School of Engineering and Natural Sciences / Electrical and Electronics Engineering (English)

2024 - 2025 Academic Year

DIGITAL SIGNAL PROCESSING

Syllabus

Course Description					
Name	**Code**	**Semester**	**T+A Hour**	**Credit**	**ECTS**
DIGITAL SIGNAL PROCESSING	EEE4210344	Spring Semester	3+0	3	6

Prerequisites Courses	SİNYALLER VE SİSTEMLER
Recommended Elective Courses	Embedded Systems
Language of Instruction	English
Course Level	First Cycle (Bachelor's Degree)
Course Type	Elective
Course Coordinator	Prof.Dr. Mehmet Kemal ÖZDEMİR
Name of Lecturer(s)	Prof.Dr. Mehmet Kemal ÖZDEMİR
Assistant(s)	None.
Aim	This is a fourth-year undergraduate course on the fundamentals of discrete-time signal processing (DSP). This course provides the students with a solid background in theory and design of DSP systems. Different transformation techniques, conversion from analog to digital and vice versa, digital filter structures, and their application to real systems are covered. The theory is realized via Matlab simulations.
Course Content	This course contains; Introduction to Discrete-Time Signals and Systems. ,Discrete LTI Systems,Z-Transform,Sampling of Continuous-Time Signals,Multi-rate signal Processing and Introduction to Discrete Random Process,Transform Analysis of LTI Systems – Part A,Transform Analysis of LTI Systems – Part B,Midterm overview,Structure for Discrete-Time Systems : Block Diagrams and IIR Systems,Structure for Discrete-Time Systems : FIR Systems and Quantization Effect,Digital Filter Design Techniques – Part A,Digital Filter Design Techniques – Part B,The Discrete Fourier Transform – Part A,The Discrete Fourier Transform – Part B,Discrete Stochastic Processes and Systems.

Course Learning Outcomes	**Teaching Methods**	**Assessment Methods**
1. Applies the basics of LTI systems and transformation approaches in analyzing LTI systems.	21, 9	A, E, F, G
2. Samples lowpass and bandpass signals.	21, 9	A, E, F, G
3. Designs LTI IIR and FIR filters.	21, 9	A, E, F, G
4. Uses DFT and FFT techniques effectively.	21, 9	A, E, F, G
5. Analyzes discrete stochastic systems.	21, 9	A, E, F, G

Teaching Methods	21: Simulation Technique, 9: Lecture Method
Assessment Methods	A: Traditional Written Exam, E: Homework, F: Project Task, G: Quiz

Lecture Schedule

Sequence	Topics	Preliminary Preparation
1	Introduction to Discrete-Time Signals and Systems.	Notes and Oppenheim Chapters 1 & 2
2	Discrete LTI Systems	Notes and Oppenheim Chapter 2
3	Z-Transform	Notes and Oppenheim Chapter 3
4	Sampling of Continuous-Time Signals	Notes and Oppenheim Chap. 4
5	Multi-rate signal Processing and Introduction to Discrete Random Process	Notes and Oppenheim Chap. 4
6	Transform Analysis of LTI Systems – Part A	Notes and Oppenheim Chap. 5
7	Transform Analysis of LTI Systems – Part B	Notes and Oppenheim Chap. 5
8	Midterm overview	Notes till Week 7 and textbook chapters 1-5
9	Structure for Discrete-Time Systems : Block Diagrams and IIR Systems	Notes and Oppenheim Chap. 6
10	Structure for Discrete-Time Systems : FIR Systems and Quantization Effect	Notes and Oppenheim Chap. 6
11	Digital Filter Design Techniques – Part A	Notes and Oppenheim Chap. 7
12	Digital Filter Design Techniques – Part B	Notes and Oppenheim Chap. 7
13	The Discrete Fourier Transform – Part A	Notes and Oppenheim Chap. 8
14	The Discrete Fourier Transform – Part B	Notes and Oppenheim Chap. 8
15	Discrete Stochastic Processes and Systems	Notes and Vetterli Chap. 3

Evaluation Methods	**Weight(%)**
Midterm Exam	30
General Exam	70

Resources

Discrete-Time Signal Processing by Alan V. Oppenheim and Ronald W. Schafer
Prentice Hall (Pearson) ISBN 978013 1988422
Foundations of Signal Processing, M. Vetterli, M. Kovacevic and V. Goyal , 2013, Cambridge University Press