SYLLABUS

1. Information about the program

1.1 Higher education institution	UNIVERSITY POLITEHNICA OF TIMISOARA
1.2 Faculty[1]/ Department [2]	ELECTRONICS, TELECOMUNICATON AND INFORMATION TECHNOLOGIES/ EA
1.3 Field of study (name/code[3])	ELECTRONIC ENGINEERING, TELECOMUNICATION AND INFORMATION TECHNOLOGIES
1.4 Study cycle	License
1.5 Study program (name/code/qualification)	TST-ENG/20/20/10/100/10/TST-ENG

2. Information about the discipline

2.1 Name of discipline/ formative category[4]			VHDL Modelling Fundamentals				
2.2 Coordinator (holder) of course activities			Associate Professor Simion Georgiana, PhD				
2.3 Coordinator (holder) of applied activities[5]			Cristina Sîrbu				
2.4 Year of study[6]	3	**2.5** Semester	6	**2.6** Type of evaluation	D	**2.7** Regime of discipline[7]	DS

3. Total estimated time – hours / semester: direct teaching activities (fully assisted or partly assisted) and individual training activities (unassisted) [8]

3.1 Number of fully assisted hours / week	4 of which:	**3.2** course	2	**3.3** seminar / laboratory / project	0/1/1
3.1* Total number of fully assisted hours / semester	56 of which:	**3.2*** course	28	**3.3*** seminar / laboratory / project	0/14/14
3.4 Number of hours partially assisted / week	of which:	**3.5** training		**3.6** hours for diploma project elaboration	
3.4* Total number of hours partially assisted / semester	of which:	**3.5*** training		**3.6*** hours for diploma project elaboration	
3.7 Number of hours of unassisted activities / week	1.36 of which:	additional documentary hours in the library, on the specialized electronic platforms and on the field			0.36
		hours of individual study after manual, course support, bibliography and notes			0.5
		training seminars / laboratories, homework and papers, portfolios and essays			0.5
3.7* Number of hours of unassisted activities / semester	19 of which:	additional documentary hours in the library, on the specialized electronic platforms and on the field			5
		hours of individual study after manual, course support, bibliography and notes			7
		training seminars / laboratories, homework and papers, portfolios and essays			7
3.8 Total hours / week [9]	5.36				
3.8* Total hours /semester	75				
3.9 Number of credits	3				

4. **Prerequisites** (where applicable)

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[1] The name of the faculty which manages the educational curriculum to which the discipline belongs
[2] The name of the department entrusted with the discipline, and to which the course coordinator/holder belongs.
[3] The code provided in HG - on the approval of the Nomenclature of fields and specializations / study programs, annually updated.
[4] Discipline falls under the educational curriculum in one of the following formative disciplines: Basic Discipline (DF), Domain Discipline (DD), Specialist Discipline (DS) or Complementary Discipline (DC).
[5] Application activities refer to: seminar (S) / laboratory (L) / project (P) / practice/training (Pr).
[6] Year of studies in which the discipline is provided in the curriculum.
[7] Discipline may have one of the following regimes: imposed discipline (DI) or compulsory discipline (DOb)-for the other fundamental fields of studies offered by UPT, optional discipline (DO) or optional discipline (Df).
[8] The number of hours in the headings 3.1 *, 3.2 *, ..., 3.8 * is obtained by multiplying by 14 (weeks) the number of hours in headings 3.1, 3.2, ..., 3.8. The information in sections 3.1, 3.4 and 3.7 is the verification keys used by ARACIS as: (3.1) + (3.4) ≥ 28 hours / wk. and (3.8) ≤ 40 hours / wk.
[9] The total number of hours / week is obtained by summing up the number of hours in points 3.1, 3.4 and 3.7.

4.1 Curriculum	• Digital Integrated Circuits, Applied Computer Programming
4.2 Competencies	• Hierarchical programming, structure of a digital system

5. Conditions (where applicable)

5.1 of the course	• Laptop, video projector, whiteboard
5.2 to conduct practical activities	• Laboratory with 8 workstands (and 24 places) each one equipped with PC, FPGA-based development boards and dedicated equipment

6. Specific competencies acquired through this discipline

Specific competencies	• Knowledge about FPGAs and VHDL programming • Knowledge about HDL based design flows. • Knowledge about logic gates, combinatorial& sequential logic circuits, semiconductor memories • Implementing the design on FPGA • Testing the design • Debugging the design • Development of a project with FPGA
Professional competencies ascribed to the specific competencies	• Application of basic methods for signal acquisition and processing. • Application of knowledge, concepts and basic methods related to computer system architecture, microprocessors, microcontrolers, programming languages and techniques. •
Transversal competencies ascribed to the specific competencies	• 1. Methodical analysis of field-related problems aimed at identifying acknowledged solutions, thus ensuring the accomplishment of professional tasks. • 2. Definition of activity stages and their distribution to subordinates in terms of responsabilities, providing effective exchange of information and interpersonal communication. • 3. Adaptation to new technologies, professional and personal development through continuous training, using printed documentation sources, specialized software and electronic resources in Romanian and at least one foreign language.

