

Signal Processing and Linear Systems – EEF206E (CRN 22134)
Spring 2024- Course Syllabus

Instructor: Prof. Mustafa Doğan, mustafadogan at itu.edu.tr

Lecture hours and place: Wednesday 10:30-12:30 ; Thursday, 12:30-14:30,

Teaching Assistant: Bora Ayvaz

Prerequisite: Arithmetic of complex numbers, differential and integral calculus.

Website: Assignments, lecture notes etc. will be available online.

Textbook:

“Signals and Systems”, A. V. Oppenheim, A. S. Willsky and S. H. Nawab. 2nd edition, Prentice Hall, 1997.

Some reference texts:

“Signals and Systems: Analysis Using Transform Methods and MATLAB”, M. J. Roberts, 2nd edition, McGraw-Hill, 2012.

“Signals and Systems”, Hwei Hsu, Schaum’s Outline, McGraw-Hill, 2013.

“Sinyaller ve Sistemler”; A. V. Oppenheim, A. S. Willsky ve S. H. Nawab. 2. basımdan çeviri; Akademi Yayıncılık; 2008.

“Signals and Systems”, Simon Haykin and Barry van Veen. John Wiley and Sons, 2002.

To be able to take the final (not to get a VF grade):

Student has to take both midterms. The average of two midterm exams must be greater than or equal to “25” points to avoid a VF grade. Otherwise VF grade will be given.

Academic Integrity: Examinations are expected to be the sole effort of the student submitting the work. Cheating will not be tolerated. Copying exams means cheating, which yields to:

i-) fail the course (VF grade), ii-) face disciplinary action.

Grading criteria:	Percent of final grade
Pop up Quiz	10%
Midterm 1	25%
Midterm 2	25%
Final exam (comprehensive)	40%

Week	Topic (tentative plan)	Reading Assignments
1	Signals and Systems. Continuous-Time (CT) and Discrete-Time (DT) Signals. Transformations of the Independent Variable. Exponential and Sinusoidal Signals. The Unit Impulse and Unit Step Functions. CT and DT Systems.	OW: Oppenheim-Willsky Rob: M. J. Roberts OW Ch.1 Rob. Ch. 1, Ch. 2
2	Basic System Properties. Linear Time-Invariant Systems. DT LTI Systems: The Convolution Sum. CT-LTI Systems: The Convolution Integral.	OW Ch. 2.1-2.2 Rob. Ch. 3
3	Properties of Linear Time-Invariant Systems. Causal LTI Systems described by Differential and Difference Equations.	OW Ch. 2.3-2.4 Rob Ch. 4, 5
4	Fourier Series Representation of Periodic Signals. The Response of LTI Systems to Complex Exponentials. Fourier Series Representation of CT Periodic Signals. Convergence of the Fourier Series. Properties of CT Fourier Series.	OW Ch. 3.1-3.5 Rob Ch. 6.1-6.2
5	The CT Fourier Transform. Properties of the CT Fourier Transform. The Convolution Property. Tables of CT Fourier Properties and Basic DT Fourier Transform Pairs.	OW Ch. 4.1-4.7 Rob Ch. 6.3-6.4
6	Laplace transform. Systems Characterized by Differential Equations.	OW Ch. 4.1-4.7 Rob Ch. 6.3-6.4
7	The DT Fourier Transform. Properties of the DT Fourier Transform. The Convolution Property. The Multiplication Property. Tables of DT Fourier Transform Properties and Basic DT Fourier Transform Pairs. Duality. Midterm 1.	OW Ch. 3.6-3.7 OW Ch. 5.1-5.8 Rob Ch. 7.1-7.5
8	The Convolution Property. The Multiplication Property. Tables of DT Fourier Transform Properties and Basic DT Fourier Transform Pairs. Duality.	OW Ch. 3.6-3.7 OW Ch. 5.1-5.8 Rob Ch. 7.1-7.5
9	Systems Characterized by Linear Constant-Coefficient Difference Equations. Discrete Fourier Transform.	OW Ch5;Rob Ch7.
10	The Magnitude-Phase Representation of the Frequency Response of LTI Systems. Time-Domain Properties of Ideal Frequency-Selective Filters. First-Order and Second-Order CT Systems.	OW Ch. 6.1-6.7 Rob Ch. 11.1-11.3
11	Sampling. The Sampling Theorem. Reconstruction of a Signal from Its Samples Using Interpolation. Aliasing. DT Processing of CT Signals.	OW Ch. 7.1-7.4 Rob Ch. 10.1-10.2
12	The z-Transform. The Region of Convergence for the z-Transform. The Inverse z-Transform. Midterm 2.	OW Ch. 10.1-10.5 Rob Ch. 9.1-9.12
13	Properties of the z-Transform. Some Common z-Transform Pairs. Block Diagram Representations. Analysis and Characterization of LTI Systems Using z-Transforms.	OW Ch. 10.6-10.7 Rob. Ch. 14.1-14.4
14	Telecommunication applications, modulation and demodulation. Multidimensional signals, image processing applications.	OW Ch. 8