

# Introduction to Signals and Systems

EEL 3135

**Class Periods:** Section 12407: TR | Period 3-4 (9:35 AM – 11:30 AM)  
Section 12408: TR | Period 9-10 (4:05 PM – 6:00 PM)

**Class Location:** LAR 0310

**Academic Term:** Fall 2019

**Canvas:** <https://ufl.instructure.com/courses/379808/>

## Instructors

Name: Tan F. Wong

Office Location: NEB 461

Office Hours: TR 11:30AM – 12:30PM

E-mail: [twong@ece.ufl.edu](mailto:twong@ece.ufl.edu)

Office Phone Number: 352-392-2665

Name: Barukh B. Rohde

Office Location: NEB 408

Office Hours: R 3:00PM – 4:00PM

E-mail: [barukh94@gmail.com](mailto:barukh94@gmail.com)

Office Phone Number:

## Teaching Assistants

### Contact Information

TA	Email
Madalyn Danielak	danielakm@ufl.edu
Chris Stauffer	Canvas message
Sabrina Edelmann	sedelmann1@ufl.edu
Cory Arthur	coryarthur@ufl.edu
Lauren Sigmund	Canvas/Slack message
Leonidas Lavdas	leonidas.lavdas@ufl.edu
Williams Paek	koreanwill@ufl.edu
Beau Bakken	beaubakken@ufl.edu
Jack Combes	jcombes@ufl.edu
Khalid Hessari	Canvas message
Szilard Beres	szilard.beres@ufl.edu

### Class Attendance

Tuesday Morning	Tuesday Afternoon	Thursday Morning	Thursday Afternoon
Leo		Sabrina	

## Office Hours

<b>Tuesday 11:45am – 1:40pm</b>	<b>Wednesday 6:15-8:30pm</b>	<b>Thursday 6:15-8:30pm</b>	<b>Friday 10:40am – 12:30pm</b>
Leo	Sabrina	Sabrina	Maddy
	Lauren	Lauren	Szilard
	Cory	Cory	
	Chris	Chris	

**Note:** TA's are usually at the listed hours, but this may be subject to change

### **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 Materials**

- DSP First, 2nd edition
  - Authors: James H. McClellan, Ronald W. Schafer, and Mark A. Yoder
  - Publisher: Pearson
  - ISBN: 0136019250
- Software Required: MATLAB, Student Version (\$99 for student edition with toolboxes, \$50 without toolboxes)

### **Course Schedule**

<b>Date</b>			<b>Lecture</b>	<b>Text Chap</b>	<b>Quiz</b>	<b>Lab Due</b>
<b>Tue</b>	Aug	20	Introduction	1		
<b>Thu</b>	Aug	22	Sinusoids, Complex Sinusoids	1		
<b>Tue</b>	Aug	27	Sums and Products of Sinusoids	2,3	Big Quiz 1	
<b>Wed</b>	Aug	28			Little Quiz 1	
<b>Thu</b>	Aug	29	Fourier Series 1	2,3		
<b>Fri</b>	Aug	30				Lab 0 Part 1 & 2

<b>Tue</b>	Sept	3	Fourier Series 2	3,4	Big Quiz 2	
<b>Wed</b>	Sept	4			Little Quiz 2	
<b>Thu</b>	Sept	5	Sampling and Reconstruction 1 & 2	3,4		
<b>Fri</b>	Sept	6				Lab 1 Part 1
<b>Tue</b>	Sept	10	Interpolation, Discrete-Time Systems	4,5	Big Quiz 3	
<b>Wed</b>	Sept	11			Little Quiz 3	
<b>Thu</b>	Sept	12	FIR Filters	4,5		
<b>Fri</b>	Sept	13				Lab 1 Part 2
<b>Tue</b>	Sept	17	Convolution, LTI Systems 1	5	Big Quiz 4	
<b>Wed</b>	Sept	18			Little Quiz 4	
<b>Thu</b>	Sept	19	LTI Systems 2	5		
<b>Fri</b>	Sept	20				Lab 2 Part 1
<b>Tue</b>	Sept	24	Frequency Response 1 & 2	6	Big Quiz 5	
<b>Wed</b>	Sept	25			Little Quiz 5	
<b>Thu</b>	Sept	26	Frequency Response 3	6		
<b>Fri</b>	Sept	27				Lab 2 Part 2
<b>Tue</b>	Oct	1	Transient Response, Discrete-Time Fourier Transform 1	7	Big Quiz 6	
<b>Wed</b>	Oct	2			Little Quiz 6	
<b>Thu</b>	Oct	3	Discrete-Time Fourier Transform 2	7		
<b>Fri</b>	Oct	4				
<b>Tue</b>	Oct	8	Review			
<b>Wed</b>	Oct	9				
<b>Thu</b>	Oct	10	<b>Midterm</b>			
<b>Fri</b>	Oct	11				
<b>Tue</b>	Oct	15	Z-Transform 1 & 2	9		
<b>Wed</b>	Oct	16			Little Quiz 7	
<b>Thu</b>	Oct	17	Poles and Zeros 1	9		
<b>Fri</b>	Oct	18				Lab 3 Part 1
<b>Tue</b>	Oct	22	Poles and Zeros 2	9	Big Quiz 8	
<b>Wed</b>	Oct	23			Little Quiz 8	
<b>Thu</b>	Oct	24	IIR Filters 1 & 2	10		
<b>Fri</b>	Oct	25				Lab 3 Part 2
<b>Tue</b>	Oct	29	IIR Filters 3	10	Big Quiz 9	
<b>Wed</b>	Oct	30			Little Quiz 9	
<b>Thu</b>	Oct	31	Inverse Z-Transform 1 & 2	10		
<b>Fri</b>	Nov	1				Lab 4 Part 1
<b>Tue</b>	Nov	5	Analysis in Three Domains, Discrete Fourier Series 1		Big Quiz 10	
<b>Wed</b>	Nov	6			Little Quiz 10	
<b>Thu</b>	Nov	7	Discrete Fourier Series 2	8		
<b>Fri</b>	Nov	8				Lab 4 Part 2
<b>Tue</b>	Nov	12	Discrete Fourier Transform 1 & 2	8	Big Quiz 11	
<b>Wed</b>	Nov	13			Little Quiz 11	
<b>Thu</b>	Nov	14	Fast Fourier Transform 1, 2, & 2.5	8		
<b>Fri</b>	Nov	15				Lab 5 Part 1

