SYLLABUS

1. Data about the program of study

1.1 Institution	Technical University of Cluj-Napoca
1.2 Faculty	Faculty of Electronics, Telecommunications and information Technology
1.3 Department	Communications
1.4 Field of study	Electronic Engineering, Telecommunications and Information Technologies
1.5 Cycle of study	Bachelor of Science
1.6 Program of study / Qualification	Telecommunications Technologies and Systems/ Engineer Applied Electronics/Engineer
1.7 Form of education	Full time
1.8 Subject code	TST-E37.00/EA-E37.00

2. Data about the subject

2.1 Subject name	Microprocessors Based Systems						
2.2 Subject area	Theoretical area Methodological area Analytic area						
2.3 Course responsible	Professor Eugen LUPU, Ph.D. - eugen.lupu@com.utcluj.ro						
2.4 Teacher in charge with seminar / laboratory / project	Assoc. Prof. Anca APATEAN, Ph.D. - anca.apatean@com.utcluj.ro						
2.5 Year of study	III	2.6 Semester	6	2.7 Assessment	E	2.8 Subject category	DD/DI

3. Estimated total time

3.1 Number of hours per week	4	of which: 3.2 course	2	3.3 seminar / laboratory	2
3.4 To Total hours in the curriculum	56	of which: 3.5 course	28	3.6 seminar / laboratory	28

Distribution of time	hours
Manual, lecture material and notes, bibliography	14
Supplementary study in the library, online specialized platforms and in the field	10
Preparation for seminars / laboratories, homework, reports, portfolios and essays	14
Tutoring	3
Exams and tests	3
Other activities:	

3.7 Total hours of individual study	44
3.8 Total hours per semester	100
3.9 Number of credit points	4

4. Pre-requisites (where appropriate)

4.1 curriculum	Basics on computers and microprocessors, digital integrated circuits, Boolean algebra, digital integrated circuit design, synthesis of logic functions
4.2 competence	programming skills: x86 assembly language, C

5. Requirements (where appropriate)

5.1. for the course	Cluj-Napoca
5.2. for the seminars / laboratories / projects	Cluj-Napoca

6. Specific competences

Professional competences	C3. Application of the basic knowledge, concepts and methods regarding the architecture of computer systems, microprocessors, microcontrollers, languages and programming techniques C4. Design, implementation and operation of data, voice, video and multimedia services. This is based on the understanding and the application of fundamental concepts in telecommunications and transmission of information C5. Selecting, installing, configuring and operating fixed or mobile telecommunications equipment. Equipping a site with usual telecommunications networks
Transversal competences	N/A

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

7.1 General objective	Developing the competences regarding the use of microprocessors, microcontrollers and interfaces in microsystems and computers
7.2 Specific objectives	1. Understanding of main architectures in data processing 2. Understanding basic microprocessors concepts and programming using Intel x86 as reference 3. Interfaces, buses and programmable devices study and use 4. To assess the requirements of a microprocessor / microcontroller for a specific application 5. To develop applications using PC resources and ESP8266 microcontrollers

8. Contents

8.1 Lecture (syllabus)	Teaching methods	Notes
Course description. Evaluation mode. 1. Pentium Processors. Architecture. Registers. Pipeline. Cache memory. Floating Point Unit. Branch prediction. New generation of Pentium. Multicore architectures.	Presentation,heuristic conversation, xemplification, problem presentation, teaching exercise, case study, formative evaluation	Use of .pptx presentation, projector, blackboard
2. PC memory. The memory map (main memory, video, UMA, HMA). Memory extended and expanded. Virtual memory. Connecting additional memory to the PC memory map.		
3. Memory Hierarchy in terms of technology. The cache role. The basic models of the cache. Cache Memory Architectures. The Pentium cache.		
4. The 80x86 programmable interfaces family. Presentation of the timer I8254. Architecture. Pins and signals. The timer programming. Employment of the timer in the PC. Examples of use.		
5. Classification of interrupts. PIC I8259A circuit architecture.PIC pins and signals. Programming of the PIC. Interrupts assignment		

in PC.		
6. Direct memory access basics. The DMA controller I8237A.The internal architecture. Pins and signals. I8237A programming.		
7. Serial Communications RS232. UART/USART. The I16550 device architecture. Programming. Applications.		
8. Serial interfaces. I2C, SPI, I2S Use and applications.		
9. Buses in the PC (ISA, PCI, AGP). ISA bus signals. Development of the ISA bus compliant cards.		
10. PCI Bus overview. Architecture and signals. Transfer modes		
11. PCI express overview. PCI Express bus topology, architecture, layers, transactions.		
12. USB Bus overview. USB On the Go. USB 3.0.		
13. ESP8266 microcontroller. Architecture.		
14. Applications. Review-exam topics.		

