

## Introduction to Signals and Systems

EEL 3135

**Class Periods:** MWF | Period 10 (5:10 PM - 6:00 PM)

**Class Location:** Various

**Academic Term:** Spring 2021

**Canvas:** <https://ufl.instructure.com/courses/416877>

### Instructors

Name: Joel B. Harley  
Office Location: NEB 441  
Office Hours: TBA, Zoom

E-mail: [joel.harley@ufl.edu](mailto:joel.harley@ufl.edu)  
Office Phone Number: 352-392-2692

Name: Sanjeev J. Koppal  
Office Location: NEB 437  
Office Hours: TBA, Zoom

E-mail: [sjkoppal@ece.ufl.edu](mailto:sjkoppal@ece.ufl.edu)  
Office Phone Number: 352-392-8942

### Teaching Assistants / Supervised Instructors

- |                        |   |                   |
|------------------------|---|-------------------|
| • Naoki Sawahashi,     | Contact: <a href="mailto:n.sawahashi@ufl.edu">n.sawahashi@ufl.edu</a> ,     | Office Hours: TBA |
| • Lauren Sigmund,      | Contact: <a href="mailto:lsigmund98@ufl.edu">lsigmund98@ufl.edu</a> ,       | Office Hours: TBA |
| • Gregory Buettner,    | Contact: <a href="mailto:buettnerg@ufl.edu">buettnerg@ufl.edu</a> ,         | Office Hours: TBA |
| • Branden Evangelista, | Contact: <a href="mailto:bevangelista@ufl.edu">bevangelista@ufl.edu</a> ,   | Office Hours: TBA |
| • Kenneth B Arnold,    | Contact: <a href="mailto:arnoldkenneth@ufl.edu">arnoldkenneth@ufl.edu</a> , | Office Hours: TBA |
| • Sophia Rossi,        | Contact: <a href="mailto:sophia.rossi@ufl.edu">sophia.rossi@ufl.edu</a> ,   | Office Hours: TBA |
| • Stefan Lagos,        | Contact: <a href="mailto:stefenlagos@ufl.edu">stefenlagos@ufl.edu</a> ,     | Office Hours: TBA |
| • Victoria Close,      | Contact: <a href="mailto:vclose@ufl.edu">vclose@ufl.edu</a> ,               | Office Hours: TBA |
| • Wei-Chi Huang,       | Contact: <a href="mailto:huangw1@ufl.edu">huangw1@ufl.edu</a> ,             | Office Hours: TBA |
| • Bradley Shelley,     | Contact: <a href="mailto:shelleyb@ufl.edu">shelleyb@ufl.edu</a> ,           | Office Hours: TBA |
| • Kevin Tandl,         | Contact: <a href="mailto:kevintandl@ufl.edu">kevintandl@ufl.edu</a> ,       | Office Hours: TBA |
| • Alex Kuzmicki,       | Contact: <a href="mailto:akuzmicki@ufl.edu">akuzmicki@ufl.edu</a> ,         | Office Hours: TBA |
| • Alejandro Reyes,     | Contact: <a href="mailto:areyes3@ufl.edu">areyes3@ufl.edu</a> ,             | Office Hours: TBA |

### 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
<b>Mon</b> Jan 11	Introduction	1			
<b>Wed</b> Jan 13	Sinusoids, Complex Sinusoids	1	L Quiz 0		
<b>Fri</b> Jan 15	Sinusoids, Complex Sinusoids	1			
<b>Mon</b> Jan 18	<b>Martin Luther King Jr. Day</b>				
<b>Wed</b> Jan 20	Sums and Products of Sinusoids	2,3	B Quiz 1	HW 1	
<b>Fri</b> Jan 22	Fourier Series 1	2,3	L Quiz 1		
<b>Mon</b> Jan 25	Fourier Series 2	3,4	B Quiz 2	HW 2	Lab 1
<b>Wed</b> Jan 27	Fourier Series 2	3,4	L Quiz 2		
<b>Fri</b> Jan 29	Sampling and Reconstruction 1 & 2	3,4			
<b>Mon</b> Feb 01	Interpolation, Discrete-Time Systems	4,5	B Quiz 3	HW 3	Lab 2
<b>Wed</b> Feb 03	Interpolation, Discrete-Time Systems	4,5	B Quiz 3		
<b>Fri</b> Feb 05	FIR Filters, Convolution	4,5			
<b>Mon</b> Feb 08	LTI Systems 1 & 2	5	B Quiz 4	HW 4	Lab 3
<b>Wed</b> Feb 10	LTI Systems 1 & 2	5	L Quiz 4		
<b>Fri</b> Feb 12	Frequency Response 1	5			
<b>Mon</b> Feb 15	Frequency Response 2 & 3	6	B Quiz 5	HW 5	Lab 4
<b>Wed</b> Feb 17	Frequency Response 2 & 3	6	L Quiz 5		
<b>Fri</b> Feb 19	Transient Response	6			
<b>Mon</b> Feb 22	Discrete-Time Fourier Transform 1	6	B Quiz 6	HW 6	Lab 5
<b>Wed</b> Feb 24	Discrete-Time Fourier Transform 1	6	L Quiz 6		
<b>Fri</b> Feb 26	Discrete-Time Fourier Transform 2	6			
<b>Mon</b> Mar 01	Review	--	B Quiz 6	HW 7	Lab 6
<b>Wed</b> Mar 03	Review	--			
<b>Fri</b> Mar 05	<b>Midterm</b>	--			

