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)				Bazele tehnologice ale microelectronicii - Proiect Microelectronics Fundamentals - Project			
2.2 Course Lecturer				Conf. Dr. Alexandru Antonescu			
2.3 Instructor for practical activities				Conf. Dr. Alexandru Antonescu			
2.4 Year of studies	4	2.5 Semester	1	2.6. Evaluation type	V	2.7 Course regime	Op
2.8 Course type		S	2.9 Course code	04.S.07.A.409		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.					28
Tutoring					6
Examinations					2
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	Completion of the following subjects: – Sensors and signal conditioning circuits – Software tools for microelectronics – Analog integrated circuits – Digital integrated circuits – Electronic devices – Fundamental electronic circuits
4.2 Results of learning	Accumulation of the following general knowledge: – The operation and use of analog, digital and interface integrated circuits between the two domains (mixed analog-digital signal); – Identification and analysis of component blocks and the connections between them at the system level.

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

5.1 Course	N/A
5.2 Seminary/ Laboratory/Project	– The project will be carried out in a room with specific equipment, which must include access to the software and/or hardware resources necessary for the development of the project (Cadence, MATLAB, Xilinx ISE, Modelsim).

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 is studied within the field of Electronic Engineering, Telecommunications and Information Technologies / specialization "Microelectronics, Optoelectronics and Nanotechnologies" and is divided into three study directions, at the students' choice: 1) advanced digital signal processing techniques and software implementation of digital signal processing systems; 2) design techniques for VLSI integrated structures and their implementation in microelectronic technology; and 3) computer system architectures and their implementation in reprogrammable electronic technology

– The aim is primarily to deepen the phenomena and concepts associated with the three study directions, from the point of view of the system designer, as well as to familiarize students with the stages related to the development of an electronic application (analysis and interpretation of the project specification, design and simulation of a high-performance electronic system, its software or hardware implementation, and functionality testing under specific conditions) and to acquire the skills to develop and present a system documentation, which justifies the solutions approached and demonstrates the achievement of the experimentally reported performances and compliance with the project specification.

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 basic knowledge appropriate to the chosen field of study: characterization of discrete signals in the time and frequency domains, design of analog, digital or mixed-signal electronic systems, description of the operation and basic principles of the architecture of a digital system. - Demonstrates understanding of the project specification and the structuring of the electronic system into functional blocks. – Practically applies the acquired theoretical knowledge and the use of simulation and development environments for the analysis, design, implementation and testing of functional blocks and the system as a whole. – Correlates the theoretical knowledge acquired in the semester's specialized disciplines with the development of a practical application in the chosen field of study. – Argues and analyzes coherently and correctly the context of application of basic knowledge, using key concepts of related disciplines and their specific methodologies. – Oral and written communication in Romanian: uses the scientific vocabulary specific to the chosen field of study, in order to communicate effectively and correctly, in writing and orally. – Oral and written communication in a foreign language (English): demonstrates understanding and correct application of the vocabulary related to the chosen field of study, in a foreign language.
Transversal (General) Competences	- Works in a team and communicates effectively, coordinating efforts with others to solve problem situations of medium complexity. – Autonomy and critical thinking: the ability to think in scientific terms, to search for and analyze data independently, to identify solutions, as well as to extract and present conclusions. – Analysis and synthesis capacity: presents the knowledge acquired in a synthetic manner, as a result of a systematic analysis process. – Respects the principles of academic ethics: in documentation activity, correctly cites the bibliographic sources used. – Puts into practice elements of emotional intelligence in the appropriate socio-emotional management of situations in academic 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.* – Defines notions and concepts specific to the chosen direction of study, in close relation to the particularities of the electronic system to be designed and its component blocks. – Properly describes the design and analysis techniques used for system development. – Understands and describes the phenomena involved in the functioning of the component blocks of the system and their impact at the system level. – Lists the most important stages of the technological processes involved and/or of the software solutions adopted, highlighting their limitations, advantages, disadvantages and applicability for the project topic. – Properly understands and describes the stages of carrying out a project in accordance with the organization, requirements and working methods used in the industry.
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 in a given context, thus being able to adequately describe various theoretical or practical aspects relevant to the chosen direction of study. – Uses concepts and principles specific to the chosen direction of study in an argumentative manner in order to correctly approach problems. – Experimentally validates the solutions identified for the practical solution of the project topic. – Identifies and correctly interprets causal relationships in the functioning of the system. – Formulates correct conclusions on the experimental results obtained. – Argues the method of solving and the solutions used to solve problems.
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 receptivity to new learning contexts. – Demonstrates team spirit and collaboration with other colleagues and teachers in carrying out teaching activities. – Demonstrates autonomy in organizing the learning context and the problems to be solved. – Recognizes the value of his/her contribution in the field of engineering in identifying viable solutions to solve problems in social and economic life. – Analyzes business or entrepreneurial development opportunities, based on the knowledge acquired in the field studied. – Demonstrates management skills in real-life situations (for example, correctly managing the time to complete the project).

