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	**Applied Electronics and Information Engineering**
1.4 Domain of studies	Electronic Engineering, Telecommunications and Information Technology
1.5 Cycle of studies	Bachelor/Undergraduate
1.6 Programme of studies	Applied Electronics

2. Date despre disciplină

2.1 Course name (ro) (en)				Bazele sistemelor de achiziţie de date Fundamentals of Data Aquisition Systems			
2.2 Course Lecturer				Conf. Dr. Vlad-Cristian Georgescu			
2.3 Instructor for practical activities				Conf. Dr. Vlad-Cristian Georgescu			
2.4 Year of studies	3	2.5 Semester	2	2.6. Evaluation type	E	2.7 Course regime	Ob
2.8 Course type		D	2.9 Course code	04.D.06.O.112		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	2	3.3 seminary/laboratory	1
3.4 Total hours in the curricula	42	Out of which: 3.5 course	28	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.					6
Tutoring					0
Examinations					2
Other activities (if any):					0

3.7 Total hours of individual study	8.00
3.8 Total hours per semester	50
3.9 Number of ECTS credit points	2

4. Prerequisites (if applicable) (where applicable)

4.1 Curriculum	none
4.2 Results of learning	none

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

5.1 Course	Room with video projector

5.2 Seminary/ Laboratory/Project	Computer room with specific hardware and software for automation (acquisition and control modules, sensors and actuators, industrial software)

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 Technologies, in the Applied Electronics specialization and aims to familiarize students with the fundamentals of data acquisition and control systems, necessary to understand the operation, use and implementation of practical applications with relevance for the industrial field.

This subject complements other subjects that present technical notions about sensors, electronic circuits, communication systems, programming, so that students understand how all these come together in a functional and efficient monitoring and control system of an industrial process.

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 of automation systems • Correlates knowledge • Applies knowledge in practice • Applies standardized methods and tools, specific to the field, to carry out the evaluation and diagnosis process of a system, depending on the identified/reported problems, and identifies solutions. • Argues and analyzes coherently and correctly the context of application of the basic knowledge of the field, using key concepts of the discipline and specific methodology. • Oral and written communication in English: uses the scientific vocabulary specific to the field, in order to communicate effectively, in writing and orally.
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, search and analyze data independently, and draw and present conclusions / identify solutions. • Ability to analyze and synthesize: presents the acquired knowledge in a synthetic way, as a result of a process of systematic analysis.

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.* • Lists the components of a procurement and control system. • Defines domain-specific notions. • Lists the main types of: sensors, communication equipment, software. • Describes the types of inputs/outputs specific to data acquisition and control equipment. • Describes the operating principles of the main equipment components of the acquisition and control systems. • Highlights relationships between the main equipment components of the acquisition and control systems.
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 appropriate component equipment of a procurement and control system, depending on the particularities of the application. • Identifies solutions and develops plans to solve given technical issues. • Argues the identified solutions/solutions. • Adequately interprets causal relationships. • Analyzes and compares solutions. • Works productively in a team. • Experimentally verifies proposed solutions. • Uses specialized equipment and software correctly. • Formulates conclusions to the experiments carried out.
Responsability and autonomy	*The student's capacity to autonomously and responsably apply their knowledge and skills.* • Demonstrates autonomy in the use and understanding of the operation of an acquisition and control system (hardware and software). • Selects appropriate bibliographic sources and technical specifications and analyze them. • Demonstrates responsiveness to new learning contexts. • Demonstrates collaboration with other colleagues and teaching staff in carrying out teaching activities. • 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. • Analyzes and capitalizes on business/entrepreneurial development opportunities in the specialized field. • Demonstrates real-life situation management skills (collaborative vs. conflict time management).

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.)*

In the teaching activity, lectures will be used, based on detailed written materials, which will be made available to the students. The materials use images and diagrams so that the information presented is easy to understand and assimilate.

Each course will begin with a brief recap of the previous chapters, focusing on the concepts covered in the last course. At the end of certain chapters, action-based methods such as exercise or problem solving will also be used. Also, with the advancement through the subject, the case study method will be used.

In the laboratory activity, practical activities will be carried out, the methods used being those of experiment and demonstration. Throughout the implementation of the applied activities, the ability to work in a team (2 or 3 students) will be practiced to solve different learning tasks.

10. Contents

COURSE

Chapter	Content	No. hours
1	General concepts: Sensors. Actuators. Signal conditioning circuits. Data acquisition equipment. Industrial software environments. Cloud software.	2
2	Types of sensors and actuators: Parametric: Resistive, Capacitive, Inductive; Generator: voltage, current. Relays. DC motors	6
3	Signal conditioning circuits: Multiplexers. Converters	2
4	Data acquisition and control equipment: Data acquisition modules. Controllers.	6
5	Industrial communication equipment: Communication media. Communication equipment. Communication protocols.	4
6	Industrial software environments: HMI. SCADA. Industrial database. Software for optimization and standardization.	4
7	IIoT (Industrial Internet of Things) solutions: Hardware. Software.	4
	Total:	28

Bibliography:

- Lectures available each year on the teaching platform „Moodle” of UPB (https://curs.upb.ro/).
- Vlad-Cristian Georgescu, "de la SCADA către INDUSTRY 4.0", MATRIXROM, Bucuresti, 2023, ISBN:978-606-25-0839-5
- D. Bailey, E. Wright, “Background to SCADA, in: Practical SCADA for Industry”, Elsevier, Burlington, MA, 2003, ISBN 07506 58053.
- Manoj, K. S. “Industrial Automation with SCADA: Concepts, Communications and Security”. Notion Press, 2019.
- Chiţă M-A, ”Senzori şi actuatoare”, Matrix Rom, Bucureşti, 2017.
- Dey, Chanchal, and Sunit Kumar Sen. “Industrial automation technologies”. CRC Press, 2020.
- G. Clarke, D. Reynders, “Practical Modern SCADA Protocols”, Elsevier, Burlington, MA, 2004, ISBN 07506 7995.

LABORATORY		
Crt. no.	**Content**	**No. hours**
1	Application with temperature sensors	2
2	Application with strain gauges	2
3	Application with SCADA system – data acquisition and control hardware	2
4	Application with SCADA system – communication hardware	2
5	Application with SCADA system – data acquisition and control software	2
6	Application with SCADA system – data acquisition in cloud	2
7	Final laboratory examination	2
	Total:	14

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- Vlad-Cristian Georgescu, "de la SCADA către INDUSTRY 4.0", MATRIXROM, Bucuresti, 2023, ISBN:978-606-25-0839-5
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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 notions - choosing the correct solutions for solving some exercises	Written mid-term exam	30
	- knowledge of fundamental theoretical notions - choosing the right solutions for solving practical problems	Written final exam	40
11.5 Seminary/laboratory/project	- knowledge of the information presented in the laboratory - knowledge of the correct use of equipment	Oral, after each lab	15
	theoretical knowledge presented in the laboratory	Written examination	15
11.6 Passing conditions			

- Promoting the laboratory (obtaining at least 50% of the assigned points allocated to the laboratory)
- 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 content of the subject is created and continuously updated based on consultations with representatives of the business environment in Romania and trends in the field.

The practical applications presented are made by studying equipment from different reputable manufacturers.

Date	Course lecturer	Instructor(s) for practical activities
25.09.2025	Conf. Dr. Vlad-Cristian Georgescu	Conf. Dr. Vlad-Cristian Georgescu

Date of department approval	Head of department
26.09.2025	Conf. Dr. Bogdan Cristian Florea

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