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)				Senzori şi circuite de condiţionare a semnalelor- Proiect Sensors and Signal Conditioning Circuits - Project			
2.2 Course Lecturer				--			
2.3 Instructor for practical activities				Conf. Dr. Marius Enachescu			
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.414		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.					32
Tutoring					2
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	• Electronic devices, • Fundamental electronic circuits, • Integrated analog circuits, • Digital circuits • IEM
4.2 Results of learning	To apply fundamental knowledge, concepts, and methods to mixed-signal circuits that incorporate sensors and operate at maximum frequencies in the hundreds of kHz range, analyzed from a system designer's perspective. Additionally, to familiarize students with the development stages of an Internet-of-Things (IoT) electronic application.

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

5.1 Course	--
5.2 Seminary/ Laboratory/Project	The project will be conducted in a dedicated laboratory equipped with computer systems running specialized software for mixed-signal circuit design.

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 focuses on applying fundamental knowledge, concepts, and methods of mixed-signal, analog, and digital integrated circuit design toward the implementation of an Internet-of-Things (IoT) electronics project. The curriculum specifically addresses hardware concepts, enabling students to develop a holistic perspective on designing sensor-based, mixed-signal circuits that operate at maximum frequencies of up to several hundred kHz.

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 foundational knowledge relevant to the field of study: Students will become familiar with the methods and techniques for measuring non-electrical quantities using electronic means. Upon completion, graduates will be competent in understanding the operation and effectively utilizing specific techniques for the acquisition of non-electrical quantities. • Demonstrates understanding of project specifications and system architecture: Able to structure an electronic system into functional blocks based on its requirements. • Argues and analyzes the application of foundational knowledge: Coherently and correctly analyzes the context for applying basic principles, using key concepts and specific methodologies from related disciplines. • Written and oral communication in Romanian: Utilizes the scientific vocabulary specific to the chosen field of study for effective and accurate communication, both in writing and orally. • Written and oral communication in a foreign language (English): Demonstrates the correct understanding and application of the vocabulary relevant to the chosen field of study in a foreign language.

Transversal (General) Competences	• Teamwork and Communication: Works effectively in a team and communicates efficiently, coordinating efforts with others to solve problems of medium complexity. • Autonomy and Critical Thinking: Demonstrates the ability to think in scientific terms, independently search for and analyze data, identify solutions, and draw and present conclusions. • Analytical and Synthesis Skills: Synthetically presents acquired knowledge as the result of a systematic analysis process. • Adherence to Academic Ethics: Respects the principles of academic ethics by correctly citing all bibliographic sources used during the research and documentation process. • Emotional Intelligence: Applies elements of emotional intelligence to appropriately manage socio-emotional situations in an academic environment, demonstrating self-control and objectivity in decision-making or under stress.

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 concepts specific to Internet-of-Things (IoT) systems, linking them directly to the characteristics of the electronic system that converts non-electrical quantities into electrical ones and its constituent blocks. • Accurately describes the design and analysis techniques used for the system's development. • Understands and describes the phenomena involved in the operation of the system's component blocks and their overall impact at the system level. • Lists the most important stages of the technological processes and/or adopted solutions, highlighting their limitations, advantages, disadvantages, and applicability in the system design. • Understands and properly describes the development stages of an IoT system in accordance with the organization, requirements, and workflows 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 organizes relevant information within a given context, enabling the accurate description of various theoretical and practical aspects of IoT systems. • Applies concepts and principles specific to sensor-based systems with clear justification to correctly approach and solve problems. • Validates the identified solutions through SPICE simulations to practically resolve the project's requirements. • Correctly identifies and interprets causal relationships within the system's operation. • Draws accurate conclusions based on the experimental results obtained. • Articulates and justifies the problem-solving approach and the solutions employed.
Responsability and autonomy	*The student's capacity to autonomously and responsably apply their knowledge and skills.* • Selects and analyzes appropriate bibliographic sources. • Adheres to principles of academic ethics, ensuring correct citation of all utilized bibliographic sources. • Demonstrates receptiveness to new learning contexts and opportunities. • Exhibits team spirit and collaborates effectively with peers and faculty during academic activities. • Demonstrates autonomy in organizing one's own learning process and in approaching problems to be solved. • Recognizes the value of their engineering contribution in identifying viable solutions to social and economic problems. • Analyzes business opportunities or entrepreneurial development paths based on the knowledge acquired in the field of study. • Demonstrates real-world management skills, such as the effective management of project timelines.

