



# USC

## EE 483: Introduction to Digital Signal Processing

Units: 4  
Fall 2021

**Lecture:** 9:00am-10:50am Tue/Thu

**Lecture Location:** OHE 136

**Discussion:** 1:00pm-1:50pm Fri

**Discussion Location:** OHE 136

**Instructor:** Prof. Justin Haldar

**Office:** Use Zoom (link posted in Lecture 1 slides)

**Office Hours:** Mon 10am-11:30pm and Tue 2pm-3:30pm

**Contact Info:**

e-mail: [jhaldar@usc.edu](mailto:jhaldar@usc.edu)

**Teaching Assistants:** Chin-Cheng Chan ([chinchen@usc.edu](mailto:chinchen@usc.edu)), Ziwei Zhao ([ziweiz@usc.edu](mailto:ziweiz@usc.edu)), and Zhibo Zhu ([zhibozhu@usc.edu](mailto:zhibozhu@usc.edu))

**Office:** Physical location TBD, can also use Zoom (link posted in Lecture 1 slides)

**Office Hours:**

Chin-Cheng: Thu 1pm-2:30pm and Fri 2:30pm-3:30pm

Ziwei: Wed 2pm-3pm and Thu 11:30am-1pm

Zhibo: Mon 8pm-9pm and Wed 10am-11:30am

**Schedule:**

**First Lecture:** Tue, August 24<sup>th</sup>

**Midterm:** Tue, October 19<sup>th</sup>  
9:00am-10:50am (during lecture time)

**Last Lecture:** Thu, December 2<sup>nd</sup>

**Final Exam:** Thu, December 9<sup>th</sup>  
11:00am-1:00pm

**Catalog Description:**

Fundamentals of digital signal processing covering: discrete time linear systems, quantization, sampling, Z-transforms, Fourier transforms, FFTs and filter design.

**Prerequisite:** EE 301

Familiarity with MATLAB

**Websites:** All course materials will be distributed through the USC DEN website (<https://courses.uscden.net/>). It is your responsibility to check the website regularly for updates (notes, assignments, due dates, etc.) If you have any problems with the website, please contact USC DEN directly.

We will be using the Piazza website for class discussion. The system is aimed at getting students help from classmates and instructors quickly and efficiently. Rather than emailing questions to the instructors, students are encouraged to post questions on Piazza so that everyone in the course can see the conversation and benefit from the discussion. The Piazza page for the course can be found at:

<https://piazza.com/usc/fall2021/ee483>

## Required Textbooks and Supplementary Materials

All books are available from the USC bookstore, online textbook vendors, or from course reserves at the USC library

Required:

- S. K. Mitra. *Digital Signal Processing: A Computer-Based Approach*, 4<sup>th</sup> edition, McGraw Hill 2010.
  - A comprehensive modern textbook on digital signal processing. Out of print, so may be hard to find (it's okay if you can't get the book, as long as you get a similar book).
- M. H. Hayes. *Schaum's Outlines: Digital Signal Processing*, 2<sup>nd</sup> edition, McGraw Hill 2011.
  - A nice complement to the text by Mitra, this book contains overviews of important DSP concepts and hundreds of solved example problems.

Other references:

- A. V. Oppenheim and R. W. Schaffer. *Discrete-Time Signal Processing*, 3<sup>rd</sup> edition, Prentice-Hall 2010.
  - The classic textbook on DSP.
- J. G. Proakis and D. K. Manolakis. *Digital Signal Processing*, 4<sup>th</sup> edition, Prentice-Hall 2006.
  - Another popular text.

There are also a large number of other DSP books and online DSP resources – take a look at what the USC and the internet have to offer.

### Grading and Course Policies:

- 25% Homework
- 35% Midterm
- 40% Final

Homeworks must be submitted electronically through the USC DEN website by 5pm PST on the due date. Late homeworks will receive a score of zero. The final homework grade will be based on the average score after discarding the lowest.

Students are allowed (and encouraged!) to discuss homework assignments with fellow classmates, but are expected to complete homework assignments individually. USC's recommended sanction for plagiarism, unauthorized collaboration, and/or cheating on any coursework is an F for the course, with a possibility for further disciplinary action.

Several of the homeworks will require MATLAB programming. It is your responsibility to make sure that you know how to access the software and read/write/debug MATLAB code. If students prefer, they may complete their programming assignments using Python or C instead of MATLAB. This may require some self-study of C or Python programming.

All exams are cumulative and closed book, with no calculators (subject to change). Please check now for any conflicts with the scheduled exam times.

### Suggestions:

My goal is to teach you and your fellow students as much as possible about DSP, while simultaneously inspiring your interest, excitement, and curiosity about the material. This will be easier if you:

- Come to class on time and pay attention.
- Ask questions and participate in classroom discussion.
- Do all of the assignments.
- Make use of office hours.
- If you're struggling with the material, don't wait until the last minute to talk to us about it.
- Don't violate USC's academic integrity standards – you won't enjoy the consequences