References.

1. E. Lupu, A. Mesaros, A.F. Suciu, MICROPROCESSORS Architectures and Applications Ed. RISOPRINT Cluj-Napoca 2002, ISBN 973-656-392-8
2. E. Lupu, Sisteme cu microprocesoare. Resurse hardware. Prezentare, programare şi aplicaţii. Ed. Albast Cluj Napoca 2004, ISBN 973-650-109-4
3. M. Tischer, B. Jenneric, "LA BIBLE PC" PROGRAMMATION SYSTEME. MICRO Application 2000
4. W. Buchanan, *PC interfacing,Communications and Windows Programing* Addison Wesley 2002
5. N. Mathivanan, Microprocessors, PC Hardware and Interfacing PHI Learning Pvt. Ltd., 2003
6. *www.pcguide.com, www.intel.com* ,…..
7. [***]*Microprocessors Reference Manual*, Intel Corporation, 2004, www.intel.com
8. Lecture Slides : https://elupu.utcluj.ro/

8.2 Laboratory	Teaching methods	Notes
1. Introduction. Laboratory Objectives topic.	Didactic and experimental proof, didactic exercise, team work	Use of laboratory instrumentation, experimental boards, computers, magnetic board
2. Identifying processors in PCs. Microprocessors resources determination employing CPUID instruction.		
3. The Cache memory. Application using CPUID instruction.		
4. The timer circuit 8254. Applications. Audio signals generation.		
5. Programmable Interrupt Controller -I8259A. Applications.		
6. 8237A DMA controller programming. DMA data transfer to PC in the video memory.		
7. The UART 16650 interface. Serial communication applications.		
8. LCD interfacing on SPP.		
9. USB Bus. Design USB devices using USB-serial converters FT232.		
10. Basic applications on ESP8266 platform. Arduino IDE.		
11. ADC applications on ESP8266 board.		
12. SPI interface on ESP8266 board.		
13. I2C application on ESP8266.		
14. Lab. recovery and laboratory activity evaluation		

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 Competences acquired will be used in the following COR occupations (Electronics Engineer; Telecommunications Engineer; Electronics Design Engineer; System and Computer Design Engineer; Communications Design Engineer) or in the new occupations proposed to be included in COR (Sale Support Engineer; Multimedia Applications Developer; Network Engineer; Communications Systems Test Engineer; Project Manager; Traffic Engineer; Communications Systems Consultant).

10. Evaluation

Activity type	10.1 Assessment criteria	10.2 Assessment methods	10.3 Weight in the final grade
10.4 Course	The level of acquired theoretical knowledge and practical skills	Written exam (theory+ problems)	65%
10.5 Laboratory	The level of acquired knowledge and abilities	Laboratory tests (3-4)	35%

10.6 Minimum standard of performance

Qualitative level:

Minimal knowledges:

- ✓ *Knowledge of Intel processors architecture*
- ✓ *Knowledge of main interfaces employed in PC.*
- ✓ *Knowledge of main buses in PC.*

Minimal competences:

- ✓ *To know the main architectural elements of Microprocessors*
- ✓ *To be able to program the main interfaces employed in PC*
- ✓ *To know to use the Arduino IDE tool*

Quantitative level:

- ✓ *Perform all laboratory work*
- ✓ *The exam and laboratory notes must be at least 5.*
- ✓ *The mark for the subject is calculated with the relation: 0.65 * Exam score + 0.35 * Labs score*

Data of filling in:	**Responsible**	**Title First name SURNAME**	**Signature**
20.06.2023	Course	Professor Eugen LUPU, Ph.D.	
	Applications	Assoc. Prof. Anca APATEAN, Ph.D.	

Date of approval in the Council of the Communications Department 11.07.2023	Head of Communications Department Prof. Virgil DOBROTA, Ph.D.
Date of approval in the Council of the Faculty of Electronics, Telecommunications and Information Technology 12.07.2023	Dean Prof. Ovidiu POP, Ph.D.