7. Objectives of the discipline (based on the grid of specific competencies acquired - pct.6)

7.1 The general objective of the discipline	• This discipline aims to familiarize students with hardware description language VHDL and modern programmable logic structures like FPGAs, the main types of programmable elements and their applications
7.2 Specific objectives	• When graduating the discipline students have skills, knowledge, and expertise on FPGA programming using VHDL

8. Content [10]

8.1 Course	Number of hours	Teaching methods [11]
Brief history of the programmable systems. Introduction to Programmable Logic Devices - SPLDs,CPLDs, FPGAs, ASICs	2	Slides, writing on the whiteboard, Q&A
Programming technologies: antifuse, EEPROM, FLASH, RAM	2	

[10] It details all the didactic activities foreseen in the curriculum (lectures and seminar themes, the list of laboratory works, the content of the stages of project preparation, the theme of each practice stage). The titles of the laboratory work carried out on the stands shall be accompanied by the notation "(*)".
[11] Presentation of the teaching methods will include the use of new technologies (e-mail, personalized web page, electronic resources etc.).

Introduction to VHDL	4	
Behavioral Modeling	4	
Sequential Processing	4	
Data Types	3	
Packages and Components	2	
Functions and procedures	2	
VHDL Synthesis	3	
High Level Design Flow	2	

1. Bibliography [12] John F. Wakerly, Digital Design: Principles and Practices, 4/E, Prentice Hall, 2005.
2. M. Morris Mano , Charles R. Kime, Tom Martin, Logic and Computer Design Fundamentals, Pearson Higher Education, 2014.
3. Douglas L. Perry, VHDL: Programming by Example
4. Charles Roth, Lizy Kurian John, Digital system design using VHDL
5. Peter J. Ashenden, VHDL Tutorial, Elsevier Science 2004
6. Digital Design with CPLDS Applications &VHDL
7. Darrin M. Hanna, Richard E. Haskell, Introduction to Digital Design Using Digilent FPGA Boards— Block Diagram / VHDL Examples, LBE Books, 2009, ISBN 978-0-9801337-6-9.

8.2 Applied activities [13]	Number of hours	Teaching methods
Presentation of the FPGA based developing boards	2	Hands-On lab
Vivado Tutorial, Logic functions implementation in FPGA using VHDL. Functional test	4	
Implementing Combinational logic circuits in FPGA using VHDL	5	
Implementing Sequential logic circuits in FPGA using VHDL	5	
VGA port-display a test image on monitor -VHDL implementation	4	Hands-On lab
ROM and RAM memories - VHDL implementation	4	Hands-On lab
FSM-Traffic light - VHDL implementation	2	Hands-On lab
Programmable frequency dividers - VHDL implementation	2	Hands-On lab
		Hands-On lab

Bibliography [14] 1. G. Simion, *FPGA Programming an Introduction*, Editura Politehnica 2012

2. Darrin M. Hanna, Richard E. Haskell, Introduction to Digital Design Using Digilent FPGA Boards— Block Diagram / VHDL Examples, LBE Books, 2009, ISBN 978-0-9801337-6-9.

3. Digilent Nexys4 Board Reference Manual

9. Corroboration of the content of the discipline with the expectations of the main representatives of the epistemic community, professional associations and employers in the field afferent to the program

[12] At least one title must belong to the discipline team and at least one title should refer to a reference work for discipline, national and international circulation, existing in the UPT library.
[13] Types of application activities are those specified in footnote 5. If the discipline contains several types of applicative activities then they are sequentially in the lines of the table below. The type of activity will be in a distinct line as: "Seminar:", "Laboratory:", "Project:" and / or "Practice/training".
[14] At least one title must belong to the discipline team.

• The content of this course was agreed with the representatives of companies like Continental SA and Hella Romania

10. Evaluation

Type of activity	**10.1** Evaluation criteria [15]	**10.2** Evaluation methods	**10.3** Share of the final grade
10.4 Course	Minimum mark is 5	A 2/2.5 h exam with multiple answer questions, theoretical subjects and applicative subjects	1/2
10.5 Applied activities	**S:**		
	L: The arithmetic average of all marks from the laboratories	Short tests at the beginning of the labs from the theoretical part and marks for the practical implementations	1/2
	P[16]**:**		
	Pr:		
10.6 Minimum performance standard (minimum amount of knowledge necessary to pass the discipline and the way in which this knowledge is verified [17])			
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Date of completion	**Course coordinator (signature)**	**Coordinator of applied activities (signature)**
20.06.2023		
Head of Department (signature)	**Date of approval in the Faculty Council** [18]	**Dean (signature)**
	14.09.2023	

[15] Syllabus must contain the procedure for assessing the discipline, specifying the criteria, methods and forms of assessment, as well as specifying the weightings assigned to them in the final grade. The evaluation criteria shall be formulated separately for each activity foreseen in the curriculum (course, seminar, laboratory, project). They will also refer to the forms of verification (homework, papers, etc.)

[16] In the case where the project is not a distinct discipline, this section also specifies how the outcome of the project evaluation makes the admission of the student conditional on the final assessment within the discipline.

[17] It will not explain how the promotion mark is awarded.

[18] The endorsement is preceded by the discussion of the board's view of the study program on the discipline record.