



EE 483: Introduction to Digital Signal Processing
Units: 4
Fall 2019

Lecture: 9:00am-10:50am Tue/Thu
Lecture Location: OHE 136

Discussion: 1:00pm-1:50pm Fri
Discussion Location: OHE 132

Instructor: Prof. Justin Haldar

Office: EEB 442

Office Hours: Mon 2pm-3:30pm
Tue 2pm-3:30pm

Contact Info:

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phone: (213)740-2358

Teaching Assistants: Tae Hyung Kim (taehyung@usc.edu) and Rodrigo Lobos (rlobos@usc.edu)

Office: PHE 320

Office Hours:

Tae: Wed 1pm-2:30pm and Thu 1pm-2:30pm

Rodrigo: Tue 5pm-6:30pm and Wed 9am-10:30am

Schedule:

First Class: Tue, August 27th

Midterm: Tue, October 22nd
9:00am-10:50am (in class)

Last Class: Thu, December 5th

Final Exam: Thu, December 12th
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.

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*, 4th edition, McGraw Hill 2010.
 - A comprehensive modern textbook on digital signal processing.
- M. H. Hayes. *Schaum's Outlines: Digital Signal Processing*, 2nd 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*, 3rd edition, Prentice-Hall 2010.
 - The classic textbook on DSP.
- J. G. Proakis and D. K. Manolakis. *Digital Signal Processing*, 4th 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.

Prerequisite: EE 301
Familiarity with MATLAB

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. Please check now for any conflicts with the scheduled exam times.

Websites: All course materials will be distributed through the USC DEN website (<https://www.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.

The website will also provide access to streaming videos of each lecture. However, please note that live attendance of each lecture is required, either on campus or at a remote DEN location. Archived lecture videos should only be used for reviewing course material, or in case you had to miss a lecture because of illness or work-related travel.

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/fall2019/ee483>

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):

Week 1 (8/27, 8/29)	Introduction and overview Discrete-time signals and systems
Week 2 (9/3, 9/5)	Linear Time-Invariant (LTI) systems Causality, stability, impulse response Linear difference equations (LDEs)
Week 3 (9/10, 9/12)	Discrete-Time Fourier Transform (DTFT) Frequency response of LTI systems
Week 4 (9/17, 9/19)	Phase and group delay Discrete Fourier Transform (DFT)
Week 5 (9/24, 9/26)	Fast Fourier Transform (FFT) Unitary Transforms: Discrete Cosine Transform and Wavelet Transforms
Week 6 (10/1, 10/3)	Sampling of continuous-time signals Aliasing, the sampling theorem, signal reconstruction A/D and D/A conversion Multi-rate systems
Week 7 (10/8, 10/10)	Relationships between the Fourier transform, DFT, and DTFT Windows and nonparametric spectral analysis
Week 8 (10/15)	Review
Week 9 (10/22, 10/24)	Midterm z-Transform
Week 10 (10/29, 10/31)	Transfer functions of LTI systems FIR and IIR digital filters
Week 11 (11/5, 11/7)	Design of FIR filters

Week 12 (11/12, 11/14)	Design of IIR filters
Week 13 (11/19, 11/21)	Digital filter structures Quantization
Week 14 (11/26)	Introduction to multidimensional sampling theory Digital cameras and color filter arrays
Week 15 (12/3, 12/5)	Introduction to adaptive filtering Introduction to tomographic imaging Life after EE 483 Review
Final Exam (12/12)	

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. Other forms of academic dishonesty are equally unacceptable. See additional information in SCampus and university policies on scientific misconduct, policy.usc.edu/scientific-misconduct.

Support Systems:

Student Health Counseling Services - (213) 740-7711 – 24/7 on call
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

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

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, 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

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

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

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

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, 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

Non-emergency assistance or information.