ESOGÜ Electrical-Electronics Engineering Department

COURSE CODE: 151227631 **COURSE TITLE:** INTRODUCTION TO VHDL

Semester	**Weekly Hours**		**COURSE**		
	Theoretical	**Practical**	**Credits**	**ECTS**	**Type**
6	3	0	3	5	Compulsory ( ) Elective (x)

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

Math and Basic Science	**Electrical Engineering** [mark (x) if there is high design content]	**General Education**	**Humanities**
0	3 (x)	0	0

Assessment	**THEORETICAL-PRACTICAL COURSES**			**LABORATORY COURSES**		
Midterm	**Type**	**Number**	**%**	**Activity Type**	**Number**	**%**
	Midterm	1	40	Quiz		
	Quiz			Lab performance		
	Homework			Report		
	Project		20	Oral exam		
	Other (……)			Other (……)		
Final			40			
Makeup exam (Oral/Written)	written					

Prerequisites	Must accompany INTRODUCTION TO VHDL LAB course
Brief content of the course	Introduction to programmable devices, FPGA structure, design flow using VHDL, use of ISE software, VHDL signal/data types, design and use of components, connections, synchronous design, waveform and VHDL simulation test benches, use of LEDs and switches on the development kit, pitfalls in VHDL, variables, more complicated keywords in VHDL, correct use of arithmetic and logical operators, state-machines, functions and procedures, memory components, communication with external components using examples
Objectives of the course	Learn how to make designs on Field Programmable Gate Arrays using VHDL.
Contribution of the course towards professional education	Students who choose to continue their carrier in advanced circuit will get to know the theoretical and some practical details of one of the highly technical and advanced subject. It is advised that a basic digital circuit design course is completed before this course.
Outcomes of the course	1.Students learn basics of FPGAs and VHDL 2.Make introduction to design of digital systems using VHDL 3.Build knowledge base for advanced VHDL and FPGA based designs 4.Build self-confidence for high technology digital systems
Textbook of the course	V.A. Pedroni, Circuit Design with VHDL, MIT Press
Other reference books	1) M.B. Pursley, Introduction to Digital Communications, Pearson-Prentica Hall, 2005. 2) Open-Core
Required material for the course	Course is highly practical involving both in class and in lab practical designs and experiments. For the lab counterpart, each student/group is provided an FPGA development kit, a computer with VHDL development software installed. Course slides and previous example designs are provided to students.

WEEKLY PLAN OF THE COURSE	
Week	**Topics**
1	Internals of FPGA, VHDL, an example introductory application
2	Design flow using ISE, an example run
3	VHDL signal/data types, defining new types, examples of combinatorial circuit designs
4	Synchronous circuits, design of a test bench and use of related software
5	Signal attributes, standard libraries, common pitfalls
6	Variables
7	CASE, WHEN, FOR, GENERATE keywords, GENERIC keyword
8	1. Midterm
9	Logical and arithmetic operators, state-machines
10	Functions and procedures
11	Use of memory components, BRAM
12	Serial communication
13	Presentations of term-projects, discussions and demonstrations
14	Presentations of term-projects, discussions and demonstrations
15,16	Final exam

Contribution of the course to the program outcomes

NO	OUTCOMES OF THE PROGRAM	3 high	2 med.	1 low	0 none
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 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, 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 for Electrical and Electronic Engineering applications, 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 Electrical and Electronic Engineering problems	**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.		**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, innovation and 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**

Name of Instructor(s): Erol Seke

Signature(s): **Date:**

ESOGÜ Electrical-Electronics Engineering Department

COURSE CODE: 151227632 **COURSE TITLE:** INTRODUCTION TO VHDL LAB

Semester	**Weekly Hours**		**COURSE**		
	Theoretical	**Practical**	**Credits**	**ECTS**	**Type**
6	0	2	1	2	Compulsory ( ) Elective (x)

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Math and Basic Science	**Electrical Engineering** [mark (x) if there is high design content]	**General Education**	**Humanities**
0	3 (x)	0	0

Assessment	**THEORETICAL-PRACTICAL COURSES**			**LABORATORY COURSES**		
Midterm	**Type**	**Number**	**%**	**Activity Type**	**Number**	**%**
	Midterm			Quiz		
	Quiz			Lab performance		
	Homework			Report		100
	Project			Oral exam		
	Other (……)			Other (……)		
Final						
Makeup exam (Oral/Written)						

Prerequisites	Must be registered along with "151227631 INTRODUCTION TO VHDL"
Brief content of the course	This is an accompanying lab-course for the INTRODUCTION TO VHDL. Course contents are ; FPGA structure, design flow using VHDL, use of ISE software, VHDL signal/data types, design and use of components, connections, synchronous design, waveform and VHDL simulation test benches, use of LEDs and switches on the development kit, pitfalls in VHDL, variables, more complicated keywords in VHDL, correct use of arithmetic and logical operators, state-machines, functions and procedures, memory components, communication with external components using examples
Objectives of the course	Learn how to make designs on Field Programmable Gate Arrays using VHDL.
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Textbook of the course	V.A. Pedroni, Circuit Design with VHDL, MIT Press
Other reference books	1) M.B. Pursley, Introduction to Digital Communications, Pearson-Prentica Hall, 2005. 2) Open-Core
Required material for the course	For each student, an FPGA development kit, a computer with VHDL development software installed are required. Course slides and previous example designs are provided to students.

WEEKLY PLAN OF THE COURSE	
Week	**Topics**
1	In-class example introductory application, demonstration.
2	Starting an ISE project
3	3 to 8 decoder
4	Up-counter
5	Up/down counter, ISIM simulation
6	Key de-bouncing example
7	Instantiation, two instances of a counter
8	Midterm week (no lab)
9	Knight-rider example with buttons
10	Rotary encoder
11	State machine
12	Another state machine
13	Block memories
14	SPI communication
15,16	Final exam

Contribution of the course to the program outcomes

NO	OUTCOMES OF THE PROGRAM	3 high	2 med.	1 low	0 none
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 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, 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 for Electrical and Electronic Engineering applications, 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 Electrical and Electronic Engineering problems	**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.		**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, innovation and 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**

Name of Instructor(s): Erol Seke

Signature(s): **Date:**