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)				Aplicaţii practice ale microcontrolerelor - Proiect Practical Applications of Microcontrollers - Project			
2.2 Course Lecturer				NA			
2.3 Instructor for practical activities				S.l. Dr. Ing. Valentin-Gabriel Voiculescu, S.l. Dr. Ing. Vasile-Mădălin Moise			
2.4 Year of studies	3	2.5 Semester	2	2.6. Evaluation type	V	2.7 Course regime	Op
2.8 Course type		S	2.9 Course code	04.S.06.A.116		2.10 Tipul de notare	Nota

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

3.1 Number of hours per week	1	Out of which: 3.2 course	0.00	3.3 seminary/laboratory	1
3.4 Total hours in the curricula	14	Out of which: 3.5 course	0	3.6 seminary/laboratory	14
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.					33
Tutoring					0
Examinations					3
Other activities (if any):					0

3.7 Total hours of individual study	36.00
3.8 Total hours per semester	50
3.9 Number of ECTS credit points	2

4. Prerequisites (if applicable) (where applicable)

4.1 Curriculum	• Electronic Devices • Basic Electronic Circuits • Digital Integrated Circuits • Microprocessor Architecture 1& 2. • Analogic Integrated Circuits
4.2 Results of learning	Applying basic knowledge, concepts and methods regarding microcontroller system architecture, programming techniques and electronic circuits.

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

5.1 Course	-
5.2 Seminary/ Laboratory/Project	The project will be carried out in a room with specific equipment, which must include: • equipment for the practical realization of electronic circuits • computer systems with software for programming microcontrollers

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 discipline aims to apply basic knowledge, concepts and methods regarding microprocessors, microcontrollers, programming languages and techniques, analog and digital circuits to the realization of an applied electronics project. The discipline addresses specific topics of software and hardware, contributing to the formation by students of an overall vision of the design of practical applications using microcontrollers.

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	**C3.1.** Describe the operation of a microcontroller system **C3.2.** Use of general-purpose programming languages and specific to microcontroller applications; explain the operation of hardware systems connected to a microcontroller **C3.3**. Solve concrete practical problems that include the design of hardware systems around microcontrollers **C3.4**. Develop programs in a programming language starting from the specification of requirements to execution, debugging and interpretation of results in correlation with the microcontroller used and the designed hardware system **C4.** Design and use of low-complexity hardware and software applications specific to electronics

Transversal (General) Competences	• Honorable, responsible, ethical behavior, in the spirit of the law to ensure the reputation of the profession. • Awareness of the need for continuous training; efficient use of learning resources and 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.* • Read the datasheet for a microcontroller and other peripheral devices for the purpose of implementing an application • Model, validate, and debug the running of the designed application on the real hardware system • Describe the operating characteristics of the microcontroller's control mechanisms in relation to the characteristics of the hardware and software modules in the system • Highlight the main problems in integrating types of hardware and software modules into a complex system
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 an argumentative manner to develop applications for microcontroller systems • Interprets appropriately the causal relationships between the main characteristics of a microcontroller and the types of applications in which it can be used. • Identifies solutions and develops a software flowchart for a proposed problem • Analyzes, compares and uses hardware circuit components to solve the problem • Justifies the identified solutions and ways of solving • Formulates conclusions on the developed project

Responsability and autonomy	*The student's capacity to autonomously and responsably apply their knowledge and skills.* • Demonstrates receptivity to new learning contexts • Manifests collaboration with other colleagues and teachers in carrying out teaching activities • Demonstrates autonomy in organizing the learning context and the problem situation to be solved • Demonstrates social responsibility by involvement in events in the academic community • Contributes through new solutions related to the specialty field to improve the quality of social life • Aware of the value of his contribution in the field of engineering to identify viable/sustainable solutions that solve problems in social and economic life • Applies principles of professional ethics in analyzing the technological impact of solutions proposed in the specialty field on the environment • Analyzes and capitalizes on entrepreneurial development opportunities in the specialty field • Demonstrates management skills in real-life situations

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 teacher will choose the assignment that will be distributed to the students organized in teams. Thus, the ability to work in a team will be practiced to carry out the project. All teams will work together to carry out and present the final projects based on the microcontroller. Starting from the analysis of the learning characteristics of the students and their specific needs, the teaching process will explore both expository (lecture, exposition) and conversational-interactive teaching methods, based on discovery learning models facilitated by direct and indirect exploration of reality (experiment, demonstration, modeling), but also on action-based methods, such as exercise, practical activities and problem solving.

