SYLLABUS

1. Program information

1.1 Higher education 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 Study program / Qualification	Telecommunications Technologies and Systems/ Engineer
1.7 Form of education	IF – full-time education

2. Course information

2.1 Course title	Microprocessors Architecture				Course code		TST-E31.00
2.2 Course coordinator	*Professor Mircea GIURGIU, Ph.D. - Mircea.Giurgiu@com.utcluj.ro*						
2.3 Seminar/ laboratory/ project/ practical activity coordinator	*Professor Mircea GIURGIU, Ph.D. - Mircea.Giurgiu@com.utcluj.ro, Ioana-Maeva CARBUNESCU-STOENESCU Ph.D. student - Ioana.Carbunescu@campus.utcluj.ro*						
2.4 Year of study	3	2.5 Semester	5	2.6 Type of assessment			E
2.7 Course status	Formative category						DF
	Optionality						DOB

3. Estimated total time

3.1 Hours per week	4	of which:	3.2 Lecture	2	3.3 Seminar		3.3 Laboratory	2	3.3 Project	-	3.3 Practical training	-
3.4 Hours per semester	56	of which:	3.5 Lecture	28	3.6 Seminar		3.6 Laboratory	28	3.6 Project	-	3.3 Practical training	-

3.7 Time distribution (hours per semester) for individual study and assessment:	
(a) Assessment	5
(b) Study using textbook, course materials, bibliography, and notes	14
(c) Additional documentation in the library, on specialized electronic platforms, and in the field	14
(d) Preparation for seminars/laboratories, assignments, reports, portfolios and essays	14
(e) Tutoring	14
(f) Other activities	8

3.8 Total hours of individual study and assessment (sum of (3.7(a)...3.7(f))	69
3.9 Total hours per semester (3.4+3.8)	125
3.10 Number of credits	5

4. Prerequisites (where applicable)

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

5. Requirements (where applicable)

5.1. for the development of the lecture	Cluj-Napoca, Lecture room with video-projector
5.2. for the development of the seminar/ laboratory/ project	Cluj-Napoca, LAN in the lab room with Internet connection, microprocessor simulator, Assembler/Linker, Debugger.

6. Specific competencies acquired

Professional competencies	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 competencie	N/A

7. Expected learning outcomes

Knowledge	**K4.** The student/ graduate describes, identifies, summarizes concepts and elementary methods of signal acquisition, analysis and processing, implemented in systems with general-purpose processors or signal processors and their application in concrete problems **K5.** The student/graduate describes, identifies, summarizes elementary concepts and methods regarding the architecture of computer systems, microcontrollers, programming languages and techniques and their application in concrete problems
Skills	**S16.** The student/ graduate designs functional blocks of low/medium complexity for digital signal analysis and processing and implements them on signal processors, microcontrollers or dedicated processors. **S17.** The student/graduate evaluates, based on specific performance criteria, the type of computing system, its architecture and the way of use necessary for an efficient solution of concrete problems. **S18.** The student/graduate specifies requirements, develops programs in general-purpose programming languages (C, etc.) and/or object-oriented (C++, Java, etc.), executes, debugs and interprets the results of the programs developed to solve a concrete problem. **S19.** Modify the scope of an information and communications technology (ICT) system by adding or reallocating additional ICT system components, such as network components, servers, or storage media to meet capacity demands.

Responsibility and autonomy	**R9.** The student/ graduate demonstrates initiative and takes action to update their professional, economic, and organizational culture knowledge. **R10.** The student/ graduate has honorable, responsible, and ethical behavior, in accordance with the law to ensure the reputation of the profession.

8. Course objectives (based on the grid of specific competencies acquired)

8.1 General objective of the course	To acquire knowledge and skills on the hardware designing and on the development of software applications in assembling language for a microprocessor-based system.
8.2 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 memory and peripheral devices 7. To be able to use in real applications specific communications protocols used for data transfer

9. Contents

9.1 Lecture	**No. of hours**	**Teaching methods**	**Remarks**
1. Basics of microprocessors: von Neumann model, Harvard model, pipelining, features of microprocessors.	2	Presentation, heuristic conversation, exemplification, problem presentation, teaching exercise, case study, formative evaluation	Use of .ppt presentation, projector, whiteboard
2. IA-32 Intel architecture and internal architecture of the I80x86 microprocessors.	2		
3. Addressing of memory in real mode. Addressing in protected mode.	2		
4. Data transfer and arithmetic instructions. Applications.	2		
5. Logical instructions and instructions for control flow.	2		
6. Instructions on strings of bytes and for I/O devices.	2		
7. Procedures and macros. Development of programs in assembling language.	2		
8. The interrupt system: the structure of IVT, HW and SW interrupts, changing the IVT, examples.	2		
9. BIOS & DOS services. TSR programs. Examples: keyboard, video-screen, HDD, serial and parallel interface.	2		

9.1 Lecture	No. of hours	Teaching methods	Remarks
10. Description of the signals for I80x86 and interfacing with external hardware.	2		
11. Basic bus operations. Connection of the microprocessor in the system.	2		
12. Principles in designing plugged-in/external I/O hardware interfaces. Designing memory blocks.	2		
13. 80x87 FPU. Functional description, hardware system interface, instruction set.	2		
14. High speed communication interfaces: SCSI, USB, I2C.	2		