## Course Schedule (Second Half)

Date	Lecture Topics	Text	Quizzes	Homework	Labs
<b>Mon</b> Mar 08	Z-Transform 1 & 2	7			
<b>Wed</b> Mar 10	Z-Transform 1 & 2	7	L Quiz 8		
<b>Thu</b> Mar 12	Poles & Zeros 1	7			
<b>Mon</b> Mar 15	Poles & Zeros 2	8	B Quiz 8	HW 8	Lab 7
<b>Wed</b> Mar 17	Poles & Zeros 2	8	L Quiz 9		
<b>Thu</b> Mar 19	IIR Filters 1 & 2	8			
<b>Mon</b> Mar 22	IIR Filters 3	8	B Quiz 9	HW 9	Lab 8
<b>Wed</b> Mar 24	IIR Filters 3	8	L Quiz 10		
<b>Thu</b> Mar 26	Inverse Z-Transform	8			
<b>Mon</b> Mar 29	Analysis in Three Domains	--	B Quiz 10	HW 10	Lab 9
<b>Wed</b> Mar 31	Analysis in Three Domains	--	L Quiz 11		
<b>Thu</b> Apr 02	Discrete Fourier Series 1 and 2	13			
<b>Mon</b> Apr 05	Discrete Fourier Transform 1	13	B Quiz 11	HW 11	Lab 10
<b>Wed</b> Apr 07	Discrete Fourier Transform 1	13	L Quiz 12		
<b>Thu</b> Apr 09	Discrete Fourier Transform 2	13			
<b>Mon</b> Apr 12	Fast Fourier Transform 1	13	B Quiz 12	HW 12	Lab 11
<b>Wed</b> Apr 14	Fast Fourier Transform 1	13	L Quiz 13		
<b>Thu</b> Apr 16	Fast Fourier Transform 2+3	13			
<b>Mon</b> Apr 19	Review	--	B Quiz 13	HW 13	Lab 12
<b>Wed</b> Apr 21	Review	--			
<b>Thu</b> Apr 23	<b>No class (Reading Day)</b>	--			
<b>Mon</b> Apr 26	<b>Final Exam (3:00 PM – 5:00 PM)</b>	--			
<b>Fri</b> Apr 28	<b>Final Exam (10:00 AM – 12:00 PM)</b>	--			

## 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: <https://uf-eel3135-sp2021.slack.com/>. This is an *optional* resource for students to discuss the course amongst each other and occasionally with the instructors. 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 (2 per week)*

**When:** Assigned in 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 (13 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 (12 in total [might be less])

**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 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
<b>Outcome 1.</b> 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"><li>- Focused exam questions on<ul style="list-style-type: none"><li>o their ability to solve differential equations</li><li>o using engineering techniques</li><li>o their ability to work with complex numbers and exponentials.</li></ul></li><li>- Exam questions target the use of<ul style="list-style-type: none"><li>o impulse responses, frequency response, DTFT, and z-transform methods.</li></ul></li><li>- Using a MATLAB programming, the students are required to<ul style="list-style-type: none"><li>o apply filtering concepts to design a piano octave detection system to meet specifications.</li></ul></li></ul>
<b>Outcome 6.</b> 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"><li>- A MATLAB lab assessments where<ul style="list-style-type: none"><li>o Students create systems and design systems to modify them</li><li>o Apply filter theory that they learn from homework and exams</li></ul></li></ul>

## 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 requesting accommodations should first register with the Disability Resource Center (352-392-8565, <https://www.dso.ufl.edu/drc>) by providing appropriate documentation. Once registered, students will receive an accommodation letter which must be presented to the instructor when requesting accommodation. Students with disabilities should follow this procedure as early as possible in the semester.

### Course Evaluation

Students are expected to provide feedback on the quality of instruction in this course by completing online evaluations at <https://evaluations.ufl.edu/evals>. Evaluations are typically open during the last two or three weeks of the semester, but students will be given specific times when they are open. Summary results of these assessments are available to students at <https://evaluations.ufl.edu/results/>.

### 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://www.dso.ufl.edu/sccr/process/student-conduct-honor-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.

### 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: <http://registrar.ufl.edu/catalog0910/policies/regulationferpa.html>

### Commitment to a Safe and Inclusive Learning Environment

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, please contact your instructor or any of the following:

- Your academic advisor or Graduate Program Coordinator
- Robin Bielling, Director of Human Resources, 352-392-0903, [rbielling@eng.ufl.edu](mailto:rbielling@eng.ufl.edu)
- Curtis Taylor, Associate Dean of Student Affairs, 352-392-2177, [taylor@eng.ufl.edu](mailto:taylor@eng.ufl.edu)
- Toshikazu Nishida, Associate Dean of Academic Affairs, 352-392-0943, [nishida@ufl.edu](mailto:nishida@ufl.edu)

*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](mailto:title-ix@ufl.edu)

### 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](mailto: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:** <http://www.counseling.ufl.edu/cwc>, and 392-1575; and the University Police Department: 392-1111 or 9-1-1 for emergencies.

**Sexual Assault Recovery Services (SARS)** at 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](mailto:Learning-support@ufl.edu).  
<https://lss.at.ufl.edu/help.shtml>.

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

**Library Support**, <http://cms.uflib.ufl.edu/ask> for assistance with 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://www.dso.ufl.edu/documents/UF\\_Complaints\\_policy.pdf](https://www.dso.ufl.edu/documents/UF_Complaints_policy.pdf).

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