An ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions	Students are assessed using: <ul style="list-style-type: none">- A MATLAB assessment where<ul style="list-style-type: none">o Students are provided EKG signals (actual data) of a number of patients from a public database. The students are required to break each EKG signal down into overlapping windows and apply FFT on each window.o From the FFT results, the students then generate a time trajectory of the heart rate of a patient.o As the EKG signals are noisy and could occasionally be distorted, the students are required to design algorithms that carefully interpret the FFT results to rid out readings that are not physically reasonable.

Course & University Policies

Modifying Syllabus by Class Vote

When: If you and/or other students believe the course would be improved by a change in the syllabus and I agree that it would be a reasonable change. **What:** The proposed change will be put to an anonymous vote with the entire class. If the majority of the class agrees to this change, it becomes part of the syllabus. **Why:** Changes to the syllabus may be necessary do to unforeseen situations. The class vote ensures the entire class agrees with the change.

Collaboration

Healthy collaboration: To solve homework assignments, healthy discussion and collaboration amongst classmates is encouraged. Healthy collaboration includes:

- Discussing and explaining general course material
- Discussing assignments for better understanding
- Providing assistance for general programming and debugging issues

If another student contributes substantially to your understanding of a problem, you should *cite* this student to let myself and the teaching assistants be aware of your similar interpretations of a problem. You will not be judged negatively for citing another student.

Cheating and plagiarism: While collaboration is encouraged, you are expected to *submit your own work*. Submitting work completed by another student is considered plagiarism and will be dealt with according to university policy. In general, if you do not fully understand your solution, the work is not your own. Examples of plagiarism or cheating include:

- Copying (or allowing someone to copy), even partially, an assignment solution or program from the course
- Submitting material, particularly code, using material taken from another source without proper a citation
- Obtaining solutions to assignments or exams through inappropriate means

Note that I may elect to use a plagiarism detection service in this course, in which case you will be required to submit your work to such a service as part of your assignment.

Consequences: If you are suspected of dishonest academic activity, I will invite you to discuss it further in private. Academic dishonesty will likely result in a grade reduction, with severity depending on the nature of the dishonest activity. I am obligated to report on academic misconduct with a letter to the department, college, and/or university leadership. Repeat offences will be treated with significantly greater severity.

Students Requiring Accommodations

Students with disabilities who experience learning barriers and would like to request academic accommodations should connect with the disability Resource Center by visiting <https://disability.ufl.edu/students/get-started/>. It is important for students to share their accommodation letter with their instructor and discuss their access needs, as early as possible in the semester.

Course Evaluation

Students are expected to provide professional and respectful feedback on the quality of instruction in this course by completing course evaluations online via GatorEvals. Guidance on how to give feedback in a professional and respectful manner is available at <https://gatorevals.aa.ufl.edu/students/>. Students will be notified when the evaluation period opens, and can complete evaluations through the email they receive from GatorEvals, in their Canvas course menu under GatorEvals, or via <https://ufl.bluera.com/ufl/>. Summaries of course evaluation results are available to students at <https://gatorevals.aa.ufl.edu/public-results/>.

In-Class Recording

Students are allowed to record video or audio of class lectures. However, the purposes for which these recordings may be used are strictly controlled. The only allowable purposes are (1) for personal educational use, (2) in connection with a complaint to the university, or (3) as evidence in, or in preparation for, a criminal or civil proceeding. All other purposes are prohibited. Specifically, students may not publish recorded lectures without the written consent of the instructor.

A “class lecture” is an educational presentation intended to inform or teach enrolled students about a particular subject, including any instructor-led discussions that form part of the presentation, and delivered by any instructor hired or appointed by the University, or by a guest instructor, as part of a University of Florida course. A class lecture does not include lab sessions, student presentations, clinical presentations such as patient history, academic exercises involving solely student participation, assessments (quizzes, tests, exams), field trips, private conversations between students in the class or between a student and the faculty or lecturer during a class session.

Publication without permission of the instructor is prohibited. To “publish” means to share, transmit, circulate, distribute, or provide access to a recording, regardless of format or medium, to another person (or persons), including but not limited to another student within the same class section. Additionally, a recording, or transcript of a recording, is considered published if it is posted on or uploaded to, in whole or in part, any media platform, including but not limited to social media, book, magazine, newspaper, leaflet, or third party note/tutoring services. A student who publishes a recording without written consent may be subject to a civil cause of action instituted by a person injured by the publication and/or discipline under UF Regulation 4.040 Student Honor Code and Student Conduct Code.

