# Linear Signals and Systems ECE 313

**COURSE INFORMATION**

**Class meets T,Th 3:30 – 5:00 pm ECJ 1.214**

**In-class attendance is heavily encouraged. However, if you cannot physically make it, you may use Zoom to virtually participate in the lecture.**
Join URL: https://utexas.zoom.us/j/99419793927?pwd=iTfFVtjbLJgii3BD7Pf5Kqa86sEeoH.1
Meeting ID: 994 1979 3927
Passcode: 504047

**Prerequisite:** Electrical and Computer Engineering 302 (or Electrical Engineering 302), or Electrical and Computer Engineering 302H (or Electrical Engineering 302H) with a grade of at least C-; Mathematics 427J or 427K with a grade of at least C-; and credit with a grade of at least C- or registration for Mathematics 340L.

**Course Description:** We will examine representation of signals and systems; system properties; convolution; Fourier series/transforms, Laplace/z-transforms; transfer functions and frequency response; convolution; stability; and relevant applications. We will also explore computer analysis using MATLAB or Python.

**General Syllabus:**

1. Introduction to signals and systems
2. Linear and time-invariant systems
3. Fourier series
4. Fourier transform
5. Laplace/Z- transform

**Instructor:** Prof. Shwetadwip Chowdhury: shwetadwip.chowdhury@utexas.edu
**Teaching Assistant:** Yue An: annyue@utexas.edu

**Instructor office hours:** (Wednesday 12:00 pm - 1:30 pm) AND (Friday 1:00 pm – 2:30 pm), both in EER 5.808
**TA recitation location:** EER 0.814C
**TA recitation hours**: Friday 10:30am – 11:30am
**Zoom ID:** 296 987 1088

**Textbook:**
Michael D. Adams, Signals and Systems 5th ed., (we will NOT be using the 6th edition)
Link: https://www.ece.uvic.ca/~frodo/sigsysbook/downloads/signals_and_systems-5.0.pdf

**Instructional Youtube videos associated with open-source textbook:** link [here]
**Organizational catalog:** link [here]

**Homework:** Consists mostly of problems from Adam's book. They are generally due a week after the set of lectures covering the relevant content. Homeworks will be submitted in via Gradescope. After uploading your homework file, please be sure to use the Select Pages option to assign individual pages of your solution to the corresponding problem number. Doing so will help the TA and grader to spend more time looking at the content of your everyone's work and less time looking for the pages

where the answers are located. If you have an issue with how your homework was graded, please contact the TA first. If the TA cannot resolve the issue, then you may contact the instructor. Late homework is 10% off when turned in one day late, 20% off when two days late, and zero thereafter. Homework will not be accepted more than two days late so that solutions can be posted in a timely manner.

If you are unfamiliar with how to select pages on Gradescope, this brief YouTube video may help: https://www.youtube.com/watch?v=nksyA0s-Geo

Gradescope Course Entry Code: **KZEJJN**

**Grading:**

1. 2 midterm exams. 22% each
2. Homework problem assignments. 24% total
3. In-class group problems. 10% total
4. Final exam (in-person). 22% total

My goal is to create an environment where students can collaborate and support one another in mastering the course material. I want to avoid any perception that grades are competitive, as this can hinder cooperation. Therefore, **this class will <u>not</u> be graded on a curve.** While this might initially seem intimidating, please know that partial credit will be generously awarded on homework and exams, and there will be no "minus" letter grades in this class. For reference, the average letter grade in this class last year was a B. Below is the grading rubric (modified from the one shown on the official UT page [here]) that outlines how weighted numeric grades will be converted to letter grades in this class:

Valid Grades

| GRADE | GRADE POINTS | |
|---|---|---|
| A | 4 | ≥ 90% |
| ~~A-~~ | ~~3.67~~ | |
| B+ | 3.33 | ≥ 87% |
| B | 3 | ≥ 80% |
| ~~B-~~ | ~~2.67~~ | |
| C+ | 2.33 | ≥ 77% |
| C | 2 | ≥ 70% |
| ~~C-~~ | ~~1.67~~ | |
| D+ | 1.33 | ≥ 67% |
| D | 1 | ≥ 60% |
| ~~D-~~ | ~~0.67~~ | |
| F | 0 | |

**Scholastic Dishonesty:**
UT policy will be followed. This is not intended to tell you that it won't be tolerated (it won't), but to tell you what is permissible and what is not.

