Universitatea Naţională de Ştiinţă şi Tehnologie Politehnica Bucureşti
Facultatea de Electronică, Telecomunicaţii şi
Tehnologia Informaţiei

COURSE DESCRIPTION

1. Program identification information

1.1 Higher education institution	**National University of Science and Technology Politehnica Bucharest**
1.2 Faculty	**Electronics, Telecommunications and Information Technology**
1.3 Department	**Electronic Devices, Circuits and Architectures**
1.4 Domain of studies	Electronic Engineering, Telecommunications and Information Technology
1.5 Cycle of studies	Bachelor/Undergraduate
1.6 Programme of studies	Microelectronics, Optoelectronics and Nanotechnologies

2. Date despre disciplină

2.1 Course name (ro) (en)				Arhitectura microprocesoarelor 1 Microprocessor Architecture 1			
2.2 Course Lecturer				Prof. Dr. Sorin Zoican			
2.3 Instructor for practical activities				Prof. Dr. Sorin Zoican			
2.4 Year of studies	2	2.5 Semester	1	2.6. Evaluation type	E	2.7 Course regime	Ob
2.8 Course type		D	2.9 Course code	04.D.03.O.003		2.10 Tipul de notare	Nota

3. Total estimated time (hours per semester for academic activities)

3.1 Number of hours per week	3.5	Out of which: 3.2 course	2	3.3 seminary/laboratory	1.5
3.4 Total hours in the curricula	49	Out of which: 3.5 course	28	3.6 seminary/laboratory	21
Distribution of time:					hours
Study according to the manual, course support, bibliography and hand notes Supplemental documentation (library, electronic access resources, in the field, etc) Preparation for practical activities, homework, essays, portfolios, etc.					45
Tutoring					0
Examinations					6
Other activities (if any):					0

3.7 Total hours of individual study	51.00
3.8 Total hours per semester	100
3.9 Number of ECTS credit points	4

4. Prerequisites (if applicable) (where applicable)

4.1 Curriculum	• Computer Programming and Programming Languages 1 • Computer Programming and Programming Languages 2
4.2 Results of learning	Applying knowledge about the basic concepts and methods of programming languages and techniques

5. Necessary conditions for the optimal development of teaching activities (where applicable)

5.1 Course	The course will take place in a room equipped with a video projector and a computer.
5.2 Seminary/ Laboratory/Project	The laboratory will take place in a room with specific equipment, which must include: computers and installed software: Emu 8086, Proteus

6. General objective *(Reffering to the teachers' intentions for students and to what the students will be thought during the course. It offers an idea on the position of course in the scientific domain, as well as the role it has for the study programme. The course topics, the justification of including the course in the currcula of the study programme, etc. will be described in a general manner)*

This subject is studied within the field of Electronic Engineering, Telecommunications and Information Technology / specialization Telecommunications Networks and Software and aims to familiarize students with the main approaches, models, and explanatory theories of the field, used in solving practical applications and problems, with relevance for stimulating the learning process of students.
The subject specifically covers basic/advanced notions, concepts, and principles in the field of microprocessor architectures (microprocessor components and their interaction), assembly programming languages, and the design of a microprocessor-based system from both hardware and software perspectives —all of which contribute to providing students with an overview of the methodological and procedural benchmarks of the field.

7. Competences *(Proven capacity to use knowledge, aptitudes and personal, social and/or methodological abilities in work or study situations and for personal and proffesional growth. They refflect the empolyers requirements.)*

Specific Competences	Demonstrates possession of basic/advanced knowledge in the field of Electronic Engineering, Telecommunications and Information Technology Correlates knowledge from various areas (electronic circuits, programming) to solve problems using a microprocessor-based system. Applies in practice the knowledge of algorithmization and programming languages by creating assembly language programs with all necessary stages: formal description, code writing, testing, and debugging. Applies standardized methods and tools specific to the field to carry out the evaluation and diagnosis process of a situation, according to the problems identified/reported, and identifies solutions. Argues and analyzes coherently and correctly the context for applying the domain’s fundamental knowledge, using key concepts of the subject and specific methodology. Oral and written communication in Romanian: uses the scientific vocabulary specific to the field for effective written and oral communication.

