SYLLABUS – LOGIC DESIGN

1. Data about the program of study

1.1	Institution	The Technical University of Cluj-Napoca
1.2	Faculty	Faculty of Automation and Computer Science
1.3	Department	Automation
1.4	Field of study	Systems Engineering
1.5	Cycle of study	Bachelor of Science
1.6	Program of study/Qualification	Automation and Applied Informatics, English
1.7	Form of education	Full time
1.8	Subject code	20.00

2. Data about the subject

2.1	Subject name					Logic Design					
2.2	Subject area					Logic Design					
2.3	Course responsible/lecturer					Șl. eng. Vlad-Cristian Miclea– vlad.miclea@cs.utcluj.ro					
2.4	Teachers in charge of seminars					Șl. eng. Vlad-Cristian Miclea– vlad.miclea@cs.utcluj.ro Șl.dr.ing. Lișman Dragoș Florin – dragos.lisman@cs.utcluj.ro					
2.5	Year of study	2	2.6	Semester	1	2.7	Assessment	Continuous assessment CA	2.8	Subject category	CS

3. Estimated total time

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	• N/A
5.2	For the applications	• Lab attendance is mandatory.

6. Specific competences

Professional competences	**C1 –** Using basic knowledge from Mathematics, Physics, Measuring theory, Technical Graphics, Mechanical engineering, Electricity and Electronics in Systems Engineering. **C2** – Operating with basic concepts from Computer Science, Information technology and Communications in order to explain the structure and functioning of hardware systems **C3** – Building a set of models for different components of computing systems **C4** – Formal evaluation of functional and non-functional characteristics of computing systems **C5** – Theoretical proof of the projected systems characteristics
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
Introduction. Number systems and codes, errors	Blackboard presentation, Power Point presentation, discussions	The lectures and the laboratories will be either on site or online.
Number representation systems. Binary arithmetic		
Boolean Algebra. Boolean functions. Logic gates. Digital systems and functions representation		
Methods for minimizing Boolean functions and systems of functions		
Combinational logic circuits (CLCs) analysis and design (synthesis). SSI and MSI CLCs.		
Methods for designing digital systems with SSI, MSI, LSI and VLSI circuits. Combinational Hazard.		
Sequential logic circuits. Latches and Flip-Flops.		
Flip-Flops applications: frequency dividers, counters		
Flip-Flops applications: data registers, converters, memories		
Methods for designing digital systems using Flip-Flops		
Methods for designing digital systems using memories, multiplexers, decoders, counters		
Methods for designing sequential synchronous systems		
Methods for designing digital systems using programmable devices (I)		
Methods for designing digital systems using programmable devices (II)		

References

1. Contemporary Logic Design, Randy H. Katz, Benjamin Cunnings / Addison Wesley Publishing Co., 2005.
2. Probleme de proiectare logică / Digital Design problems, Octavian Creţ, Lucia Văcariu, UTPres, 2008.
3. Digital Design Principles and Practices, John F. Wakerly, Prentice-Hall, 2000.
4. 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/Seminars)	Teaching methods	Notes
1	Basic Logic Circuits	Practical work on test boards, FPGA boards, specialized software, blackboard presentations, supplemental explanations and discussions	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		
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	Final test		

Bibliography

1. Analiza şi sinteza dispozitivelor numerice, Îndrumător de laborator, Ediţia a-3-a, L. Văcariu, O. Creţ, Ed. U.T. Press, Cluj-Napoca, 2009.
2. Contemporary Logic Design, Randy H. Katz, Benjamin Cunnings / Addison Wesley Publishing Co., 2005.
3. Digital Design Principles and Practices, John F. Wakerly, Prentice-Hall, 2000.
4. Lucia Văcariu, Octavian Creţ – *Probleme de proiectare logică a sistemelor numerice. Logic Design Problems for Digital Systems*. Editura UTPres, Cluj-Napoca, ROMÂNIA, 2013.

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		Onsite exam or online exam using MS Teams, Moodle and/or oral interview		70%
		Presence, (Inter)activity				
Applications		Problems solving abilities		Onsite testing or online testing using MS Teams, Moodle and/or oral interview		30%
		Presence, (Inter)activity				
10.4 Minimum standard of performance						
• Conditions for participating in the final exam: Applications grade ≥ 5; • Conditions for passing the exam: Exam grade ≥ 5; • Modeling and solving typical Logic Design problems using the domain-specific formal apparatus.						

Date of filling in
10.02.2025

Professors in charge of seminars
S.l. Eng. Vlad-Cristian Miclea

Date of approval in the department Automation

Head of department
Prof. dr. eng. Honoriu Vălean

Date of approval in the Faculty of Automation and Computer Science

Dean
Prof.dr.ing. Vlad Muresan

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