Homework: conferring with others is encouraged, but what you submit must be your own work (not copied). For the project, one common version is submitted. What you submit must be the team's own work, programs, results, etc., **<u>or</u>** it must be referenced properly. If it's not referenced, and it's not yours,

then it is plagiarism. I do encourage consulting all sources that you can (including your uncle at IBM) so long as those sources are acknowledged. Be careful to cite web sources completely as well.

Exams: Note sheets and programmable calculators are allowed for the exams. Any exchange of information (one-way or two-way) outside of you, your note sheet, and your calculator during the exam is obviously NOT OK. Prior knowledge of exam questions is also NOT OK.

**Linear Systems and Signals - ECE 313** **Tentative Syllabus Spring 2025**

| Class number | Day | Date | Topics | Reading Chapter (5th ed) |
|---|---|---|---|---|
| | | | | |
| 1 | T | 14-Jan | **Introduction to Signals and Systems:** Class intro and mathematical preliminaries | 2.3-2.5 |
| 2 | Th | 16-Jan | **Introduction to Signals and Systems:** Basic signal properties and transformations | 2.8-2.10, 3.2-3.4 |
| 3 | T | 21-Jan | **Introduction to Signals and Systems:** Elementary and composite functions | 3.5-3.6, 8.4 |
| 4 | Th | 23-Jan | **Recorded class: Introduction to systems** | |
| 5 | T | 28-Jan | **Recorded class: System memory, linearity, and time invariance** | |
| 6 | Th | 30-Jan | **Linear and Time Invariant Systems:** Review of memory, linearity and time invariance | 3.8, 8.7 |
| 7 | T | 4-Feb | **Linear and Time Invariant Systems:** Discrete-time convolutional integral | 9.2 |
| 8 | Th | 6-Feb | **Linear and Time Invariant Systems:** Continuous- time convolutional integral | 4.2 |
| 9 | T | 11-Feb | **Linear and Time Invariant Systems:** Convolution properties and characterization of LTI systems | 4.3, 4.5-4.6, 4.9, 9.5-9.6 |
| 10 | Th | 13-Feb | **Fourier Series:** Fourier series of periodic waveforms and properties | 5.2-5.5 |
| 11 | T | 18-Feb | **Fourier Series:** Frequency response and filtering | 5.6-5.8 |
| 12 | Th | 20-Feb | **Exam review of mathematical preliminaries, LTI systems, and convolution** | |
| 13 | T | 25-Feb | **EXAM 01 (mathematical preliminaries, LTI systems, and convolution)** | |
| 14 | Th | 27-Feb | **Fourier Series:** Review of Fourier series and intro to Fourier transforms | 6.2-6.3 |
| 15 | T | 4-Mar | **Fourier Transform:** Continuous-time Fourier transforms | 6.3-6.4 |
| 16 | Th | 6-Mar | **Fourier Transform:** Properties of Fourier transforms | 6.7-6.9 |
| 17 | T | 11-Mar | **Fourier Transform:** Frequency response and filtering | 6.10-6.13, 6.16 |
| 18 | Th | 13-Mar | **Fourier Transform:** Sampling and aliasing | 6.20-6.21 |
| | T | 18-Mar | **Spring break** | |
| | Th | 20-Mar | **Spring break** | |
| 19 | T | 25-Mar | **Fourier Transform:** Review Fourier transforms and properties | |
| 20 | Th | 27-Mar | **Fourier Transform:** Fourier transform practical examples | |
| 21 | T | 1-Apr | **Demo day with optical Fourier transforms** | |
| 22 | Th | 3-Apr | **Exam review of Fourier series and transforms** | |
| 23 | T | 8-Apr | **EXAM 02 (Fourier series and transforms)** | |
| 24 | Th | 10-Apr | **Laplace/Z-Transform:** Introduction to Laplace and Z transform | 7.2-7.7, 12.3-12.4 |
| 25 | T | 15-Apr | **Laplace/Z-Transform:** Laplace/Z transform properties and examples | 7.8-7.10, 12.8-12.10 |
| 26 | Th | 17-Apr | **Laplace Transform:** Characterization of LTI systems | |
| 27 | T | 22-Apr | **Laplace Transform:** Solving differential equations and practical examples | 7.13-7.14 |
| 28 | Th | 24-Apr | **Review of Laplace/Z-transform** | |

**Final Exam** **Monday, May 5, 8:00 am-10:00 am**