SYLLABUS

1. Data about the program of study

1.1	Institution	The Technical University of Cluj-Napoca
1.2	Faculty	Faculty of Electrical Engineering
1.3	Department	Electrotechnics and Measurements
1.4	Field of study	Electrical Engineering
1.5	Cycle of study	Bachelor of Science
1.6	Program of study/Qualification	Electrical systems – eng.
1.7	Form of education	Full time
1.8	Subject code	28

2. Data about the subject

2.1	Subject name			Digital Systems			
2.2	Course responsible/lecturer			Lect. Mărginean Călin, PhD			
2.3	Teachers in charge of seminars			Lect. Mărginean Călin, PhD; Conf. Bojan Mircea, PhD			
2.4 Year of study	2	2.5 Semester	2	2.6 Assessment			E
2.7 Subject category	Formative category						DID
	Optionality						

3. Estimated total time

3.1 Number of hours per week	5	of which	3.2 Course	2	3.3 Seminar	1	3.3 Laboratory	2	3.3 Project	
3.4 Total hours in the curriculum	70	of which	3.5 Course	28	3.6 Seminar	14	3.6 Laboratory	28	3.6 Project	

3.7 Individual study:	
(a) Manual, lecture material and notes, bibliography	10
(b) Supplementary study in the library, online and in the field	8
(c) Preparation for seminars/laboratory works, homework, reports, portfolios, essays	6
(d) Tutoring	3
(e) Exams and tests	3
(f) Other activities	

3.8 Total hours of individual study (summ (3.7(a)…3.7(f)))	30
3.9 Total hours per semester (3.4+3.8)	100
3.10 Number of credit points	4

4. Pre-requisites (where appropriate)

4.1	Curriculum	
4.2	Competence	

5. Requirements (where appropriate)

5.1	For the course	
5.2	For the applications Seminar /Laboratory/Project	Attendance at the seminar and laboratory is mandatory.

6. Specific competences

Professional competences	Theoretical knowledge regarding: - elements of digital circuits and binary logic; - types of digital circuits; - digital systems design methods; After completing the discipline, students will acquire knowledge about: - basic notions of binary arithmetic and logic; - design with basic logic circuits by intuitive methods and using the computer; - minimal architectures of digital systems. After completing the discipline students will be able to: - use a professional software environment for the design of digital circuits - use specific laboratory equipment for designing and testing boards with logic circuits;
Cross competences	

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

7.1	General objective	Knowledge of the basics in the field of digital systems and the formation of practical skills in digital electronics.
7.2	Specific objectives	• to identify the notion of digital system ; • to know the types of digital circuits ; • to analyze and synthesize combinational and sequential logic systems ; • to know the methods of designing digital circuits.

8. Contents

8.1. Lecture (syllabus)	Number of hours	Teaching methods	Notes
C1 - Number systems and codes – codes conversion, binary codes, BCD, alphanumeric codes, error-detecting codes.	2	Slides presentation with explanation and discussions. Examples at the blackboard, discussions.	
C2 - Fundamentals of digital logic technique (Definition of Boolean algebra, Basic logic functions, Laws and Theorems of Boolean Algebra, Boolean expressions, Classification of digital logic circuits).	2		
C3 - Software and hardware support for digital circuit design.	2		
C4,5 - Combinational logic circuits and applications I - CLC implementation with SSI components.	4		
C6 - Hazard in logic circuits. Static and dynamic hazard. Methods for hazard elimination.	2		
C7 - Combinational logic circuits and applications II - CLC implementation with MSI and LSI components (MUX, DCD, PROM…).	2		
C8,9 – Common combinational logic circuits(Code converters, BCD to 7 segment decoder, magnitude comparators, binary adders).	4		

C10,11 - Sequential logic circuits and applications I (SLC definitions, Asynchronous sequential circuits I, Design methods).	4		
C12,13 – Sequential logic circuits and applications II (Latches and Flip flops, Sequential circuits using latches and flip-flops)	4		
C14 - Sequential logic circuits and applications III (Synchronous sequential circuits)	2		