Transversal (General) Competences	Works in a team and communicates effectively, coordinating efforts with others to solve medium-complexity problem situations. Autonomy and critical thinking: the ability to think in scientific terms, to search for and analyze data independently, as well as to draw and present conclusions / identify solutions. Capacity for analysis and synthesis: presents the acquired knowledge in a synthetic manner, as a result of a systematic analysis process. Respects the principles of academic ethics: correctly cites the bibliographic sources used during documentation. Puts into practice elements of emotional intelligence in the appropriate socio-emotional management of situations from real/academic/professional life, demonstrating self-control and objectivity in decision-making or in stressful situations.

8. Learning outcomes *(Synthetic descriptions for what a student will be capable of doing or showing at the completion of a course. The learning outcomes reflect the student's acomplishments and to a lesser extent the teachers' intentions. The learning outcomes inform the students of what is expected from them with respect to performance and to obtain the desired grades and ECTS points. They are defined in concise terms, using verbs similar to the examples below and indicate what will be required for evaluation. The learning outcomes will be formulated so that the correlation with the competences defined in section 7 is highlighted.)*

Knowledge	*The result of knowledge aquisition through learning. The knowledge represents the totality of facts, priciples, theories and practices for a given work or study field. They can be theoretical and/or factual.* Developing the skills to apply general knowledge of microprocessor architectural attributes to various projects and implementing them at hardware and software level. Ability to evaluate, based on learned performance criteria, which processor and in what manner it can be used for the efficient solution of concrete problems.
Skills	*The capacity to apply the knowledge and use the know-how for completing tasks and solving problems. The skills are described as being cognitive (requiring the use of logical, intuitive and creative thinking) or practical (implying manual dexterity and the use of methods, materials, tools and intrumentation).* Selects and groups relevant information within a given context. • Uses specific principles, with justification, to solve various problems with the help of a program. • Works productively in a team. • Drafts a scientific text. • Experimentally verifies identified solutions. • Solves practical applications. • Properly interprets causal relationships. • Analyzes and compares various ways of solving a problem • Identifies solutions and develops plans for solving. • Formulates conclusions for the completed problems. • Argues the identified solutions and ways of solving.

Responsability and autonomy	*The student's capacity to autonomously and responsably apply their knowledge and skills.* Selects appropriate bibliographic sources and analyzes them. • Respects the principles of academic ethics, correctly citing the bibliographic sources used. • Demonstrates receptiveness to new learning contexts. • Shows collaboration with other colleagues and teaching staff in carrying out teaching activities • Demonstrates autonomy in organizing the learning situation/context or the problem situation to be solved • Shows social responsibility through active involvement in student social life/involvement in events of the academic community • Promotes/contributes with new solutions, specific to the field, to improve the quality of social life. • Is aware of the value of one's contribution in engineering to identifying viable/sustainable solutions to solve problems in social and economic life (social responsibility). • Applies principles of ethics/professional deontology when analyzing the technological impact of proposed solutions in the field on the environment. • Analyzes and leverages business/entrepreneurial development opportunities in the field. • Demonstrates management skills for real-life situations (managing time, collaboration vs. conflict).

9. Teaching techniques *(Student centric techniques will be considered. The means for students to participate in defining their own study path, the identification of eventual fallbacks and the remedial measures that will be adopted in those cases will be described.)*

Starting from the analysis of students' learning characteristics and their specific needs, the teaching process will explore both expository methods (lecture, presentation) and conversational–interactive ones, based on discovery learning models facilitated by direct and indirect exploration of reality (experiment, demonstration, modeling), as well as action-based methods such as exercises, practical activities, and problem solving.
Teaching will use lectures based on presentations that will be made available to students. Each course will begin with a recap of previously covered chapters, with emphasis on the topics from the last class.
The presentations use images and diagrams so that the information presented is easy to understand and absorb.
This subject covers information and practical activities intended to support students in their learning efforts and in developing optimal relationships of collaboration and communication in a climate conducive to discovery learning.
Active listening and assertive communication skills will be practiced, as well as mechanisms for constructing feedback as means of behavioral regulation in diverse situations and adapting the pedagogical approach to students' learning needs.
The ability to work in teams to solve different learning tasks will be practiced.

