SYLLABUS

1. Program Information

1.1 Higher education institution	Technical University of Cluj-Napoca
1.2 Faculty	Faculty of Automation and Computer Science
1.3 Department	Department of Automation
1.4 Field of study	Automation, Applied Informatics and Intelligent Systems
1.5 Cycle of studies	Bachelor
1.6 Study Programme/Qualification	Intelligent Automation Systems (dual, in English language)
1.7 Form of education	IF – full-time education
1.8 Course code	24.00

2. Course information

2.1 Course title				Digital Electronics	
2.2 Course lecturer				*Sl.dr.ing Gabriel Harja - Gabriel.Harja@aut.utcluj.ro*	
2.3 Seminar / Laboratory / Project Lecturer				*Ing. Calin Buhu (Emerson)* *Ing. Catalin Mandrusca (Emerson)*	
2.4 Year of study	2	2.5 Semester	2	2.6 Type of assessment	E
2.7 Course status	Formative category *(DF, DS, DC)*				DF
	Optionality *(DOB, DOP, DFac)*				DOB

3.Total estimated time

3.1 Number of hours per week	4	of which:	HEI	Lecture	2	Seminar	0	Laboratory	0	Project	0
			CO		0		0		2		0
3.2 Number of hours per semester	56	of which:	HEI	Lecture	28	Seminar	0	Laboratory	0	Project	0
			CO		0		0		28		0

3.3 Distribution of time allocation (hours per semester) for:	HEI	CO
(a) Study based on textbook, course support, bibliography, and notes	23	0
(b) Additional documentation in library, specialized electronic platforms, and fieldwork	17	0
(c) Preparation of seminars/laboratories, assignments, papers, portfolios and essays	17	0
(d) Tutoring	6	0
(e) Examinations	6	0
(f) Other activities:	0	0
3.4 Total individual study hours (sum (3.3(a)... 3.3(f)))	69	0
3.5 Total hours per semester (3.2+3.4)	125	0
3.6 Number of credits per semester	5	0

(HEI = Higher Education Institution, CO = Company)

4. Prerequisites (where applicable)

4.1 Curriculum Prerequisites	• Mathematical Analysis, Fundamentals of Electronic Circuits, Computer Programming, Physics (electricity).
4.2 Competency Prerequisites	• Basic electronics circuits, computer operating, differential equations

5. Conditions (where applicable)

5.1. Course Organization Conditions	-
5.2. Seminar / Laboratory / Project organization conditions	• Attendance at the laboratory is mandatory.

6. Specific Competencies Acquired

Professional Competencies	• PC02 Analyze test data • PC08 Design automation components • PC10 Develop electronic test procedures • PC20 Record test data • PC25 Use technical drawing software • PC28 Use testing equipment • PC31 Use remote control equipment
Transversal Competencies	• TC01 Apply knowledge of science, technology and engineering • TC02 Think analitically

7. Learning outcomes

Knowledge:	• Identify and describe the fundamental concepts of digital electronics including number systems, logic gates, and Boolean algebra. Explain the working principles of combinational and sequential circuits. Distinguish between digital logic families (TTL, CMOS) and their characteristics. Understand the role of microcontrollers in digital systems and embedded applications.
Skills:	• Design and implement combinational and sequential circuits using basic gates, ICs, or simulation tools. • Simplify logic expressions using Boolean laws and Karnaugh maps. Construct and test digital subsystems such as adders, counters, registers, and finite state machines.
Responsibility and autonomy:	• Demonstrate responsibility in handling electronic components, observing safety protocols and professional lab practices. Design and present a combinational/sequential logic or a microcontroller-based system, to solve structured, practical problems. Reflect critically on design choices, logic simplification, and circuit performance, proposing improvements.

8. Course Objectives

8.1 General objective of the course	• Knowledge about fundamental concepts of operation of digital circuits, semiconductor memory, and microcontrollers. • Ability to analyze, design and implement digital systems.
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; • Design digital circuits electrical scheme; • Design circuits with microcontrollers.

