SYLLABUS

1. Data about the program of study

1.1	Institution	The Technical University of Cluj-Napoca
1.2	Faculty	Automation and Computer Science
1.3	Department	Computer Science
1.4	Field of study	Computer Science and Information Technology
1.5	Cycle of study	Bachelor of Science
1.6	Program of study/Qualification	Computer Science/ Engineer
1.7	Form of education	Full time
1.8	Subject code	

2. Data about the subject

2.1	Subject name					***Digital Systems Design***					
2.2	Subject area					Computer Science and Information Technology					
2.3	Course responsible/lecturer					Prof. dr. eng. Creţ Octavian-Augustin - Octavian.Cret@cs.utcluj.ro					
2.4	Teachers in charge of applications					Lect. dr. eng. Cristian-Cosmin Vancea - Cristian.Vancea@cs.utcluj.ro Lect. dr. eng. Dragoș-Florin Lisman - Dragos.Lisman@cs.utcluj.ro					
2.5	Year of study	I	2.6	Semester	2	2.7	Assessment	exam	2.8	Subject category	DID/OB

3. Estimated total time

Sem.	Subject name	Lecture	Applications			Lecture	Applications			Individual study	TOTAL	Credit
		[hours / week.]				[hours / semester]						
			S	L	P		S	L	P			
2	**Digital Systems Design**	**2**	**-**	**2**	**-**	**28**	**-**	**28**	**-**	**74**	**130**	**5**

3.1	Number of hours per week	4	3.2	of which, course	2	3.3	applications	2
3.4	Total hours in the teaching plan	130	3.5	of which, course	28	3.6	applications	28

Individual study	Hours
Manual, lecture material and notes, bibliography	25
Supplementary study in the library, online and in the field	17
Preparation for seminars/laboratory works, homework, reports, portfolios, essays	17
Tutoring	6
Exams and tests	9
Other activities	0

3.7	Total hours of individual study	74
3.8	Total hours per semester	130
3.9	Number of credit points	5

4. Pre-requisites (where appropriate)

4.1	Curriculum	Logic Design
4.2	Competence	At least one high level programming language (i.e. C or PASCAL)

5. Requirements (where appropriate)

5.1	For the course	• A minimum of 80% course attendance rate is mandatory for being admitted to the final exam
5.2	For the applications	• Preliminary preparation of summaries from the indicated bibliography (laboratory textbook)

6. Specific competences

Professional competences	**C2 –** Designing hardware, software and communication components **C2.1 -** Describing the structure and functioning of computational, communication and software components and systems **C2.2 –** Explaining the role, interaction and functioning of hardware, software and communication components **C2.3 –** Building the hardware and software components of some computing systems using algorithms, design methods, protocols, languages, data structures, and technologies **C2.4 –** Evaluating the functional and non-functional characteristics of the computing systems using specific metrics **C2.5 –** Implementing hardware, software and communication systems
Cross competences	N/A

7. Discipline objectives (as results from the *key competences gained*)

7.1	General objective	• The main objective of this discipline is to give to the students the bases of Digital Systems Design, in order to make them able to analyze, design and implement any complex digital system.
7.2	Specific objectives	To reach this goal, students will learn to: • Apply Digital System Design principles and descriptive techniques; • Understand various aspects of Automata Theory with applications in the field of Digital Systems Design; • Describe any digital system in VHDL; • Utilize programmable devices such as FPGAs and PLDs to implement digital systems.

