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 System Cluj-Napoca in English language
1.7	Form of education	Full time
1.8	Subject code	43.00

2. Data about the subject

2.1	Subject name			Microprocessor based systems			
2.2	Course responsible/lecturer			Assoc. Prof. Eng. Ioana-Cornelia Gros, PhD			
2.3	Teachers in charge of seminars			Asist. Eng. Lucian-Nicolae Pintilie, PhD			
2.4 Year of study	IV	2.5 Semester	8	2.6 Type of assessment	Exam		
2.7 Subject category	Formative category						DID
	Optionality						

3. Estimated total time

3.1 Number of hours per week	4	of which	3.2 Course	2	3.3 Seminar	-	3.3 Laboratory	2	3.3 Project	-
3.4 Total hours in the curriculum	56	of which	3.5 Course	28	3.6 Seminar	-	3.6 Laboratory	28	3.6 Project	-

3.7 Individual study:	
(a) Manual, lecture material and notes, bibliography	25
(b) Supplementary study in the library, online and in the field	8
(c) Preparation for seminars/laboratory works, homework, reports, portfolios, essays	8
(d) Tutoring	1
(e) Exams and tests	2
(f) Other activities	0

3.8 Total hours of individual study (summ (3.7(a)…3.7(f)))	44
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	Computer Programming, Electronics, Digital Systems

5. Requirements (where appropriate)

5.1	For the course	
5.2	For the applications Laboratory	mandatory presence

6. Specific competences

Professional competence	Operating with fundamental concepts in computer science and information technology. Analysis, modelling and simulation of electrical systems
Cross competences	-to develop learning techniques through individual study; -to efficiently use the sources of information and communication; -to be able to integrate in a work team

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

7.1	General objective	To use of computer systems in the design, experimentation and operation of electrical engineering equipment.
7.2	Specific objectives	Coherent study of microprocessor computing systems, with the aim of acquiring detailed knowledge in: -digital computer architecture ; -computer programming; -design and programming and computing systems in digital process control.

8. Contents

8.1. Lecture (syllabus)	Number of hours	Teaching methods	Notes
Microprocessor system architectures. Instruction execution. Harvard vs Von Neumann architecture. RISC vs CISC	2	Speech and discussions/presentations	
Embedded systems in electrical engineering. Categories of microprocessor systems. Description and applications	2		
AVR microcontroller family. Architecture and programming mode. ATMEGA 328p microcontroller	2		
AVR family: Registers, addressing modes, assembly language programming. Examples.	2		
Programming I/O ports in the AVR family.	2		
Programming the serial port. I2C and SPI protocols.	2		
Computer system architecture – evolution, basic functions, general structure of a microprocessor, bus concept, memories. INTEL 8086 family	2		
INTEL 8086 family – architecture, registers, memory organization, addressing modes, programming mode	2		
INTEL 8086 family – Multiplexed bus operation. Minimum and maximum mode of operation.	2		

Intel 8086 Family - Interrupt System	2		
ARM Architectures. Classification. Applications in Electrical Engineering	2		
ARM Architecture. Operating Modes. Register Organization. Instruction Set.	2		
ARM Architecture – Example STM32 in Real-Time Applications.	2		
Recap	2		

Bibliography

[1] Barry B. Brey, The INTEL microprocessors (8086/8088, 80186/80188, 80286, 80386, 80486, Pentium, Pentium Pro Processor, Pentium II, Pentium III, Pentium 4, and Core2 with 64-Bit Extensions) Architecture, Programming, and Interfacing, Eighth Edition, 2013.

[2] L. Kreindler, R. Giuclea – „Bazele microprocesoarelor", Editura Matrix Tom, Bucuresti 1998.

[3] Intel 80286 Programmer's Reference Manual, Intel Corp USA 1988.

[4] D. Rotar, M.Anghelut „Arhitectura sistemelor de calcul", on-line document .

[5] V. Ivanov, Sisteme cu microprocesoare–on-line document.

[6] Ioana Gros, L. Pintile, T.Pană, Sisteme embedded în inginerie electrică – ghid de aplicații https://biblioteca.utcluj.ro/files/carti-online-cu-coperta/431-5.pdf.

[7] Alte resurse web

8.2. Laboratory	Number of hours	Teaching methods	Notes
1. Introduction to embedded systems theory (mainly based on AVR MCU architecture)	4	Projections Implementation on microcontrollers	
2. Introductions to Wiring and C / C++ based programming languages and digital signal processing (mainly based on GPIO manipulation methods on AVR MCU architecture)	4		
3. Analog signal processing methods based on the AVR MCU architecture	4		
4. General human – machine interfacing applications based on AVR MCU architecture	4		
5. Hard-wired low-level communication protocols	4		
6. Matlab – Simulink and the AVR architecture	4		
7. Short overview of Linux / Unix, Python and NodeRed applications based on ARM architecture.	4		

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

The acquired competencies are necessary for positions in the domain of embedded systems, automation, design and programming of control circuits.

10. Evaluation

Activity type	10.1 Assessment criteria	10.2 Assessment methods	10.3 Weight in the final grade

10.4 Course	Answer to a set of questions, comprising both theoretical aspects and practical implementations exercises (	Written exam – 1 hour	60%
10.5 Laboratory	Solving a high degree of complexity homework	Practical exam – 20 min	40%
10.6 Minimum standard of performance			
Fulfilling the laboratory assignments and to provide correct answers to a percent of the questions.			

Date of filling in: 14.08.2024		**Title Surname Name**	**Signature**
	Lecturer	Assoc. Prof. Eng. Ioana-Cornelia Gros, PhD	
	Teachers in charge of application	Asist. Eng. Lucian-Nicolae Pintilie, PhD	

Date of approval in the ETHM Department Council

September 2024

Head of Department:
Prof. Eng. MICU Dan Doru, PhD

Date of approval in the Faculty of Electrical Engineering Council

September 2024

Dean:
Assoc. Prof. Eng. CZIKER Andrei, PhD