University Honesty Policy

UF students are bound by The Honor Pledge which states, “We, the members of the University of Florida community, pledge to hold ourselves and our peers to the highest standards of honor and integrity by abiding by the Honor Code. On all work submitted for credit by students at the University of Florida, the following pledge is either required or implied: “On my honor, I have neither given nor received unauthorized aid in doing this assignment.” The Honor Code (<https://sccr.dso.ufl.edu/process/student-conduct-code/>) specifies a number of behaviors that are in violation of this code and the possible sanctions. Furthermore, you are obligated to report any condition that facilitates academic misconduct to appropriate personnel. If you have any questions or concerns, please consult with the instructor or TAs in this class.

Commitment to a Safe and Inclusive Learning Environment

The Herbert Wertheim College of Engineering values broad diversity within our community and is committed to individual and group empowerment, inclusion, and the elimination of discrimination. It is expected that every person in this class will treat one another with dignity and respect regardless of gender, sexuality, disability, age, socioeconomic status, ethnicity, race, and culture.

If you feel like your performance in class is being impacted by discrimination or harassment of any kind, please contact your instructor or any of the following:

- Your academic advisor or Graduate Program Coordinator
- Jennifer Nappo, Director of Human Resources, 352-392-0904, jpennacc@ufl.edu
- Curtis Taylor, Associate Dean of Student Affairs, 352-392-2177, taylor@eng.ufl.edu
- Toshikazu Nishida, Associate Dean of Academic Affairs, 352-392-0943, nishida@eng.ufl.edu

Software Use

All faculty, staff, and students of the University are required and expected to obey the laws and legal agreements governing software use. Failure to do so can lead to monetary damages and/or criminal penalties for the individual violator. Because such violations are also against University policies and rules, disciplinary action will be taken as appropriate. We, the members of the University of Florida community, pledge to uphold ourselves and our peers to the highest standards of honesty and integrity.

Student Privacy

There are federal laws protecting your privacy with regards to grades earned in courses and on individual assignments. For more information, please see: <https://registrar.ufl.edu/ferpa.html>

Campus Resources:

Health and Wellness

U Matter, We Care:

Your well-being is important to the University of Florida. The U Matter, We Care initiative is committed to creating a culture of care on our campus by encouraging members of our community to look out for one another and to reach out for help if a member of our community is in need. If you or a friend is in distress, please contact umatter@ufl.edu so that the U Matter, We Care Team can reach out to the student in distress. A nighttime and weekend crisis counselor is available by phone at 352-392-1575. The U Matter, We Care Team can help connect students to the many other helping resources available including, but not limited to, Victim Advocates, Housing staff, and the Counseling and Wellness Center. Please remember that asking for help is a sign of strength. In case of emergency, call 9-1-1.

Counseling and Wellness Center: <https://counseling.ufl.edu>, and 392-1575; and the University Police Department: 392-1111 or 9-1-1 for emergencies.

Sexual Discrimination, Harassment, Assault, or Violence

If you or a friend has been subjected to sexual discrimination, sexual harassment, sexual assault, or violence contact the **Office of Title IX Compliance**, located at Yon Hall Room 427, 1908 Stadium Road, (352) 273-1094, title-ix@ufl.edu

Sexual Assault Recovery Services (SARS)

Student Health Care Center, 392-1161.

University Police Department at 392-1111 (or 9-1-1 for emergencies), or <http://www.police.ufl.edu/>.

Academic Resources

E-learning technical support, 352-392-4357 (select option 2) or e-mail to Learning-support@ufl.edu.
<https://lss.at.ufl.edu/help.shtml>.

Career Resource Center, Reitz Union, 392-1601. Career assistance and counseling; <https://career.ufl.edu>.

Library Support, <http://cms.uflib.ufl.edu/ask>. Various ways to receive assistance with respect to using the libraries or finding resources.

Teaching Center, Broward Hall, 392-2010 or 392-6420. General study skills and tutoring.
<https://teachingcenter.ufl.edu/>.

Writing Studio, 302 Tigert Hall, 846-1138. Help brainstorming, formatting, and writing papers.
<https://writing.ufl.edu/writing-studio/>.

Student Complaints Campus: <https://sccr.dso.ufl.edu/policies/student-honor-code-student-conduct-code/>;
<https://care.dso.ufl.edu>.

On-Line Students Complaints: <http://www.distance.ufl.edu/student-complaint-process>