Bibliography

1. John F. Wakerly - Digital Design: Principles and Practices, Pearson Prentice-Hall, New York, 1990
2. M. Morris Mano, Michael D. Ciletti, - Digital Design, 4th Edition, Pearson Prentice-Hall, 2006.
3. Trifa, V. – Iniţiere în circuite logice cu aplicaţii în OrCAD. Ed. UTPress, Cluj-Napoca, 2005, ISBN 973-662-172-3.
4. Hintea S., Csipkes G., Csipkes D., Faragó P., Cîrlugea M. - Digital Integrated Circuits, Casa Cărţii de Ştiinţă, 2017.

8.2. Seminar /Laboratory/Project	Number of hours	Teaching methods	Notes
A. Seminar		Examples at the blackboard, discussions.	
Number systems and codes	2		
Fundamentals of digital logic technique	2		
Combinational logic circuits and applications I	2		
Combinational logic circuits and applications II	2		
Sequential logic circuits and applications I	2		
Sequential logic circuits and applications II	2		
Sequential logic circuits and applications III	2		
B. Laboratory			
Introduction and presentation of general and specific labor protection rules. Initiation into the simulation environment.	4	Individual work on the computer - simulation using specific software. Practical work on test boards	.
Example of CLC designed using specialized software.	4		
Examples of CLC designed and simulated using specialized software.	4		
Working with PCB Editor - presentation of work stages. Examples.	4		
Examples of SLC designed and simulated using specialized software.	4		
Implementing on solderless breadboard some of the examples of CLC and SCL studied by simulation and comparative analysis of the simulation results with the results obtained from the performed measurements - I.	4		
Implementing on solderless breadboard some of the examples of CLC and SCL studied by simulation and comparative analysis of the simulation results with the results obtained from the performed measurements -II.	4		

Bibliography

1. *** https://www.orcad.com/resources/orcad-tutorials
2. *** OrCAD Flow Tutorial. Product Version 16.2, 2008, Cadence Design Sytems, 2019-2020, San Jose, USA.
3. *** OrCAD Tutorial. Product Version 17.4, oct. 2019, Cadence Design Sytems, 1996-2008, San Jose, USA.

4. https://www.analog.com/en/design-center/design-tools-and-calculators/ltspice-simulator.html
5. KiCAD PCB Editor - https://docs.kicad.org/6.0/en/pcbnew/pcbnew.pdf
6. *** Signetics Digital Circuits. 54/74 Logic Families Catalogue, 1986.

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

The content of the discipline and the specific competencies acquired correspond to the expectations of the companies in which the students carry out internships or are employed.

10. Evaluation

Activity type	10.1 Assessment criteria	10.2 Assessment methods	10.3 Weight in the final grade
10.4 Course	Knowledge of digital systems, methods of analysis and synthesis	Written exam	70%
10.5 Seminar/ Laboratory	**Seminar** - Ability to solve logic circuit problems. **Laboratory** - Ability to use specialized software in the design and implementation of digital electronic circuits.	Individual evaluation during seminar meetings. Individual evaluation during laboratory meetings.	10% 20%
10.6 Minimum standard of performance			
Grade 5 for course (at exam); S(sufficient) grade (E-equivalent ECTS) for laboratory and seminar(Attendance at the seminar and laboratory is mandatory).			

Date of filling in:		**Title Surname Name**	**Signature**
09.2024	Lecturer	Lect. Mărginean Călin	
	Teachers in charge of application	Lect. Mărginean Călin	
		Conf. Bojan Mircea	

Date of approval in the department of Electrical Machines and Drives
September 2024

Head of department
Prof. Eng. MICU Dan Doru, PhD

Date of approval in the faculty of Electrical Engineering
September 2024

Dean
Conf.dr.eng. Andrei CZIKER