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 instructor will assign project themes to students, who will be organized into teams. This structure is designed to cultivate teamwork skills throughout the project's development. All teams will collaborate towards the final completion and presentation of their projects.

Based on an analysis of student learning characteristics and specific needs, the teaching process will employ a variety of methods. These will include expository techniques (such as lectures and presentations) as well as interactive and conversational approaches. The methodology will also incorporate discovery-based learning models facilitated by the direct and indirect exploration of reality (e.g., experiments, demonstrations, and modeling), alongside action-oriented methods like practical exercises, hands-on activities, and problem-solving.

10. Contents

PROJECT		
Crt. no.	**Content**	**No. hours**
1	This is the most common and easily understood phrasing for a course syllabus. Course Introduction & Logistics Hardware Review: Amplifiers Software Review: LTspice	2
2	Sensor Presentation and its Electrical Model Initial Work on Coursework Assignments Consultations on Coursework and the Final Project	2
3	Presentation of the Simplified Sensor Readout Circuit Model Overview of the System's Key Parameters	2
4	Assessment of the simplified sensor readout circuit model.	2
5	Assessment of coursework assignments and related documentation. Q&A and guidance for the final project.	2
6	Completion of coursework and documentation review. Final project consultations.	2
7	Final Project Demonstration and Documentation Presentation.	2
	Total:	

Bibliography:

1. M. Enachescu, Senzori şi circuite de condiţionare a semnalelor, suport de curs electronic pe platforma Moodle a facultăţii de ETTI: https://curs.upb.ro/2021/course/view.php?id=9872
2. R.J. Baker, CMOS: Circuit Design, Layout, and Simulation, 4th Ed., IEEE Press, Wiley, 2019.
3. Behzad Razavi, „Design of Analog CMOS Integrated Circuits”, McGraw-Hill, Inc., 2017.
4. Bodea, M., I. Mihut, L. Turic, V. Tiponut, Aparate Electronice pentru Masurare si Control, Editura Didactica si Pedagogica, 1985
5. R.C. M. Meijer, “Smart Sensor Systems”, John Wiley & Sons, 2008

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	Assessment of ongoing assignments and the incremental documentation for the final project.	Ongoing assessment.	50%
	Assessment of final documentation for the final project.	Final assessment.	50%
11.6 Passing conditions			

- Achieving a minimum of 50% of the total score.
- Demonstrating the ability to create the simplified model of the sensor and its readout circuit.

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)

Alignment with Industry and Academic Standards

The course content and the competencies acquired are designed to meet the expectations of relevant professional organizations (e.g., ARIES), industry companies where students conduct internships or find employment, and national quality assurance bodies (e.g., ARACIS).

Target Employers

Representative employers include small to medium-sized national and international design centers specializing in the design and implementation of hybrid sensor and signal conditioning systems.

Graduate Outcomes and Strategic Fit

This course provides graduates with competencies that are aligned with current qualification requirements, ensuring they receive modern, high-quality, and competitive scientific and technical training. This facilitates rapid employment upon graduation. Furthermore, the course is perfectly aligned with the policy of the Politehnica University of Bucharest, both in terms of its content and structure, and with respect to the skills and international exposure it offers to students.

Date	Course lecturer	Instructor(s) for practical activities
25.09.2025		Conf. Dr. Marius Enachescu

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

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