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.)*

Teaching is based on oral communication, the methods used being mainly the expository method and the problematization method, used frontally. The video projector is used, covering the communication and demonstrative function, as well as interactive means, based on questions and answers and student feedback.

– During the project meetings, students are guided in the analysis, interpretation and understanding of the project specification, the analysis and design of the component blocks of the system according to the specification, the redesign and their iterative validation, as well as the implementation of software and/or hardware and testing of the final system.

– Students work in teams and are monitored and guided in the appropriate division of design, simulation, implementation and testing tasks, as well as in the production of final documentation related to the project presentation.

– The complete package of materials necessary for the project (project specification, block diagrams and detailed diagrams of the component blocks, auxiliary files – libraries, scripts, databases) is available in electronic format on the faculty's Moodle platform.

10. Contents

PROJECT		
Crt. no.	**Content**	**No. hours**
1	Familiarization with the working environment (software and/or hardware) and the project specification. Identification of the system's functionality elements	2
2	Analysis of the system's component blocks, identification of critical parameters and/or performance measures involved. Determination of analysis, design, implementation and testing techniques for the system's component blocks	2
3	Design of the system's component blocks and experimental validation of their functionality	4
4	Implementing functional blocks within the overall system and testing its functionality	4
5	Final evaluation	2
	Total:	14

Bibliography:

1. R. J. Baker, CMOS: Circuit Design, Layout, and Simulation, 4th Ed., IEEE Press, Wiley, 2019.
2. P. R. Gray, P. J. Hurst, S. H. Lewis, R. G. Meyer, Analysis and Design of Analog Integrated Circuits, 5th Ed., John Wiley & Sons, 2009.
3. A. Hastings, The Art of Analog Layout, 2nd Ed., Prentice Hall, 2005.
4. G. Ştefan, Loops and Complexity in Digital Systems. Lecture Notes on Digital Design in GigaGate/Chip Era, 2020, disponibil în format electronic: http://users.dcae.pub.ro/~gstefan/2ndLevel/teachingMaterials/0-BOOK.pdf
5. C. Unsalan, B. Tar, Digital System Design with FPGA: Implementation Using Verilog and VHDL, McGraw Hill, 2017.
6. Xilinx, Vivado Design Suite User Guide, 2017, disponibil în format electronic: https://docs.xilinx.com/v/u/2017.3-English/ug893-vivado-ide

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	Knowledge of fundamental theoretical notions.	Oral evaluation in the last project meeting.	20%
	Knowledge of how to apply theory to problems specific to the chosen field of study	Oral presentation in the last project meeting.	80%
11.6 Passing conditions			
– Obtaining 50% of the total score.			

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 segment of the labor market that this project is targeting is very diverse. Students can gain both hardware and software knowledge from three representative areas of electronics: digital signal processing and software implementation of digital signal processing systems; design of VLSI structures and their implementation in microelectronic technology; and development of computer system architectures and their implementation in reprogrammable electronic technology. They represent a significant segment of the labor market, both locally and globally. At national and international levels, there is a significant number of representative employers, in particular multinational companies, but also medium and small-sized research and development centers. The project curriculum responds to the current development and evolution requirements of the implementation of analog and/or digital electronic systems in the context of the aggressive growth of resources offered by the global development of microelectronic technologies and information technology. This ensures that students have skills appropriate to the needs of current qualifications and a modern, quality and competitive scientific and technical training, which will allow them to be quickly employed after graduation, the discipline 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. The content of the discipline is largely similar to that of disciplines with the same objectives taught in universities in the European Union and is continuously updated and adapted following consultations with representatives of the business environment.

Date	Course lecturer	Instructor(s) for practical activities
25.09.2025	Conf. Dr. Alexandru Antonescu	Conf. Dr. Alexandru Antonescu

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

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