<b>Tue</b>	Nov	19	Fast Fourier Transform 2	8	Big Quiz 12	
<b>Wed</b>	Nov	20			Little Quiz 12	
<b>Thu</b>	Nov	21	Fast Fourier Transform 2.5			
<b>Fri</b>	Nov	22				Lab 5 Part 2
<b>Tue</b>	Nov	26	Review			
<b>Wed</b>	Nov	27				
<b>Thu</b>	Nov	28	<b>Thanksgiving (no class)</b>			
<b>Fri</b>	Nov	29				
<b>Tue</b>	Dec	3	<b>Final Exam</b>			

## Course Structure

### *Attendance & Participation:*

While attendance is not graded, lectures will include regular homework help and in-class discussions and demonstrations on the subject material. Participation is as participating in classwork and in-class activities.

### *Slack Page:*

We have a Slack page for the course: <https://ufeel3135fall2019.slack.com/>. This is an *optional* resource for students to discuss the course amongst each other and occasionally with the Professors and TAs. 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.**

### *Dr. Wong's Very Rough Class Logistics (Tuesday):*

- **Part 1:** Discussion / Conversation (15 minutes)
  - This is not a lecture, but a brief discussion or Q&A session to improve your understanding of the material. Therefore, you should come into this with having watched the lecture videos.
- **Part 2:** Big Quiz on previous week material (20 minutes)
- **Part 3:** Class-collaborative coursework (20 minutes)
  - Classwork problems completed as a class
- **Part 4:** Team-collaborative question (35 minutes)
  - Challenging classwork problems completed in teams
- **Part 5:** Design time! Programming and lab discussion (25 minutes)
  - Solve MATLAB problems in the lab

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- **Part 2:** Class-collaborative coursework (20 minutes)
  - Classwork problems completed as a class
- **Part 3:** Team-collaborative coursework (40 minutes)
  - Challenging classwork problems completed in teams
- **Part 4:** Design time! Programming and lab discussion (40 minutes)
  - Solve MATLAB problems in the lab

## 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 lab reports will generally be due every week. **DO NOT FALL BEHIND.**

### Coursework (20 in total)

**When:** Assigned roughly once a week (see course schedule on website).

**What:** Analytical problems that can be solved by hand.

**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.

**Grading:** Homework is graded on a scale of (1) no completion, (2) partial completion, or (3) full completion.

**Late policy:** Late assignments will not be eligible for any points.

**Submission:** Homework will be submitted on canvas before midnight (11:59 PM) on the due date.

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

**When:** The midterm is half-way thru the course on **Thursday, October 10, 2019**. The final is at the end of the course on **Tuesday, December 3, 2019**.

**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 (10-12 in total)

**When:** Occur roughly once every week (except for midterm week). The quiz will take roughly 5 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 (10-12 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.

### Labs (6-7 in total)

**When:** There are 6-7 labs over the course of the semester

**What:** You are expected to complete parts 1 and 2 of each lab.

**Why:** In each lab, 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.

**Reports:** After each lab, you are required to submit short reports via Canvas. These reports demonstrate your understanding of the material and should be self-sufficient (i.e., the report should be self-explanatory).

### Evaluation of Grades

Assignment	Percentage of Final Grade
Classwork	10%
Graded Labs	25%
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>

<p><b>Outcome 6.</b> An ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions</p>	<p>Students are assessed using:</p> <ul style="list-style-type: none"> <li>- A MATLAB assessment where <ul style="list-style-type: none"> <li>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.</li> <li>o From the FFT results, the students then generate a time trajectory of the heart rate of a patient.</li> <li>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.</li> </ul> </li> </ul>
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## 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 (352392-8565, <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. You are obligated to report any condition that facilitates academic misconduct to appropriate personnel. If you have any questions, please consult with the instructors or TAs.

### **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**

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
- 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:**

If you or a friend is in distress, please contact [umatter@ufl.edu](mailto:umatter@ufl.edu) or 352 392-1575 so that a team member can reach out to the student.

**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)** 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>. 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://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>.