

Course Description					
Name	Code	Semester	T+A Hour	Credit	ECTS
MIXED SIGNAL CIRCUIT DESIGN	EEE4268040	Spring Semester	3+0	3	6
Prerequisites Courses	ELEKTRONİK II				
Recommended Elective Courses					
Language of Instruction	English				
Course Level	First Cycle (Bachelor's Degree)				
Course Type	Elective				
Course Coordinator	Assist.Prof. Mustafa AKTAN				
Name of Lecturer(s)	Assist.Prof. Mustafa AKTAN				
Assistant(s)					
Aim	This course covers the data converter circuits in modern mixed-signal VLSI systems. We will investigate switched-capacitor amplifiers/integrators, sample- and-hold circuits, Nyquist-rate converters, and oversampled converters.				
Course Content	This course contains; Converter basics, Noise in converters and dynamic range, Sample and hold circuits, Switched-capacitor (SC) circuits, Analog integrators and discrete time amplifiers, Nyquist-rate data converters: Algorithmic, Pipeline, SAR, Nyquist-rate data converters: Integrating, Flash, Folding-and-interpolating, Nyquist-rate data converters: Subranging, Interleaved, Digital-Analog Converters, Oversampled Converters. Sigma Delta modulator, Higher order sigma delta, multi-bit sigma delta. Sigma Delta DACs, Precision and correction techniques, Digital calibration, digital assistance, and digital post-processing, Data converter testing and benchmark..				
Course Learning Outcomes			Teaching Methods	Assessment Methods	
Learn and understand the design of data converters			10, 12, 14, 16, 19, 21, 5, 6, 9	A, E, F	
Utilize sampling theory in action.			10, 12, 14, 16, 19, 21, 5, 6, 9	A, E, F	
Learn about switched capacitor circuits.			10, 12, 14, 16, 19, 21, 5, 6, 9	A, E, F	
Learn about digital calibration techniques and how to test converters.			10, 12, 14, 16, 19, 21, 5, 6, 9	A, E, F	
Teaching Methods	10: Discussion Method, 12: Problem Solving Method, 14: Self Study Method, 16: Question - Answer Technique, 19: Brainstorming Technique, 21: Simulation Technique, 5: Cooperative Learning, 6: Experiential Learning, 9: Lecture Method				
Assessment Methods	A: Traditional Written Exam, E: Homework, F: Project Task				
Lecture Schedule					
Sequence	Topics	Preliminary Preparation			
1	Converter basics.	Read the book.			
2	Noise in converters and dynamic range.	Read the book.			
3	Sample and hold circuits.	Read the book.			
4	Switched-capacitor (SC) circuits	Read the book.			
5	Analog integrators and discrete time amplifiers.	Read the book.			
6	Nyquist-rate data converters: Algorithmic, Pipeline, SAR	Read the book.			
7	Nyquist-rate data converters: Integrating, Flash, Folding-and-interpolating	Read the book.			
8	Nyquist-rate data converters: Subranging, Interleaved	Read the book.			
9	Digital-Analog Converters.	Read the book.			
10	Oversampled Converters. Sigma Delta modulator.	Read the book.			
11	Higher order sigma delta, multi-bit sigma delta. Sigma Delta DACs.	Read the book.			
12	Precision and correction techniques.	Read the book.			
13	Digital calibration, digital assistance, and digital post-processing	Read the book.			
14	Data converter testing and benchmark.	Read the book.			
Evaluation Methods			Weight(%)		
Midterm Exam			30		
General Exam			70		

Resources	
1.	Analog Circuit Design□
a.	Gray et al., Analysis and Design of Analog Integrated Circuits, Wiley, 2001
b.	Razavi, Design of Analog CMOS Integrated Circuits, McGraw-Hill, 2001□
c.	Johns and Martin, Analog Integrated Circuit Design, Wiley, 1997□
d.	Allen and Holberg, CMOS Analog Circuit Design, Oxford, 2002
2.	Data Converters
a.	Razavi, Principles of Data Conversion System Design, IEEE Press, 1995
b.	Van de Plassche, CMOS Integrated A/D and D/A Converters, Kluwer, 2003
c.	Norsworthy et al., Delta-Sigma Data Converters: Theory, Design, and Simulation, Wiley, 1996
d.	ADI Data Converter Handbook http://www.analog.com/library/analogDialogue/archives/39-06/data_conversion_handbook.html
3.	Switched-Capacitor Circuits
a.	Gregorian and Temes, Analog MOS Integrated Circuits for Signal Processing, Wiley, 1986