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	4.00

2. Data about the subject

2.1	Subject name					***Logic Design***					
2.2	Subject area					Computer Science and Information Technology					
2.3	Course responsible / lecturer					Prof. dr. eng. Octavian Creţ - 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	1	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			
1	Logic Design	2	-	2	-	28	-	28	-	44	100	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	100	3.5	of which, course	28	3.6	applications 28

Individual study	Hours
Manual, lecture material and notes, bibliography	15
Supplementary study in the library, online and in the field	7
Preparation for seminars/laboratory works, homework, reports, portfolios, essays	7
Tutoring	6
Exams and tests	9
Other activities	0

3.7	Total hours of individual study	44
3.8	Total hours per semester	100
3.9	Number of credit points	4

4. Pre-requisites (where appropriate)

4.1	Curriculum	• N/A
4.2	Competence	• Mathematics (Algebra), Physics (electricity)

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

6.1 Professional competences	**C1 –** Operating with basic Mathematical, Engineering and Computer Science concepts • **C1.1 –** Recognizing and describing concepts that are specific to the fields of calculability, complexity, programming paradigms, and modeling computational and communication systems • **C1.2 –** Using specific theories and tools (algorithms, schemes, models, protocols, etc.) for explaining the structure and the functioning of hardware, software and communication systems • **C1.3 –** Building models for various components of computing systems • **C1.4 –** Formal evaluation of the functional and non-functional characteristics of computing systems • **C1.5 –** Providing a theoretical background for the characteristics of the designed systems
6.2 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 Logic Design, in order to make them able to analyze, design and implement any digital system.
7.2	Specific objectives	To reach this goal, students will learn to: • Analyze and synthesize combinational logic systems; • Analyze and synthesize synchronous and asynchronous sequential machines; • Apply digital system design principles and descriptive techniques; • Utilize programmable devices such as FPGAs and PLDs to implement digital systems; • Understand timing issues in digital systems and study these via digital circuit simulation.

8. Contents

8.1. Lecture (syllabus)		Teaching methods	Notes
1	Introduction. Number systems and codes, errors	Presentations, discussions	N/A
2	Number representation systems. Binary arithmetic		
3	Boolean Algebra. Boolean functions. Logic gates. Digital systems and functions representation		
4	Methods for minimizing Boolean functions and systems of functions		
5	Combinational logic circuits (CLCs) analysis and design (synthesis). SSI and MSI CLCs.		
6	Methods for designing digital systems with SSI, MSI, LSI and VLSI circuits. Combinational Hazard.		
7	Sequential logic circuits. Latches and Flip-Flops.		
8	Flip-Flops applications: frequency dividers, counters		
9	Flip-Flops applications: data registers, converters, memories		
10	Methods for designing digital systems using Flip-Flops		
11	Methods for designing digital systems using memories, multiplexers, decoders, counters		
12	Methods for designing sequential synchronous systems		
13	Methods for designing digital systems using programmable devices (I)		
14	Methods for designing digital systems using programmable devices (II)		

Bibliography

1. Contemporary Logic Design, Randy H. Katz, Benjamin Cunnings / Addison Wesley Publishing Co., 1993.
2. Digital Design Principles and Practices, John F. Wakerly, Prentice-Hall, 2000.
3. FPGA-based System Design, Wayne Wolf, PRENTICE HALL Professional Technical Reference Upper Saddle River, NJ 07458 www.phptr.com ISBN: 0-13-142461-0.

8.2. Applications (Laboratory)		Teaching methods	Notes
1	Basic Logic Circuits	Practical work on test boards, FPGA boards, specialized software, blackboard	N/A
2	ActiveHDL Schematic Editor and Simulator (I)		
3	ActiveHDL Schematic Editor and Simulator (II)		
4	Combinational Logic Circuits (I)		
5	Combinational Logic Circuits (II) – MSI circuits		

6	Combinational Logic Circuits (III) – Complex circuits		
7	Synthesis of Combinatorial Logic Circuits using Programmable Logic Devices	presentations, supplemental explanations and discussions	
8	Flip-flops		
9	Counters (I)		
10	Counters (II)		
11	Registers and Shift Registers		
12	The XILINX FPGA Family		
13	Synthesis of Sequential Logic Circuits using FPGA Devices		
14	Laboratory test		

Bibliography

1. Analiza şi sinteza dispozitivelor numerice, Îndrumător de laborator, Ediţia a-3-a, L. Văcariu, O. Creţ, A. Neţin, Ed. U.T. Press, Cluj- Napoca, 2009.

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	Assessment criteria	Assessment methods	Weight in the final grade
Course	Problems solving abilities Presence, (Inter)activity	Written Exam	70%
Seminar	-	-	-
Laboratory	Problems solving abilities Presence, (Inter)activity	Using TEAMS platform, if necessary)	30%
Project	-	-	-

Minimum standard of performance:

• Conditions for participating in the final Written exam: Applications grade ≥ 5 AND a minimum of 80% course attendance rate;

• Conditions for passing the exam: Written exam grade ≥ 5;

Modeling and solving typical Logic Design problems using the domain-specific formal apparatus.

Date of filling in 12.06.2024	**Teachers**	**Title First name Last Name**	**Signature**
	Course	Prof.dr.eng. Octavian Creț	
	Applications	Lect.dr.eng. Cristian-Cosmin Vancea	
		Lect.dr.eng. Dragoș-Florin Lișman	

Date of approval in the department
20.02.2024

Head of department,
Prof.dr.eng. Rodica Potolea

Date of approval in the Faculty Council
22.02.2024

Dean,
Prof.dr.eng. Mihaela Dînșoreanu