SYLLABUS

1. Data about the program of study

1.1 Institution	Technical University of Cluj-Napoca
1.2 Faculty	Electronics, Telecommunications and Information Technology
1.3 Department	Applied Electronics
1.4 Field of study	Electronic Engineering and Telecommunications
1.5 Cycle of study	Bachelor of Science
1.6 Program of study/Qualification	Applied electronics/Engineer
1.7 Form of education	IF-Full time
1.8 Subject code	41.00

2. Data about the subject

2.1 Subject name	Microcontrollers						
2.2 Subject area	Theoretical area Methodological area Area of analysis						
2.3 Course responsible/lecturer	Prof. Dorin Petreus, PhD Eng.– Dorin.Petreus@ael.utcluj.ro						
2.4 Teachers in charge of applications	Prof. Dorin Petreus, PhD Eng.– Dorin.Petreus@ael.utcluj.ro Assist. Prof. Eniko Szilagyi, PhD Eng. – Eniko.Lazar@ael.utcluj.ro Assist. Prof. Toma Patarau, PhD Eng. – Toma.Patarau@ael.utcluj.ro Eng. Mirela Olteanu, PhD Stud. – Mirela.Olteanu@ael.utcluj.ro						
2.5 Year of study	III	2.6 Semester	2	2.7 Assessment	E	2.8 Subject category	DD/DI

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 curriculum	56	3.5	of which, course	28	3.6	Applications	28

Individual study	Hours
Manual, lecture material and notes, bibliography	8
Supplementary study in the library, online and in the field	1
Preparation for seminars/laboratory works, homework, reports, portfolios, essays	8
Tutoring	1
Exams and tests	1
Other activities	-

3.7 Total hours of individual study	19
3.8 Total hours per semester	75
3.9 Number of credit points	3

4. Pre-requisites (where appropriate)

4.1 Curriculum	
4.2 Competence	

5. Requirements (where appropriate)

5.1. For the course	Amphitheatre (with blackboard and video projector), Cluj-Napoca
5.2. For the applications	Laboratory, Cluj-Napoca

6. Specific competences

Professional competences	C3 To apply knowledge, concepts and basic methods regarding computing systems' architecture, microprocessors, microcontrollers, programming languages and techniques • C3.1 Description of the operation of a computing system, of the basic principles of the architecture of general-purpose microprocessors and microcontrollers, of the general principles of structured programming • C3.2 Use of general-purpose programming languages and of those specific to microprocessor and microcontroller applications; explaining the operation of automatic control systems that use these architectures and interpreting the experimental results • C3.3 Solving concrete practical problems including elements of data structures and algorithms, programming and use of microprocessors/microcontrollers • C3.4 Elaboration of programs in a general-purpose and / or specific programming language, starting from the specification of the requirements until the execution, debugging and interpretation of the results in correlation with the used processor • C3.5 Projects involving hardware (processors) and software (programming) components C4 To design and use low complexity hardware and software applications, specific to Applied Electronics • C4.5 Design of dedicated equipment from the fields of applied electronics, which use: microcontrollers, programmable circuits or computing systems with simple architecture, including related programs C5. To apply knowledge, concepts and basic methods from power electronics, automated systems, electric energy management, electromagnetic compatibility • C5.1 Defining the specific elements that individualize the electronic devices and circuits in the fields of: power electronics, automated systems, electricity management, medical electronics, automotive electronics, consumer goods • C5.2 Qualitative and quantitative interpretation of the functioning of circuits in the fields of: power electronics, automatic systems, electricity management, medical electronics, automotive electronics, consumer goods; operation regarding electromagnetic compatibility • C5.5 Designing, using established principles and methods of subsystems of reduced complexity, from the fields of applied electronics: power electronics, automated systems, electricity management, medical electronics, auto electronics, consumer goods
Cross competences	N.A.

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

7.1 General objectives	Developing the competences regarding the use, analysis and design of systems with microcontrollers
7.2 Specific objectives	1. Assimilation of theoretical knowledge regarding the simulation of electronic circuits with microcontrollers 2. Obtaining the skills to use the simulation programs of the electronic circuits with microcontrollers 3. Obtaining the skills to use the specific equipment of the electronic circuits with microcontrollers