8. Contents

8.1. Lecture (syllabus)		Teaching methods	Notes
1	VHDL hardware description language – basic design units, signals	Blackboard presentation discussions (face to face or using TEAMS platform, if necessary)	N/A
2	VHDL hardware description language – generics, constants, operators, data types, attributes		
3	VHDL hardware description language – sequential domain		
4	VHDL hardware description language – concurrent domain		
5	Creating testbenches for simulating and testing circuits in VHDL		
6	Automata (Finite State Machines) Theory – classification, definitions, formal models		
7	Microprogramming		
8	Microprogrammed Devices		
9	Designing Synchronous Automata		
10	Analysis and Design (Synthesis) of Asynchronous Automata (I)		
11	Analysis and Design (Synthesis) of Asynchronous Automata (II)		
12	Automata Identification		
13	Lossless Machines		
14	Linear Automata		

Bibliography

1. Digital Design Principles and Practices, John F. Wakerly, Prentice-Hall, 2000.
2. Automate programabile, Th. Borangiu, R. Dobrescu, Ed. Academiei, 1986.
3. Advanced Digital Logic Design Using VHDL, State Machines, and Synthesis for FPGA's, Sunggu Lee, Thomson-Engineering; 1 edition (April 25, 2005), ISBN 0534466028.
4. PowerPoint slides for VHDL and Automata Theory lectures + sets of problems for the individual study: http://users.utcluj.ro/~lucia/index.html

8.2. Applications (Laboratory)		Teaching methods	Notes
1	Introduction to VHDL	Practical work on test boards, FPGA boards, specialized	N/A
2	Basic design units in VHDL		
3	Signals, generics, constants, in VHDL		
4	Operators, data types in VHDL		

5	Attributes in VHDL	software, blackboard presentations, supplemental explanations and discussions (face to face or using TEAMS platform, if necessary)	
6	Sequential domain. Processes in VHDL		
7	Sequential statements in VHDL		
8	Concurrent domain in VHDL		
9	Concurrent statements in VHDL		
10	Sub-programs in VHDL		
11	Testbenches in VHDL		
12	Standard and predefined packages in VHDL		
13	Mini-projects delivery		
14	Lab test		

Bibliography

1. Limbajul VHDL, Îndrumător de laborator, Ediţia a-3-a. O. Creţ, L. Văcariu, Ed. U.T. Press, Cluj-Napoca, 2007.
2. PowerPoint slides for VHDL and Automata Theory lectures + sets of problems for the individual study: http://users.utcluj.ro/~lucia/index.html

9. Bridging course contents with the expectations of the representatives of the community, professional associations and employers in the field

• Since this discipline is a basic one in Computer Science, its content is "classic" but also modern because it familiarizes students with the modern principles of Logic Design (utilization of modern simulation and synthesis tools, FPGA and CPLD-based design etc.). Its contents have been discussed with major academia and industry actors from Romania, Europe and U.S.A. and it has been evaluated several times by Romanian Governmental Agencies like CNEAA and ARACIS.

10. Evaluation

Activity type	10.1	Assessment criteria	10.2	Assessment methods	10.3	Weight in the final grade
Course		Problems solving abilities		Written Exam (face to face or using TEAMS platform, if necessary)		60%
		Presence, (Inter)activity				
Homeworks		Problems solving abilities		Practical Evaluation (face to face or using TEAMS platform, if necessary)		20%
Applications		Problems solving abilities		Practical Evaluation (hands-on) (face to face or using TEAMS platform, if necessary)		20%
		Presence, (Inter)activity				

10.4 Minimum standard of performance

• Conditions for participating in the final Written exam: Applications grade ≥ 5 AND Homeworks grade ≥ 5 AND a minimum of 80% course attendance rate;
• Conditions for passing the exam: Written exam grade ≥ 5;
• Modeling and solving typical Digital Systems Design problems using the domain-specific formal apparatus

Date of filling in: 22.06.2023	**Teachers**	**Title First name Last name**	**Signature**
	Course	Prof. dr. eng. Creţ Octavian Augustin	
	Applications	Lect. dr. eng. Cristian-Cosmin Vancea	
		Lect. dr. eng. Dragoș-Florin Lisman	

Date of approval in the department	Head of department, Prof. dr. eng. Rodica Potolea
Date of approval in the Faculty Council	Dean, Prof. dr. eng. Liviu Miclea