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-E31.00/EA-E31.00

2. Data about the subject

2.1 Subject name	Microprocessors Architecture						
2.2 Subject area	Theoretical area Methodological area Analytic area						
2.3 Course responsible	Professor Mircea GIURGIU, Ph.D. – Mircea.Giurgiu@com.utcluj.ro						
2.4 Teacher in charge with laboratory	Professor Mircea GIURGIU, Ph.D. – Mircea.Giurgiu@com.utcluj.ro Eng. Alexandra DROBUT, Ph.D. student – Alexandra.Drobut@com.utcluj.ro						
2.5 Year of study	3	2.6 Semester	5	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 laboratory	2
3.4 To Total hours in the curriculum	56	of which: 3.5 course	28	3.6 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	14
Preparation for seminars / laboratories, homework, reports, portfolios and essays	14
Tutoring	14
Exams and tests	5
Other activities: expand the laboratory activities into an individual mini-project	12

3.7 Total hours of individual study	69
3.8 Total hours per semester	125
3.9 Number of credit points	5

4. Pre-requisites (where appropriate)

4.1 curriculum	Digital Integrated Circuits, Computer Programming - Algorithms
4.2 competence	Computer programming (basics), Digital competences

5. Requirements (where appropriate)

5.1. for the course	Lecture room with video-projector
5.2. for the seminars / laboratories / projects	LAN in the lab room with Internet connection, microprocessor simulator, Assembler/Linker, Debugger.

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	To acquire knowledge and skills on the hardware designing and on the development of software applications in assembling language for a microprocessor-based system.
7.2 Specific objectives	1. to classify the microprocessors and to know their architecture and functional description; 2. to apply the instruction set in developing applications that include the use of various addressing modes of memory and peripheral devices 3. to know the interrupt system and to be able to use BIOS/DOS interrupts 4. to know the signals of the microprocessor and its connection in the system 5. to develop applications in assembling language 6. to design a microprocessor-based system by connecting the memory and the peripheral devices 7. to be able to use in real applications specific communications protocols used for data transfer

8. Contents

8.1. Lectures	Teaching methods	Notes
1. Basics of microprocessors: von Neumann model, Harvard model, pipelining, features of microprocessors.	PPT presentations, practical demos, interactive discussions and debates, problem solving.	N/A
2. IA-32 Intel architecture and internal architecture of the I80x86 microprocessors.		
3. Addressing of memory in real mode. Addressing in protected		

mode.		
4. Data transfer and arithmetic instructions. Applications.		
5. Logical instructions and instructions for control flow.		
6. Instructions on strings of bytes and for I/O devices.		
7. Procedures and macros. Development of programs in assembling language.		
8. The interrupt system: the structure of IVT, HW and SW interrupts, changing the IVT, examples.		
9. BIOS & DOS services. TSR programs. Examples: keyboard, video screen, HDD, serial and parallel interface.		
10. Description of the signals for I80x86 and interfacing with external hardware.		
11. Basic bus operations. Connection of the microprocessor in the system.		
12. Principles in designing plugged-in/external I/O hardware interfaces. Designing of the memory blocks.		
13. 80x87 FPU. Functional description, hardware system interface, instruction set.		
14. High speed communication interfaces: SCSI, USB, I2C.		

Bibliography:

1. M Giurgiu, “Microprocessors”, Lectures notes as PPT slides.
2. B. B. Brey, “INTEL Microprocessors 8086/8088, 80186/80188, 80286, 80386, 80486, Pentium, Prentium ProProcessor, Pentium II, III, 4”, ed. 8, Prentice Hall, 2008
3. M.A. Mazidi,S. Naimi, S. Naimi, AVR Microcontroller and Embedded Systems: Using Assembly and C, Prentice Hall, 2010.
4. S Kumar, M. Saravanan, “Microprocessors and interfacing”, Oxford Higher Education Publ, 2012, ISBN-13: 978-0198079064,
5. Serge Liddin – Inside Microsoft .NET Assembler, Redmond - Washinghton, 2003.
6. ***, Microprocessors Reference Manual, Intel Corporation, 2004
7. V. Lungu - Procesoare Intel. Programare in limbaj de asamblare, Ed. Teora, 2000
8. Gh. Musca, Programarea in limbaj de asamblare, Ed. Teora, Bucuresti, 1998

8.2 Laboratory	Teaching methods	Notes
1. Presentation of the laboratory and computing facilities.	Individual hands on activities, experiments, following demos, problem-based learning.	NA
2. Representation of information in microcomputers.		
3. Hands-on microprocessor simulator. Traffic lights controller and other simple applications.		
4. Addressing modes and internal architecture of 80x86. Hands-on Turbo-debugger.		
5. Applications with instructions set (I). Data transfer and arithmetic instructions.		
6. Applications with instructions set (II). Logic instructions and		

instructions for control flow		
7. Applications with instructions on strings of bytes. Procedures and macros		
8. Intermediary evaluation (test)		
9. Development of programs in assembling language. Using INT 10h and INT 21h.		
10. Applications using Program Status Prefix (PSP)		
11. The keyboard programming: installing own interrupt routine. The use of INT 16h. Applications.		
12. Generation of sound signals using 8253.		
13. Implement a real time clock using the 8253 and interrupts.		
14. Synthesis problems, final lab reports.		

Bibliography:

1. M Giurgiu, "Microprocessors", Lectures notes as PPT slides.
2. B. B. Brey, "INTEL Microprocessors 8086/8088, 80186/80188, 80286, 80386, 80486, Pentium, Prentium ProProcessor, Pentium II, III, 4", ed. 8, Prentice Hall, 2008
3. M.A. Mazidi,S. Naimi, S. Naimi, AVR Microcontroller and Embedded Systems: Using Assembly and C, Prentice Hall, 2010.
4. S Kumar, M. Saravanan, "Microprocessors and interfacing", Oxford Higher Education Publ, 2012, ISBN-13: 978-0198079064,
5. Serge Liddin – Inside Microsoft .NET Assembler, Redmond - Washinghton, 2003.
6. ***, Microprocessors Reference Manual, Intel Corporation, 2004

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	Final written examination: knowledge and problem solving skills (50 %).	50%
10.5 Laboratory	The level of acquired knowledge and abilities	2 laboratory tests (15%) Mid-term assessment on problem solving (20%) Final practical work assessment (15%)	50%

10.6 Minimum standard of performance
Hardware designing and development of software applications in assembling language for a microprocessor-based system.

Data of filling in:	**Responsible**	**Title First name SURNAME**	**Signature**
20.06.2023	Course	Professor Mircea GIURGIU Ph.D.	
	Applications	Professor Mircea GIURGIU Ph.D.	
		Eng. Alexandra DROBUT, Ph.D. student	

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.