SIGNALS and SYSTEMS – EHB252E

Course Syllabus

Instructor: Assoc.Prof. Ender M. Ekşioğlu, eksioglue at itu.edu.tr, Office: 2401
Lecture hours and place: Thursday, 13:30-16:30, 5104
Office hours for lecturer: Tuesday 10:00-12:00
Teaching Assistant: MSc. Özden Bayır, Office: 3104, bayiroz at itu.edu.tr,
Office hours for TA: to be announced
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):
- Attend at least 10 (out of 14) lectures
-Attend both of the midterms (unless there is a proven excuse)
-Get at least 20% percent of the points available for the midterms

Homework: A due date will accompany each homework assignment. You will be neither excused from nor granted any extension for an assignment without prior approval from the instructor.

Quizzes: There will be pop quizzes during the class hours.

Academic Integrity: Homework and examinations are expected to be the sole effort of the student submitting the work. Cheating will not be tolerated. Please be in class on time.

Grading criteria:	**Percent of final grade**
Homework and Quizzes:	10%
Midterm 1:	25%
Midterm 2:	25%
Final exam (cumulative):	40%

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

Tentative Course Schedule:

Tentative Course Outline

Introduction to Signals and Systems

Basic discrete and continuous-time signals and their properties, transformations of the independent variable, basic system properties

Linear Time-Invariant Systems

Discrete and continuous time LTI systems, convolution sum and integral, properties of LTI systems, LTI systems defined by differential and difference equations

Fourier Series

Representation of continuous and discrete-time signals using Fourier series, properties of Fourier series

Continuous-Time Fourier Transform

Discrete-Time Fourier Transform

Frequency Domain Characterization of Systems

Magnitude-phase representations, ideal frequency selective filters

Discrete Fourier transform

Sampling

A/D, D/A conversion, aliasing, discrete-time processing of continuous-time signals

z-Transform

z-transform, region of convergence, inverse z-transform, properties of the z-transform, characterizing LTI systems using the z-transform

Laplace Transform

Laplace transform, region of convergence, inverse Laplace transform, properties of the Laplace transform, characterizing LTI systems using the Laplace transform