10. Contents

COURSE		
Chapter	**Content**	**No. hours**
1	1. Structure of a microcomputer. Definitions 1.1. Functional components of a microcomputer 1.2. Definitions; CISC and RISC microprocessors 1.3. Representation of information in digital systems 1.4. Notation conventions	4

2	2. Structure of a general-purpose CISC µP core 2.1. Step 1 of detailing: data register and address register 2.2. Step 2 of detailing: general-purpose registers 2.3. Step 3 of detailing: arithmetic processing unit 2.4. Step 4 of detailing: memory addressing control unit 2.5. Step 5 of detailing: µP control unit	4
3	3. Functional development of a general-purpose 16-bit µP (µP16GP) — CISC 3.1. Functional organization of a typical µP16GP 3.2. Register structure 3.3. Organization of the microcomputer memory	4
4	4. Basic principles of a typical CISC architecture 4.1. Data transfers 4.2. Addressing techniques 4.3. Instruction types 4.4. Addressing techniques typical of 16-bit microprocessors	4
5	5. Basic principles of a typical RISC architecture 5.1. Register set 5.2. Instruction set and addressing techniques 5.3. µP control unit 5.4. RISC characteristics at software level	3
6	6. Input/Output strategies 6.1. I/O device space 6.2. Common I/O techniques 6.3. Interrupts characteristic of general-purpose microprocessors 6.4. Types of interrupts for Intel x86 µP in real mode	3
7	8. Performance of general-purpose µP 8.1. Performance criteria 8.2. Evolution of the architecture from 8-bit to 16-bit and 32-bit general-purpose µP 8.3. Fundamental concepts of advanced CISC and RISC microprocessors	3
	Total:	28

Bibliography:

- - Sorin Zoican, „Microprocesoare si microcontrolere. Aplicatii”, Editura Politehnica Press, Bucuresti, 2011
- C. Burileanu ş.a., “Microprocesoarele x86 – o abordare software”, Ed. “Grupul microInformatica”, Cluj-Napoca, 1999.
- E. Borcoci, S. Zoican, E. Popovici, “Arhitectura microprocesoarelor”, Ed. Media Publishing, Bucureşti, 1995.
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LABORATORY

Crt. no.	Content	No. hours
1	Presentation of a development environment for x86 microprocessors	2
2	Data transfer instructions and string operations for Intel x86 microprocessors in real mode.	2

3	Data processing instructions for Intel x86 microprocessors in real mode	2
4	Program control instructions for Intel x86 microprocessors in real mode.	2
5	Interrupts for Intel x86 microprocessors in real mode	2
6	Translating instructions from high-level languages into assembly language.	2
7	Final laboratory colloquium	2
	Total:	14

Bibliography:
- S. Zoican, E. Popovici, “Arhitectura microprocesoarelor - Îndrumar de laborator” litografia U.P.B., 1997.
- www.elcom.pub.ro/discipline/amp

11. Evaluation

Activity type	11.1 Evaluation criteria	11.2 Evaluation methods	11.3 Percentage of final grade
11.4 Course	- knowledge of fundamental theoretical concepts; - knowledge of how to apply theory to specific problems; - differential analysis of theoretical techniques and methods.	- Homework or in-class assignments (30% of the final score) - Written exam during the exam session (50% of the final score) Homework (in-class assignments) will not be retaken at the final exam.	80%
11.5 Seminary/laboratory/project	- - knowledge of how to write an assembly-language program to solve a given problem; - knowledge of how to use tools for developing, simulating, and debugging programs - demonstration of the functioning of the implemented programs	final laboratory colloquium. Both understanding of theoretical aspects and the ability to implement in C simple or medium-difficulty algorithms are assessed; - assessment of activity during laboratory sessions	20%
11.6 Passing conditions			
Example: Obtaining 50% of the total score. Obtaining 50% of the score for activities during the semester. **Attention to the applicable Study Regulations; references in this regard may be included here!**			

12. Corroborate the content of the course with the expectations of representatives of employers and representative professional associations in the field of the program, as well as with the current state of knowledge in the scientific field approached and practices in higher education institutions in the European Higher Education Area (EHEA)

Through the activities carried out, students develop skills to provide solutions to problems and to propose ideas for improving the state of affairs in the field of Electronic Engineering, Telecommunications and Information Technology, industrial branch Telecommunications networks and software
In developing the content of the subject, knowledge described in the specialized literature and our own published and presented research were taken into account.
The course has content similar to courses taught at the POLITEHNICA University of Bucharest.
The development of the graduate's ability to manage practical situations that may be encountered in real life is considered, with the aim of increasing their contribution to the improvement of the socio-economic environment.

Date	Course lecturer	Instructor(s) for practical activities
25.09.2025	Prof. Dr. Sorin Zoican	Prof. Dr. Sorin Zoican

Date of department approval	Head of department
26.09.2025	Prof. Dr. Claudius Dan

Date of approval in the Faculty Council	Dean
26.09.2025	Prof. Dr. Mihnea Udrea