### Course Timeline (subject to change):

<b>Week 1 (8/24, 8/26)</b>	Introduction and overview Discrete-time signals and systems
<b>Week 2 (8/31, 9/2)</b>	Linear Time-Invariant (LTI) systems Causality, stability, impulse response Linear difference equations (LDEs)
<b>Week 3 (9/7, 9/9)</b>	Discrete-Time Fourier Transform (DTFT) Frequency response of LTI systems
<b>Week 4 (9/14, 9/16)</b>	Phase and group delay Discrete Fourier Transform (DFT)
<b>Week 5 (9/21, 9/23)</b>	Fast Fourier Transform (FFT) Unitary Transforms: Discrete Cosine Transform and Wavelet Transforms
<b>Week 6 (9/28, 9/30)</b>	Sampling of continuous-time signals Aliasing, the sampling theorem, signal reconstruction A/D and D/A conversion Multi-rate systems
<b>Week 7 (10/5, 10/7)</b>	Relationships between the Fourier transform, DFT, and DTFT Windows and nonparametric spectral analysis
<b>Week 8 (10/12)</b>	Review
<b>Week 9 (10/19, 10/21)</b>	<b>Midterm</b> z-Transform
<b>Week 10 (10/26, 10/28)</b>	Transfer functions of LTI systems FIR and IIR digital filters
<b>Week 11 (11/2, 11/4)</b>	Design of FIR filters

<b>Week 12 (11/9, 11/11)</b>	Design of IIR filters
<b>Week 13 (11/16, 11/18)</b>	Digital filter structures Quantization
<b>Week 14 (11/23)</b>	Introduction to multidimensional sampling theory Digital cameras and color filter arrays
<b>Week 15 (11/30, 12/2)</b>	Introduction to adaptive filtering Introduction to tomographic imaging Life after EE 483 Review
<b>Final Exam (12/9)</b>	

## Statement on Academic Conduct and Support Systems

### Academic Conduct:

Plagiarism – presenting someone else’s ideas as your own, either verbatim or recast in your own words – is a serious academic offense with serious consequences. Please familiarize yourself with the discussion of plagiarism in SCampus in Part B, Section 11, “Behavior Violating University Standards” [policy.usc.edu/scampus-part-b](http://policy.usc.edu/scampus-part-b). Other forms of academic dishonesty are equally unacceptable. See additional information in SCampus and university policies on scientific misconduct, [policy.usc.edu/scientific-misconduct](http://policy.usc.edu/scientific-misconduct).

### Support Systems:

*Student Health Counseling Services - (213) 740-7711 – 24/7 on call*  
[engemannshc.usc.edu/counseling](http://engemannshc.usc.edu/counseling)

Free and confidential mental health treatment for students, including short-term psychotherapy, group counseling, stress fitness workshops, and crisis intervention.

*National Suicide Prevention Lifeline - 1 (800) 273-8255 – 24/7 on call*  
[suicidepreventionlifeline.org](http://suicidepreventionlifeline.org)

Free and confidential emotional support to people in suicidal crisis or emotional distress 24 hours a day, 7 days a week.

*Relationship and Sexual Violence Prevention Services (RSVP) - (213) 740-4900 – 24/7 on call*  
[engemannshc.usc.edu/rsvp](http://engemannshc.usc.edu/rsvp)

Free and confidential therapy services, workshops, and training for situations related to gender-based harm.

*Office of Equity and Diversity (OED) | Title IX - (213) 740-5086*  
[equity.usc.edu](http://equity.usc.edu), [titleix.usc.edu](http://titleix.usc.edu)

Information about how to get help or help a survivor of harassment or discrimination, rights of protected classes, reporting options, and additional resources for students, faculty, staff, visitors, and applicants. The university prohibits discrimination or harassment based on the following protected characteristics: race, color, national origin, ancestry, religion, sex, gender, gender identity, gender expression, sexual orientation, age, physical disability, medical condition, mental disability, marital status, pregnancy, veteran status, genetic information, and any other characteristic which may be specified in applicable laws and governmental regulations.

*Bias Assessment Response and Support - (213) 740-2421*  
[studentaffairs.usc.edu/bias-assessment-response-support](http://studentaffairs.usc.edu/bias-assessment-response-support)

Avenue to report incidents of bias, hate crimes, and microaggressions for appropriate investigation and response.

*The Office of Disability Services and Programs - (213) 740-0776*  
[dsp.usc.edu](http://dsp.usc.edu)

Support and accommodations for students with disabilities. Services include assistance in providing readers/notetakers/interpreters, special accommodations for test taking needs, assistance with architectural barriers, assistive technology, and support for individual needs.

*USC Support and Advocacy - (213) 821-4710*  
[studentaffairs.usc.edu/ssa](http://studentaffairs.usc.edu/ssa)

Assists students and families in resolving complex personal, financial, and academic issues adversely affecting their success as a student.

*Diversity at USC - (213) 740-2101*

[diversity.usc.edu](http://diversity.usc.edu)

Information on events, programs and training, the Provost's Diversity and Inclusion Council, Diversity Liaisons for each academic school, chronology, participation, and various resources for students.

*USC Emergency - UPC: (213) 740-4321, HSC: (323) 442-1000 – 24/7 on call*

[dps.usc.edu](http://dps.usc.edu), [emergency.usc.edu](http://emergency.usc.edu)

Emergency assistance and avenue to report a crime. Latest updates regarding safety, including ways in which instruction will be continued if an officially declared emergency makes travel to campus infeasible.

*USC Department of Public Safety - UPC: (213) 740-6000, HSC: (323) 442-120 – 24/7 on call*

[dps.usc.edu](http://dps.usc.edu)

Non-emergency assistance or information.