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

2. Data about the subject

2.1 Subject name	***Logic Design***			Subject code	**4**
2.2 Course responsible / lecturer	Lect. dr. eng. Lișman Dragoș-Florin - Dragos.Lisman@cs.utcluj.ro				
2.3 Teachers in charge of seminars / Laboratory / project	Lect. dr. eng. Lișman Dragoș-Florin - Dragos.Lisman@cs.utcluj.ro				
2.4 Year of study	I	2.5 Semester	1	2.6 Type of assessment (E - exam, C - colloquium, V – verification)	E
2.7 Subject category	Formative category: DF – fundamental, DS – speciality, DC – complementary				DF
	Optionality: DOB – mandatory, DOP – optional (alternative), DFA – optional (free choice)				DOB

3. Estimated total time

3.1 Number of hours per week	4	of which:	Course	2	Seminars	-	Laboratory	2	Project	-
3.2 Number of hours per semester	56	of which:	Course	28	Seminars	-	Laboratory	28	Project	-
3.3 Individual study:										
(a) Manual, lecture material and notes, bibliography										25
(b) Supplementary study in the library, online and in the field										17
(c) Preparation for seminars/laboratory works, homework, reports, portfolios, essays										16
(d) Tutoring										6
(e) Exams and tests										5
(f) Other activities:										-

3.4 Total hours of individual study (suma (3.3(a)...3.3(f)))	69
3.5 Total hours per semester (3.2+3.4)	125
3.6 Number of credit points	5

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	• Technical communication and the ability to synthesize information. • Problem-solving for the analysis and synthesis of digital logic circuits. • Optimization of structural elements in computing architectures. • Teamwork.

7. Expected Learning Outcomes

Knowledge	Describes, identifies, and summarizes elementary concepts and methods regarding the modeling, analysis, design, and testing of digital circuits using switching circuits, namely: • Number representation methods in computing systems • Modeling switching circuits using Boolean algebra • Analysis and synthesis techniques for combinational and sequential logic circuits • Implementation mechanisms for synchronous sequential systems. • Development of digital computing systems with programmable logic devices: (Designing hardware using chips like FPGAs).
Skills	• Develop models for digital circuit components and evaluate functional and non-functional characteristics. • Design and implement functional units of low/medium complexity using Field Programmable Gate Arrays • Utilize specific methods and tools for the implementation, analysis, and simulation of digital circuits. (Using industry-standard software like Vivado for testing and verification).
Responsibilities and autonomy	Demonstrates initiative and proactive action in updating professional, economic, and organizational culture knowledge.

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

8.1 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.
8.2 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.

9. Contents

9.1. Lecture (syllabus)	Teaching methods	Notes
Introduction. Number systems and codes, errors	Presentations, discussions	Physical on-site lectures
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)		

Bibliography:

1. Contemporary Logic Design, Randy H. Katz, Benjamin Cunnings / Addison Wesley Publishing Co., 1993.
2. R. H. Katz, G. Borriello, "Contemporary Logic Design", 2nd edition, Pearson, 2004.
3. J. F. Wakerly, "Digital Design Principles and Practices", 5th edition, Pearson, 2018.
4. R. P. Jain, K. Sarawadekar, "Modern Digital Electronics", 5th Edition, Mc Graw Hill India, 2022.
5. T. L. Floyd, "Digital Fundamentals", 11th Edition, Global Edition, Pearson, 2015.
6. S. L. Harris, D. M. Harris, "Digital Design and Computer Architecture", RISC-V edition, Morgan-Kaufmann, 2021.
7. M. M. Mano, "Digital Design with an introduction to the Verilog, VHDL, HDL, and SystemVerilog", 6th edition, global edition, Pearson, 2018.

9.2 Applications (Laboratory)	Teaching methods	Notes
Basic Logic Circuits	Practical work on test boards, FPGA boards, specialized software, blackboard presentations, supplemental explanations and discussions.	Physical on-site laboratory works.
ActiveHDL Schematic Editor and Simulator (I)		
ActiveHDL Schematic Editor and Simulator (II)		
Combinational Logic Circuits (I)		
Combinational Logic Circuits (II) – MSI circuits		
Combinational Logic Circuits (III) – Complex circuits		
Synthesis of Combinatorial Logic Circuits using Programmable Logic Devices		
Flip-flops		
Counters (I)		
Counters (II)		
Registers and Shift Registers		
The XILINX FPGA Family		
Synthesis of Sequential Logic Circuits using FPGA Devices		
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.
   In virtual libraries
2. C. Vancea, Laboratory Works https://users.utcluj.ro/~vcristian/PL.html

10. 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.

11. Evaluation

Activity type	Assessment criteria	Assessment methods	Weight in the final grade
Course	Problems solving abilities Presence, (Inter)activity	Written Exam	70%
Applications	Problems solving abilities	(face to face or using TEAMS platform, if necessary)	30%
	Presence, (Inter)activity		

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: 29.04.2026	**Responsible**	**Title, First name Last name**	**Signature**
	Course	Lect.dr.eng. Dragoș-Florin LIȘMAN	
	Applications	Lect.dr.eng. Dragoș-Florin LIȘMAN	

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. Vlad Mureșan