ESOGÜ Electrical-Electronics Engineering Department

COURSE CODE: 151227636-151247636 **COURSE TITLE:** Digital Communications

Semester	Weekly Hours		COURSE			
	Theoretical	Practical	Credits	ECTS	Type	Language
7	3	2	4	7	Compulsory ( ) Elective (x)	Turkish ( ) English (x)

Write the credit (for non-credit courses weekly hours) below (If necessary distribute the credits.).

Math and Basic Science	Electrical Engineering [mark (√) if there is high design content]	General Education	Humanities
	4 ( )		

Assessment	THEORETICAL-PRACTICAL COURSES			LABORATORY COURSES		
	Type	Number	%	Activity Type	Number	%
Midterm	Midterm	1	30	Quiz		
	Quiz			Lab performance		
	Homework			Report		
	Project			Oral exam		
	Other (Lab)	10	25	Other (……)		
Final			45			
Makeup exam (Oral/Written)	written					

Prerequisites	Signals and Systems, Communications
Brief content of the course	Modulations techniques in digital communication, ASK, FSK, PSK, QAM, waveform coding, PCM, DPCM, Delta-M, orthogonalization, MAP/ML decision criterion, channel coding error correcting techniques, parity, LRC, Hamming codes, polynomial coding, cyclic coding, convolutional coding and Viterbi algorithm, serial communication principles, bit synchronization, bit interleaving, examples in VHDL.
Objectives of the course	Learn the methods/techniques, problems and solutions and what is involved in digital communication.
Contribution of the course towards professional education	Students who choose to continue their carrier in communication will get to know the theoretical and some practical details of the subject. It is advised that a basic electronic communication course is completed before this course.
Outcomes of the course	1. Students learn basic digital communication systems 2. Make introduction to design of digital communication systems 3. Build knowledge base for advanced digital communication systems
Textbook of the course	B. Sklar, Digital Communications, Fundamentals and Applications, Prentice Hall, 2000
Other reference books	1) M.B. Pursley, Introduction to Digital Communications, Pearson-Prentica Hall, 2005. 2) V.A. Pedroni, Circuit Design with VHDL, MIT, 2004.
Required material for the course	Experiments are done in an equipped laboratory. Course also has an in-class experiment performed with all students. This experiment requires a computer with required software installed, 2 FPGA development kits, an oscilloscope and a spectrum analyzer. In addition, students need access to a computer with simulation software for take-home experiments.

WEEKLY PLAN OF THE COURSE	
Week	**Topics**
1	Recall of modulation techniques used in digital communications; ASK, PSK, FSK, QAM Use of the FFT function of the oscilloscope for spectrum analysis, spectrum of random-binary-stream
2	Waveform coding, PCM, DPCM, Delta-Modulation, PWM ASK modulation/demodulation and spectrum analysis
3	Orthogonal signal sets, Gram-Schmidt orthogonalization FSK modulation/demodulation and spectrum analysis
4	Channel capacity, introduction to channel coding. PSK modulation/demodulation and spectrum analysis
5	Block coding, Hamming codes. PWM, RZ, Manchester coding
6	Error detection, parity bit, LRC. QPSK modulation/demodulation
7	General FEC, polynomial codes. Time Division Multiplexing
8,9	Midterm
10	Cyclic codes. Generation of ASK and PSK signals in MATLAB-simulink
11	Convolutional coding and Viterbi algorithm. Generation of QPSK signals in simulink
12	Principles in serial communication, jitter, 8B10B. Serial transmission of analog signals using ADC-serializer-deserializer-DAC
13	Bit synchronization, frame synchronization. Distortion/noise over transmission lines
14	Interleaving, communication example using VHDL/FPGA. Completion of missing experiments
15,16	Final

NO	OUTCOMES OF THE PROGRAMME	4	3	2	1
1	Adequate knowledge of mathematics, science and Electrical and Electronic Engineering; ability to practice theoretical and practical knowledge of these areas into modeling and solving complex problems of Electrical and Electronic Engineering			**x**	
2	Ability to identify complex engineering problems in Electrical and Electronic Engineering and related fields, for this purpose having skills to formulate, select and apply appropriate methods.			**x**	
3	Having skills to apply modern design methods to design a complex system, process, equipment or product that should work under realistic conditions and constraints and satisfy specific requirements concerning the Electrical and Electronic Engineering.				**x**
4	Having skills to develop, select and apply modern techniques and tools needed to analyze and solve complex applications in Electrical and Electronic Engineering, skills to use information technology effectively.		**x**		
5	Skills to design and conduct tests, collect data, analyze results, and interpret data for the experimental investigation of complex problems in Electrical and Electronic Engineering		**x**		
6	Ability to function effectively as an individual and as a member of teams within the discipline and in multidiscipline areas.				**x**
7	Communicating effectively in oral and written form both in Turkish and English. Effective report writing and understanding written reports, preparing design and manufacturing reports, making effective presentations, skills to give and receive clear and concise instructions.				**x**
8	Awareness of the necessity of lifelong learning, access to information, monitoring developments in science and technology and the ability to self-renewing				**x**
9	Understanding of professional and ethical responsibility				**x**
10	Information on project management, change management and risk management practices, awareness on entrepreneurship and innovation, knowledge on sustainable development.				**x**
11	Information about universal and societal effects of engineering applications on health, safety and environment; awareness of the legal consequences of engineering solutions.				**x**

Scale for assessing the contribution of the course to the program outcomes:

3: Very high **2: Medium** **1: None**

Name of Instructor(s): Yrd. Doç. Dr. Erol Seke

Signature(s): **Date:**