10. Contents

PROJECT		
Crt. no.	**Content**	**No. hours**
1	Organizational introduction. Hardware aspects. ETTI board. Microcontroller (e.g. STM32, Atmega). Software aspects - VSCode and STM Cube tools. Resources available Moodle/Teams/online. List of project topics. Mid semester assignments.	2
2	Soldering components. Initial investigations on coursework. Troubleshooting board hardware and tool software issues. Consultations on mid semester and final project assignments	2
3	Validation of the development board with the test software. Aspects about modifying the test software to solve the course assignments (low-level programming, microcontroller datasheet, buses, registers, additional resources). Consultations on mid semester and final project assignments	2
4	Evaluation of the mid semester assignments and related documentation. Consultations related to the final project assignment	2

5	Completion of the mid semester assignments and related documentation. Consultations related to the final project assignment.	2
6	Interim evaluation of the final project status. Consultations related to the final project assignment.	2
7	Presentation of the practical implementation and documentation related to the final project assignment.	2
	Total:	14

Bibliography:

1. ST32 Cortex-M4 MCUs and MPUs programming manual, https://www.st.com/resource/en/programming_manual/pm0214-stm32-cortexm4-mcus-and-mpus-programming-manual-stmicroelectronics.pdf
2. C. Noviello, Mastering STM32 - Second Edition, 2025
3. Platforms and guides available online Moodle/Teams/other forms
4. ham.elcom.pub.ro/proiect2

11. Evaluation

Activity type	11.1 Evaluation criteria	11.2 Evaluation methods	11.3 Percentage of final grade
11.4 Course			
11.5 Seminary/laboratory/project	Evaluation of the course topics and the gradual documentation of the final project.	Evaluation during the semester practical, written and oral.	80%
	Final project evaluation	Final oral evaluation	20%
11.6 Passing conditions			
Obtaining 50% of the total grade. Ability to change the hardware interconnection scheme, make changes to the code, program the board, debug and validate the project and the mid semester assignments to a functional form.			

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 discipline continues in the vein of other project disciplines from the younger years, offering students an example of combining the main areas studied in the faculty: hardware, software and communications, through a practical, functional example that combines design and programming aspects together with testing aspects, this time in a lower level form that requires additional skills for design, implementation and validation, similar to those widely used in industry. The industry has a significant demand for qualified engineers, with specializations related to the use of microcontrollers and with a solid foundation in electronics, systems and information technology, so that the pace of development of new hardware products and software applications can be maintained.

The project curriculum responds concretely to these current development and evolution requirements, at national and European level. In the context of the current technological progress of electronic devices, the fields of activity targeted are practically unlimited, from the field of electronics and telecommunications, the military field, the field of security (surveillance systems), the field of industrial automation (product inspection systems), robotics (human-machine interface systems) and others.

Graduates are thus provided with skills appropriate to the needs of current qualifications and a modern scientific and technical training, of competitive quality on the labor market, which allows them to be quickly employed after graduation, being perfectly aligned with the policy of the National University of Science and Technology Politehnica Bucharest, both in terms of content and structure, as well as in terms of the skills and international openness offered to students.

Date	Course lecturer	Instructor(s) for practical activities
25.09.2025	NA	S.l./Lect. Dr. Ing. Valentin-Gabriel Voiculescu
		S.l. Dr. Ing. Vasile-Mădălin Moise

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