SYLLABUS

1. Program Information

1.1 Higher education institution	Technical University of Cluj-Napoca
1.2 Faculty	Faculty of Automation and Computer Science
1.3 Department	Department of Automation
1.4 Field of study	Automation, Applied Informatics and Intelligent Systems
1.5 Cycle of studies	Bachelor
1.6 Study Programme/Qualification	Intelligent Automation Systems (dual, in English language)
1.7 Form of education	IF – full-time education
1.8 Course code	18.0

2. Course information

2.1 Course title				**Measurement and transducers**		
2.2 Course lecturer				*PhD. Eng. Nicoleta Stroia – nicoleta.stroia@aut.utcluj.ro*		
2.3 Seminar / Laboratory / Project Lecturer				*Eng. Daniel Stoica (Emerson)*		
2.4 Year of study	2	2.5 Semester	1	2.6 Type of assessment		
2.7 Course status	Formative category *(DF, DS, DC)*					DF
	Optionality *(DOB, DOP, DFac)*					DOB

3.Total estimated time

3.1 Number of hours per week	4	of which:	HEI	Lecture	2	Seminar		Laboratory		Project	
			CO		0		0		2		
3.2 Number of hours per semester	56	of which:	HEI	Lecture	28	Seminar		Laboratory		Project	
			CO		0		0		28		

3.3 Distribution of time allocation (hours per semester) for:	HEI	CO
(a) Study based on textbook, course support, bibliography, and notes	10	10
(b) Additional documentation in library, specialized electronic platforms, and fieldwork	9	5
(c) Preparation of seminars/laboratories, assignments, papers, portfolios and essays	0	5
(d) Tutoring	0	0
(e) Examinations	3	2
(f) Other activities:	0	0
3.4 Total individual study hours (sum (3.3(a)... 3.3(f)))	22	22
3.5 Total hours per semester (3.2+3.4)	50	50
3.6 Number of credits per semester	2	2

(HEI = Higher Education Institution, CO = Company)

4. Prerequisites (where applicable)

4.1 Curriculum Prerequisites	• Fundamentals of Electronic Circuits
4.2 Competency Prerequisites	• Basics of electronic circuits

5. Conditions (where applicable)

5.1. Course Organization Conditions	• Blackboard • Multimedia projector • PC
5.2. Seminar / Laboratory / Project organization conditions	• Laboratory room equipped with computers, network, Internet connection, specialized software, video projector, whiteboard/blackboard/smart board • Mandatory attendance

6. Specific Competencies Acquired

Professional Competencies	• PC02 Analyse test data • PC08 Design automation components • PC10 Develop electronic test procedures • PC20 Record test data • PC25 Use technical drawing software • PC28 Use testing equipment • PC31 Use remote control equipment
Transversal Competencies	• TC01 Apply knowledge of science, technology and engineering • TC02 Think analitically

7. Learning outcomes

Knowledge:	• The student/graduate describes, identifies, and summarizes concepts and methods related to systems in general, as well as to measurement techniques, electrical and electronic engineering and their application to concrete problems, using specific mathematical and physical tools.
Skills:	• The student/graduate explains the tasks to be solved, argues the solutions in systems engineering based on the principles of mathematics and the laws of physics and uses the basic components in the field and the techniques for measuring electrical and non-electrical quantities. • The student/graduate applies techniques, principles of physics and appropriate mathematical methods to solve common problems in systems engineering, with an emphasis on numerical calculation methods. • The student/graduate selects and applies specific scientific methods and techniques in the development and implementation of projects in the field of electrical systems engineering and analyzes the level of scientific documentation and the potential advantages and disadvantages of the proposed methods and procedures.
Responsibility and autonomy:	• The student/graduate carries out processes in electrical engineering project management, taking on different roles in the team and clearly and concisely describing the results, verbally and in writing.

