ESE-337/547 Digital Signal Processing: Theory
Fall 2020

Stony Brook University

Syllabus

1. Course Staff and Office Hours

Instructor: Yue Zhao
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Time: Tuesday & Thursday, 8:15pm – 9:35pm, Synchronous sessions via Zoom

Office Hours: Tuesday & Thursday, 1:30pm to 3:00pm, via Zoom

TA: TBD

2. Course Description

Introduces digital signal processing theory, discrete time sequences and systems, linear time-invariant (LTI) systems, convolution sum, Discrete Time Fourier Transform (DTFT), Z-transform, Discrete Fourier Series (DFS), sampling DTFT, Discrete Fourier Transform (DFT), Fast Fourier Transform (FFT), sampling and reconstruction of continuous and discrete time signals, design of FIR and IIR filters, difference equations.

Prerequisites: ESE 305

Credits: 3

3. Textbook

A.V. Oppenheim and R.W. Schafer, *Discrete Time Signal Processing*, Prentice Hall, Third Edition, 2009.

4. Course Learning Objectives

Upon completion of the course, students will achieve the following learning objectives:

- Analyze discrete time signals and systems using frequency domain transforms;
- Process continuous time signals using discrete time systems;
- Design samplers for C/D and D/C converters with no or low losses;
- Design techniques for FIR and IIR digital filters.

5. Student Learning Outcomes

	Student Outcomes	% contribution
1	an ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics.	100%

6. Schedule

Lectures will be held via Zoom synchronously on Tuesdays and Thursdays from 8:15pm to 9:35pm.

Week 1.	Discrete time signals and systems, LTI systems, stability, causality
Week 2.	Frequency domain representation of discrete time signals and systems, eigen functions, frequency response
Week 3.	Discrete time Fourier transform (DTFT), symmetry properties of DTFT, DTFT theorems, DTFT pairs
Week 4.	z-Transform, poles and zeros, Region of Convergence (ROC)
Week 5.	Midterm I. Inverse z-Transform.
Week 6.	z-Transform properties, Discrete Fourier Sequence (DFS)
Week 7.	Properties of DFS, DTFT of periodic signals, Sampling DTFT, Discrete Fourier Transform (DFT)
Week 8.	Properties of DFT, linear convolution using DFT, implementing LTI systems using DFT
Week 9.	Midterm II, Fast Fourier Transform (FFT) FFT algorithms.
Week 10.	Periodic sampling, frequency domain representation of sampling, Nyquist sampling theorem, reconstruct a bandwidth limited signal from its samples
Week 11.	Downsampling, upsampling, DT processing of CT signals, impulse invariance
Week 12.	IIR filter design
Week 13.	FIR filter design
Week 14	Difference equations, Review

7. Assignments

7.1. Homework Assignments

Homework Assignments will be issued roughly weekly. These are for the students' exercises, and the solutions will not be graded.

8. Grading

Your grade will be based on two midterm examinations and one final examination.

Midterm #1	25%
Midterm #2	25%
Final Exam	50%

The exams will be conducted using the Respondus Lockdown Browser.

9. Academic Honesty

All exam work must be entirely your own with no collaboration or outside materials/information. Any academic dishonesty on the midterm exams or the final exam will result in failing the course. The case will be submitted to the College of Engineering's Committee on Academic Standing and Appeals.

11. Electronic Communication Statement

Email and especially email sent via Blackboard (http://blackboard.stonybrook.edu) is one of the ways the faculty officially communicates with you for this course. It is your responsibility to make sure that you read your email in your official University email account. For most students that is Google Apps for Education (http://www.stonybrook.edu/mycloud), but you may verify your official Electronic Post Office (EPO) address at http://it.stonybrook.edu/help/kb/checking-or-changing-your-mail-forwarding-address-in-the-epo.

If you choose to forward your official University email to another off-campus account, faculty are not responsible for any undeliverable messages to your alternative personal accounts. You can set up Google Mail forwarding using these DoIT-provided instructions found at http://it.stonybrook.edu/help/kb/setting-up-mail-forwarding-in-google-mail.

If you need technical assistance, please contact Client Support at (631) 632-9800 or supportteam@stonybrook.edu.

12. Student Accessibility Support Statement

If you have a physical, psychological, medical, or learning disability that may impact your course work, please contact the Student Accessibility Support Center, 128 ECC Building, (631) 632-6748, or at sasc@Stonybrook.edu. They will determine with you what accommodations are necessary and appropriate. All information and documentation is confidential.

13. Academic Integrity Statement

Each student must pursue their academic goals honestly and be personally accountable for all submitted work. Representing another person's work as your own is always wrong. Faculty is required to report any suspected instances of academic dishonesty to the Academic Judiciary. Faculty in the Health Sciences Center (School of Health Technology & Management, Nursing, Social Welfare, Dental Medicine) and School of Medicine are required to follow their school-specific procedures. For more comprehensive information on academic integrity, including categories of academic dishonesty please refer to the academic judiciary website at http://www.stonybrook.edu/commcms/academic_integrity/index.html

14. Critical Incident Management Statement

Stony Brook University expects students to respect the rights, privileges, and property of other people. Faculty are required to report to the Office of University Community Standards any disruptive behavior that interrupts their ability to teach, compromises the safety of the learning environment, or inhibits students' ability to learn. Faculty in the HSC Schools and the School of Medicine are required to follow their school-specific procedures. Further information about most academic matters can be found in the Undergraduate Bulletin, the Undergraduate Class Schedule, and the Faculty-Employee Handbook.