8. Contents

8.1 Lecture (syllabus)	Teaching methods	Notes
1. Introduction. Microprocessors and Microcontrollers	Presentation, heuristic conversation, exemplification, problems presentation, teaching exercise,	Use of .ppt presentation, projector, blackboard
2. 8051 Microcontroller Hardware • General description • Internal memory • Stack;		
3. Programming uC8051• Assembler •Assembly directives;		
4. uC8051 instruction set • Addressing modes • Data transfer instructions;		
5. Modular programming;		
6. Logical instructions • Logical operations at byte level • Logical operations at bit level • Arithmetic operations • Incrementing, Decrementing • Summation, extract, multiply, divide;		
7. Input/ Output Pins, Ports, and Circuits • Description;		
8. Timers and Counters • Functioning modes;		
9. Programming microcontrollers in C language;		
10. Serial port • Serial port interrupts • Operation modes of the serial port;		
11. Interrupts • Description • Types of interrupts • Interrupts control • Interrupts validation • Interrupts priority;		
12. Converters A/D, D/A • PWM Generators;		
13. Jump and call opcodes • Conditional and unconditional jumps•		
14. Jump and call opcodes • Conditional and unconditional jumps•		
Bibliografy 1. D. Petreuș, E. Szilágyi, R. Etz, T. Pătărău, "Microcontrolere – Aplicații", Editura U.T. PRESS, ISBN: 978-606-737-495-7, Cluj-Napoca, 2021 2. D. Petreuş, G. Munteanu, Z. Juhos, N. Palaghiţă, “Aplicaţii cu microcontrolere din familia 8051”, Editura Mediamira, Cluj-Napoca, 2005 ***On-line references*** www.intel.com, www.philips.com, www.microchip.com;		
8.2 Applications (seminar / laboratory / project)	Teaching methods	Notes
1. Lab instrumentation • Introduction • Introduction to Keil uVision IDE	Apolications (Simulation, Eperimental Measurments), blackboard	Use of laboratory instrumentation, experimental and evaluation boards, computers,
2. RAM memory testing		
3. Soft delay subroutine • Introduction to Proteus;		
4. Working with data tables;		
5. Modular programming;		
6. Logical and arithmetic operations;		

7. Ports;		
8. Hard delay subroutine;		
9. Keyboard types used in microcontroller systems • Subroutines used to command the keyboards;		
10. Serial port • Serial interface • Working principles;		
11. Interrupts;		
12. Displays used in microcontroller systems • Subroutines used to command the displays;		
13. External signals processing;		
14. Lab recovery.		

Bibliografy

1. D. Petreuș, E. Szilágyi, R. Etz, T. Pătărău, "Microcontrolere – Aplicații", Editura U.T. PRESS, ISBN: 978-606-737-495-7, Cluj-Napoca, 2021
2. D. Petreuş, G. Munteanu, Z. Juhos, N. Palaghiţă, "Aplicaţii cu microcontrolere din familia 8051", Editura Mediamira, Cluj-Napoca, 2005

On-line references

www.intel.com, www.philips.com, www.microchip.com;

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

The discipline content and the acquired skills are in agreement with the expectations of the professional organizations and the employers in the field, where the students carry out the internship stages and/or occupy a job (in the field of applied electronics), and the expectations of the national organization for quality assurance (ARACIS).

10. Evaluations

Activity type	10.1 Assessment criteria	10.2 Assessment methods	10.3 Assessment methods
10.4 Course	The level of knowledge obtained	Summative evaluation written exam	Verification (V: 0…10 points);
10.5 Seminar/Laboratory	The level of acquired abilities	Continuous formative evaluation	L (0..10 points)
10.6 Minimum standard of performance			

Qualitative level:

Minimum knowledge:

- ✓ Knowledge of the basic operation of the studied microcontroller
- ✓ Knowledge of the basic peripherals of a microcontroller
- ✓ Knowledge of the basic programing languages to program microcontrollers (C and assembly)

Minimum competences:

- ✓ To be able to describe the functionality of the microcontroller studied
- ✓ To be able to write a simple program used in microcontroller applications

Quantitative level:

- ✓ Participation to all applications and laboratories
- ✓ The final exam and laboratory grades to be higher than 5
- ✓ The final grade is calculated as follows: M = 0.6E + 0.4L. Condition: E≥5 si L≥5

Date of filling in:	Holders	Title Name	Signitures
24.06.2024	Course responsible	Prof. Dorin Petreus, PhD Eng.	
	Teachers in charge of applications	Assist. Prof. Toma Patarau, PhD Eng.	
		Assist. Prof. Eniko Szilagyi (Lazar), PhD Eng.	
		Asist. Eng. Olteanu Mirela, PhD Stud.	

Date of approval in the Department of Applied Electronics

28.06.2024

Head of Department
Prof. Dorin PETREUS, PhD Eng.

Date of approval in the Council of Faculty of Electronics, Telecommunications and Information Technology

11.07.2024

Dean
Prof. Ovidiu Aurel POP, PhD Eng.