9. Contents

9.1 Lectures	No. of hours	Teaching methods	Obs.
Introduction to Digital Electronics	2	Slides presentation, explanations and demonstrations	
Number Systems and Codes	2		
Binary arithmetic and Boolean Algebra	2		
Logic Gate Implementation and Minimization	2		

Combinational Logic Circuits	2	on whiteboard, discussions	
Sequential Logic Circuits. Latches and Flip-Flops	2		
Flip-Flops applications: frequency dividers, counters, data registers, converters	2		
Synchronous and Asynchronous Sequential Circuits	2		
Switching regime of semiconductor devices. Integrated logic circuits	2		
Static and dynamic parameters of logic circuits. Digital Logic Families: TTL	2		
Digital Logic Families: CMOS. TTL-CMOS interconnection.	2		
Semiconductor Memory and Storage Elements	2		
Microcontrollers I	2		
Microcontrollers II	2		

Bibliography

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. I. Naşcu (2002): Digital circuits. Editura Mediamira, Cluj Napoca.
5. Dadarlat V., Peculea A.,(2006) Analog and digital circuits. Cluj Napoca
6. I. Ardelean, (1986): CMOS integrated circuits, E.T. Bucuresti.
7. I. Stojanov(1987): From TTL gate to microprocessor. E.T. Bucuresti.
8. David J. Comer, Donald Corner, Fundamentals of Electronic Circuit Design, Wiley, 2003
9. Anant Agarwal, Jefrey H. Lang, Foundations of Analog and Digital Electronic Circuits, Morgan Kaufmann Publishers, 2005

9.2 Seminar / laboratory / project	Hours HEI	Hours CO	Teaching methods	Obs.
Introduction to Digital Laboratory Environment		2	Practical work on test boards, FPGA boards, microcontrollers, specialized software, blackboard presentations, supplemental explanations and discussions	
Introduction to Development Board Hardware		2		
Combinational Logic Circuits 1 – Logic Gates		2		
Combinational Logic Circuits 2 – MUXes, DeMUXes		2		
Combinational Logic Circuits 3 – Complex Circuits		2		
Sequential Logic Circuits 1 – Flip-Flops		2		
Sequential Logic Circuits 2 – Frequency Dividers, Counters		2		
Sequential Logic Circuits 3 – Data Registers, Converters		2		
Synchronous and Asynchronous Sequential Circuits		2		
Measuring Integrated Logic Circuit Parameters		2		
Interfacing Logic Circuit Families		2		
Circuits With Memories		2		
Applications with Microcontrollers 1 – DIOs, Timers		2		
Applications with Microcontrollers 2 – Interrupts, PWM		2		

Bibliography

1. Contemporary Logic Design, Randy H. Katz, Benjamin Cunnings/Addison Wesley Publishing Co., 2005.
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8. David J. Comer, Donald Corner, Fundamentals of Electronic Circuit Design, Wiley, 2003
   Anant Agarwal, Jefrey H. Lang, Foundations of Analog and Digital Electronic Circuits, Morgan Kaufmann Publishers, 2005

10. Correlation of course content with the expectations of the epistemic community representatives, professional associations, and major employers in the field related to the program

The content of the course and laboratory was aligned with representatives from multinational companies from Romania and continuously evaluated by Romanian agencies (CNEAA, ARACIS)

11. Evaluation

Activity Type	**Evaluation criteria**	**Evaluation methods**	**Weight in final grade**
11.1 Lecture	Theory and problems questions	Written exam	70%
11.2 Seminar/ Laboratory/Project	Application and result presenting	Laboratory test / project	30%
11.3 Minimum Performance Standard Participation in the laboratory: 100%; Laboratory test grade ≥ 5; Exam grade ≥ 5;			

Date of completion: 14.05.2025	Lecturers	Title First Name LAST NAME	Signature
	Course	Sl.dr.ing Gabriel Harja	
	Applications		

Date of approval by the Department of Automation Council 24.11.2025 _____ Date of approval by the Faculty of Automation and Computer Science Council 28.11.2025 _____	Director of the Department of Automation Prof.dr.ing. Honoriu VĂLEAN Dean Prof.dr.ing. Vlad MUREȘAN