8. Course Objectives

8.1 General objective of the course	• To provide students with the theoretical and practical knowledge necessary to understand, design, and implement basic measurement systems
8.2 Specific objectives	• Identify and describe a measurement problem • Analyse and interpret measurement results • Implement simple measurement setups • Use measurement intrumentation • Select appropriate sensors, processing units and comunication protocols • Integrate sensors into embedded systems • Use debugging techniques for embedded measurement systems

9. Contents

9.1 Lectures	No. of hours	Teaching methods	Obs.
Introduction to measurement, sensors and transducers, measurement systems	2	Presentations, discussions, demos	
Sensors (resistive, capacitive, inductive)	2		
Sensors (thermoelectric, piezoelectric, semiconductor-based)	2		
Signal conditioning	2		
Analog to digital converters (sampling, quantization, ADC types)	2		
Measurement instruments	2		
Integration of sensors into embedded systems (sensor interfacing and data acquisition)	2		
Integration of sensors into embedded systems (data processing and analysis)	2		
Communication protocols for interfacing embedded measur ement systems	2		
Debugging techniques for embedded measurement systems	2		
Embedded measurement system – demo application I	2		
Embedded measurement system – demo application II	2		
Applications of embedded systems and sensor interactions	4		
Bibliography [1] P.P.L. Regtien. Electronic Instrumentation, 2017, Delft Academic Press, http://resolver.tudelft.nl/uuid:51bca43e-2b53-47c1-b7ae-be108c8634c4 [2] D.Moga, P.Dobra, Smart Sensor Systems, Mediamira, 2006. [3] J. Webster (editor). Measurement, Instrumentation and Sensors Handbook. CRC Press, 1999 [4] W. Nawrocki. Measurement Systems and Sensors. Artech House, 2016			

9.2 Seminar / laboratory / project	Hours HEI	Hours CO	Teaching methods	Obs.
Introduction to measurement, sensors and transducers, measurement systems		4	Examples, simulations, practical applications	
Simulation of analog sensors		4		
Analysis of sensor characteristics through simulation		4		
Usage of measurement instruments		4		
Interfacing with embedded functionality in smart measurement instruments/systems		4		
Embedded code development in manufacturer-specific environments. Examples of sensor interfacing and data acquisition		4		
Communication protocols for interfacing embedded measurement systems. Debugging techniques for embedded measurement systems		4		
Bibliography [1] P.P.L. Regtien. Electronic Instrumentation, 2017, Delft Academic Press, http://resolver.tudelft.nl/uuid:51bca43e-2b53-47c1-b7ae-be108c8634c4 [2] J.W. Valvano. Embedded Systems: Introduction to ARM Cortex-M Microcontrollers, 2014, Volume 1, 5th Edition, https://users.ece.utexas.edu/~valvano/ [3] Mathworks, Inc. Embedded Coder User's Guide, https://www.mathworks.com/help/pdf_doc/ecoder/ecoder_ug.pdf				

[4] T. Karvinen, K. Karvinen, V. Valtokari. Make: Sensors. Projects and Experiments to Measure the World with Arduino and Raspberry Pi, 2014, Maker Media, Inc.

10. Correlation of course content with the expectations of the epistemic community representatives, professional associations, and major employers in the field related to the program

The course content is aligned with other technical universities programs and provides the necessary knowledge to deal with industry and employers requirements for measurement and measurement systems.

11. Evaluation

Activity Type	**Evaluation criteria**	**Evaluation methods**	**Weight in final grade**
11.1 Lecture	Conceptual understanding, applied knowledge, problem-solving, analysis	Written exam (E)	50%
11.2 Seminar/ Laboratory/Project	Practical skills, conceptual explanation, troubleshooting and debugging, use of tools	Written tests and practical applications (L)	50%
11.3 Minimum Performance Standard			
E ≥ 5, L ≥ 5 mandatory to be able to take the final exam Final grade (0.5E + 0.5L) ≥ 5			

Date of completion:	Lecturers		Signature
15.09.2025	Course	PhD. Eng. Nicoleta Stroia	

Date of approval by the Department of Automation Council 24.11.2025 _____	Director of the Department of Automation Prof.dr.eng. Honoriu VĂLEAN
Date of approval by the Faculty of Automation and Computer Science Council 28.11.2025 _____	Dean Prof.dr.eng. Vlad MUREȘAN