Bibliography:

1. M. Giurgiu, *Microprocessors, Lectures notes as PPT slides*. Technical University of Cluj-Napodca, 2026
2. B.B. Brey, *The Intel Microprocessors: 8086/8088, 80186/80188, 80286, 80386, 80486, Pentium, Pentium Pro Processor, Pentium II, Pentium III, and Pentium 4*, 8th Edition, Prentice Hall, 2016.
3. M.A. Mazidi, S. Naimi, *AVR Microcontroller and Embedded Systems: Using Assembly and C, Second Edition*. Prentice Hall, 2017.
4. S. Kumar, M. Saravanan, *Microprocessors and Interfacing*, Oxford Higher Education Publ, 2012, ISBN-13: 978-0198079064.
5. S. Liddin, *Inside Microsoft .NET Assembler*, Redmond - Washinghton, 2014.
6. ***, *Microprocessors Reference Manual*, Intel Corporation, 2026
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

9.2 Laboratory	No. of hours	Teaching methods	Remarks
1. Presentation of the laboratory and computing facilities.	2	Individual hands-on activities, experiments, following demos, problem-based learning.	NA
2. Representation of information in microcomputers.	2		
3. Hands-on microprocessor simulator. Traffic lights controller and other simple applications.	2		
4. Addressing modes and internal architecture of 80x86. Hands-on Turbo-debugger.	2		
5. Applications with instructions set (I). Data transfer and arithmetic instructions.	2		
6. Applications with instructions set (II). Logic instructions and instructions for control flow	2		
7. Applications with instructions on strings of bytes. Procedures and macros	2		
8. Intermediary evaluation (test)	2		
9. Development of programs in assembling language. Using INT 10h and INT 21h.	2		
10. Applications using Program Status Prefix (PSP)	2		

9.2 Laboratory	No. of hours	Teaching methods	Remarks
11. The keyboard programming: installing own interrupt routine. The use of INT 16h. Applications.	2		
12. Generation of sound signals using 8253.	2		
13. Implement a real time clock using the 8253 and interrupts.	2		
14. Synthesis problems, final lab reports.	2		

References:

1. M. Giurgiu, *Microprocessors, Lectures notes as PPT slides*. Technical University of Cluj-Napodca, 2026
2. B.B. Brey, *The Intel Microprocessors: 8086/8088, 80186/80188, 80286, 80386, 80486, Pentium, Pentium Pro Processor, Pentium II, Pentium III, and Pentium 4*, 8th Edition, Prentice Hall, 2016.
3. M.A. Mazidi, S. Naimi, *AVR Microcontroller and Embedded Systems: Using Assembly and C, Second Edition*. Prentice Hall, 2017.
4. S. Kumar, M. Saravanan, *Microprocessors and Interfacing*, Oxford Higher Education Publ, 2012, ISBN-13: 978-0198079064.
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8. Gh. Musca, *Programarea in limbaj de asamblare*, Ed. Teora, Bucuresti, 1998

10. Alignment of the course contents with the expectations of the epistemic community, professional associations, and representative employers in the field related to the program

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).

11. Assessment

Activity type	11.1 Assessment criteria	11.2 Assessment methods and type of assessment: continuous/ summative)	11.3 Weight in 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%

11.6 Minimum performance standard

Qualitative level

Minimum knowledge:

- ✓ to know different types of microprocessor architectures and their internal organisation

- ✓ to know the addressing modes
- ✓ to know the instruction set and development of programs in assembling language
- ✓ to know the signals and the connections of the input/output ports and memory blocks

Minimum competences:

- ✓ to be able to handle different addressing modes in small programs
- ✓ to design data processing algorithms and to implement them in assembling language
- ✓ to use the interrupt services in different applications for data processing
- ✓ to be able to design the electrical schemes to connect a microprocessor with the I/O devices and to design the corresponding memory blocks

Quantitative level:

- ✓ To properly execute the laboratory activities
- ✓ To pass the laboratory tests and the mid-term evaluation
- ✓ Overall mark is calculated as: 0,5 * Laboratory + 0,5 * FinalExam

Completion date:	**Course coordinators**	**teaching rank, title First name LAST NAME**	**Signature**
16.06.2026	Lecture	*Professor Mircea GIURGIU, Ph.D. - Mircea.Giurgiu@com.utcluj.ro*	
	Applications	*Professor Mircea GIURGIU, Ph.D. - Mircea.Giurgiu@com.utcluj.ro*	
		Ioana-Maeva CARBUNESCU-STOENESCU Ph.D. student - Ioana.Carbunescu@campus.utcluj.ro	

Approval of the Head of the Department coordinating the course, only if this differs from the department organizing the study program	Head of Department

Date of approval by the Council of the Communications Department 19.06.2026	Head of Communications Department Prof. Virgil DOBROTA, Ph.D.
Date of approval by the Council of the Faculty of Electronics, Telecommunications and Information Technology 30.06.2026	Dean, Prof. Ovidiu-Aurel POP, Ph.D.