Universitatea Națională de Știință și Tehnologie Politehnica București
Facultatea de Electronică, Telecomunicații și
Tehnologia Informației

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	**Telecommunications**
1.4 Domain of studies	Electronic Engineering, Telecommunications and Information Technology
1.5 Cycle of studies	Masters
1.6 Programme of studies	Electric Vehicle Propulsion and Control

2. Date despre disciplină

2.1 Course name (ro) (en)				Aplicații ale microprocesoarelor pentru sisteme de calcul în timp real Microprocessor Applications for Real Time Systems			
2.2 Course Lecturer				S.l./Lect. Dr. Georgian Nicolae			
2.3 Instructor for practical activities				S.l./Lect. Dr. Georgian Nicolae			
2.4 Year of studies	2	2.5 Semester	I	2.6. Evaluation type	E	2.7 Course regime	Ob
2.8 Course type		DA	2.9 Course code	UPB.04.M3.O.24-25		2.10 Tipul de notare	Nota

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

3.1 Number of hours per week	3	Out of which: 3.2 course	1.00	3.3 seminary/laboratory	2
3.4 Total hours in the curricula	42.00	Out of which: 3.5 course	14	3.6 seminary/laboratory	28
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.					53
Tutoring					3
Examinations					3
Other activities (if any):					0

3.7 Total hours of individual study	58.00
3.8 Total hours per semester	100
3.9 Number of ECTS credit points	4

4. Prerequisites (if applicable) (where applicable)

4.1 Curriculum	not applicable

4.2 Results of learning	not applicable

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

5.1 Course	• Room equipped with a video projector.
5.2 Seminary/ Laboratory/Project	• Room equipped with computers and specific software. • Compulsory presence at laboratory classes, according to current POLITEHNICA Bucharest regulations.

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)*

Study of the basic concepts in CISC and RISC general microprocessor architecture: registers, memory management, addressing techniques, data transfer, instruction set, input/output strategies. The students should have the possibility to approach any specific microprocessor architecture, either general or dedicated.

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	**C2.** Design of hardware, software and telecommunication systems **C2.1.** Description of the structure and of the architecture for hardware, software and telecommunication systems **C2.2.** Explaining the purpose and the operation details for hardware, software and telecommunication systems **C4.** Using programming technologies and environments
Transversal (General) Competences	• Honorable, responsible and ethical behavior to ensure the reputation of the profession. • Awareness of the need for continuous training; efficient use of resources and learning techniques for personal and professional development.

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.* • Defines specific characteristics of general purpose microprocessors • Lists the main architecture attributes for x86 • Classify instructions into the three categories • Describes the activation of functional blocks within instructions • Highlight the main differences between CISC and RISC
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).* • Uses specific principles in the development of applications for computing systems • Adequately interprets causal relationships between instructions, instruction format, and timing • Identifies solutions and develops plans to solve the proposed problem • Analyze, compare and group microprocessors based on their main characteristics • Motivate the identified solutions and the ways of solving them • Formulates conclusions on developed applications
Responsability and autonomy	*The student's capacity to autonomously and responsably apply their knowledge and skills.* • Demonstrates responsiveness to new learning contexts • Demonstrates collaboration with other colleagues and teaching staff in carrying out teaching activities • Demonstrates autonomy in organizing the learning context and the problem situation to be solved • Demonstrates social responsibility through involvement in academic community events • Contributes through new solutions related to the specialized field to improve the quality of social life • Realizes the value of his contribution in the field of engineering to the identification of viable/sustainable solutions to solve problems in social and economic life • Apply principles of professional ethics in the analysis of the technological impact of the proposed solutions in the specialized field on the environment • Analyzes and exploits opportunities for entrepreneurial development in the specialized field • Demonstrates real-life situation management skills

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.)*

The course lectures are performed in a lecture hall equipped with multimedia facilities. Course materials are: course notes and presentations. All materials are available in electronic format on the POLITEHNICA Bucharest "Moodle" platform.

In the laboratory-type applications, the tutor makes a short theoretical presentation of the concepts that will be used in the respective laboratory, then guides the students in developing applications for the 8086 microprocessor using the emu8086 simulator. The didactic materials are the laboratory platforms included in the laboratory guide.

10. Contents

COURSE		
Chapter	**Content**	**No. hours**
1	Microcomputer Structure. Definitions	2
2	Overview of a CISC, General Purpose Microprocessor Core	2
3	Fundamentals of a Typical CISC Architecture	2
4	Fundamentals of a Typical RISC Architecture	2
5	Input/Output Strategies	2
6	Time-Dimension of a General Purpose Microprocessor Architecture	2
7	An Overview of Intel x86 Architecture (IA-32) in Real Mode	2
	Total:	14

Bibliography:

C. Burileanu, Microprocessor Applications for Real Time Systems , suport de curs electronic, https://curs.upb.ro/2021/
C. Burileanu, “Arhitectura microprocesoarelor”, Editura Denix, Bucureşti, 1994.
C. Burileanu s.a., “Microprocesoarele x86 – o abordare software”, Ed. “Grupul microInformatica”, Cluj-Napoca, 1999

LABORATORY		
Crt. no.	**Content**	**No. hours**
1	Introducing a development environment for x86 microprocessors: emu 8086	2
2	Data transfer instructions and array 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	Translation of instructions from high-level programming into assembly	2
7	Laboratory test	2
	Total:	14
PROJECT		
Crt. no.	**Content**	**No. hours**
1	Development of core functions for real-time applications using the x86 architecture	2
2	Development of input/output procedures	4
3	Implementation of functionalities according to the proposed topic	6
4	Project presentation	2

	Total:	14

Bibliography:

. Burileanu, Microprocessor Applications for Real Time Systems , suport de curs electronic, https://curs.upb.ro/2021/

Elena-Diana Şandru, Horia Cucu, Corneliu Burileanu, “Arhitectura Microprocesoarelor”, Îndrumar de laborator, Editura MatrixRom (cod CNCSIS: 39), Bucureşti, 2018, ISBN 978-606-25-0443-4

11. Evaluation

Activity type	11.1 Evaluation criteria	11.2 Evaluation methods	11.3 Percentage of final grade
11.4 Course	- knowledge of theoretical fundamentals; - solving practical problems	Written Exam	40%
11.5 Seminary/laboratory/project	- knowing how to design an algorithm to solve a given problem; - knowledge of how to implement an algorithm using assembly language; - demonstration of the operation of an 8086 program.	Laboratory Test	20%
	- knowing how to design a practical application with real-time operation for the x86 architecture - solving implementation problems using the concepts assimilated in the course and laboratory	Project	40%
11.6 Passing conditions			
Obtaining 50% of the final grade			

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)

The content of the course is largely similar to other courses, aiming for the same objectives, lectured across the universities in the European Union. The content of the discipline is continuously updated and adapted following consultations with representatives of the business environment in Europe.

Date	Course lecturer	Instructor(s) for practical activities
09.09.2022	S.l./Lect. Dr. Georgian Nicolae	S.l./Lect. Dr. Georgian Nicolae

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Date of department approval	Head of department
27.10.2024	Conf. Dr. Serban Georgica Obreja
Date of approval in the Faculty Council	Dean
25.10.2024	Prof. Dr. Mihnea Udrea