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	28.10

2. Course information

2.1 Course title					**Microsystems and Data Acquisition**	
2.2 Course lecturer					*Prof. Eng. Silviu FOLEA, PhD – Silviu.Folea@aut.utcluj.ro*	
2.3 Seminar / Laboratory / Project Lecturer					*Drd.Ing. Eliza Olariu (Emerson)*	
2.4 Year of study	2	2.5 Semester	2	2.6 Type of assessment		E
2.7 Course status	Formative category *(DF, DS, DC)*					DS
	Optionality *(DOB, DOP, DFac)*					DOP

3.Total estimated time

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

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	10	10
(c) Preparation of seminars/laboratories, assignments, papers, portfolios and essays	0	20
(d) Tutoring	0	4
(e) Examinations	2	3
(f) Other activities:	0	0
3.4 Total individual study hours (sum (3.3(a)... 3.3(f)))	22	47
3.5 Total hours per semester (3.3+3.4)	50	75
3.6 Number of credits per semester	2	3

(HEI = Higher Education Institution, CO = Company)

4. Prerequisites (where applicable)

4.1 Curriculum Prerequisites	N/A
4.2 Competency Prerequisites	• Analog and digital signal acquisition system architectures, signal conditioning circuitry, signal generators, sensors and transducers, microcontrollers, and industrial equipment programming.

5. Conditions (where applicable)

5.1. Course Organization Conditions	• Room with computers, NI LabVIEW™, and equipment for hands-on.
5.2. Seminar / Laboratory / Project organization conditions	• Attendance is mandatory.

6. Specific Competencies Acquired

Professional Competencies	• PC02 Analyse test data • PC08 Design automation components • PC09 Design prototypes • PC19 Prepare production prototypes • PC20, Record test data • PC26 Use information technology tools • PC30 Design control systems
Transversal Competete	• TC01 Apply knowledge of science, technology and engineering • TC05 Interpret mathematical information

7. Learning outcomes

Knowledge:	• The student will be able to **describe and summarize** the principles and components of data acquisition systems, including sensors, signal conditioning, and data interfaces. • The student will be able to **identify and explain** the use of NI LabVIEW™ software in developing data acquisition applications.
Skills:	• The student will be able to **apply data acquisition and signal processing techniques** using NI LabVIEW™. • The student will be able to **design and implement** data collection, visualization, and analysis modules for real-world industrial systems.
Responsibility and autonomy:	• The student will be able to **collaborate with colleagues** to address data acquisition challenges and propose improvements. • The student will be able to **assume responsibility** for ensuring the quality and reliability of measurement and analysis applications in industrial environments.

8. Course Objectives

8.1 General objective of the course	• Understand the concept of virtual instrumentation, of analog and digital signal acquisition systems.
8.2 Specific objectives	• Knowledge of NI LabVIEW™ specific programming techniques. Implementing programs using graphical programming. Accomplishment of analog and digital signal acquisition from sensors. Implementing control structures using NI LabVIEW™, with industrial equipment or instruments.

9. Contents

9.1 Lectures	No. of hours	Teaching methods	Obs.
1. Course Guide (*8*). Introduction to NI Tools (*23*). NI LabVIEW Add-Ons (*6*). Navigating NI LabVIEW™ (*35*). Creating Your First Application (*39*).	2	Projector presentations	
2. NI MAX and NI-DAQmx Express VI (*51*). Troubleshooting and Debugging VIs (*29*).	2		
3. NI-DAQmx API, Finite Sample (*34*).	2		

NI-DAQmx API, Continuous Sample (*15*). Using Loops (*39*).			
4. Creating and Leveraging Data Structures (*64*).	2		
5. Using Decision-Making Structures (*26*). Modularity (*30*). File I/O (*22*). Sequential and State Machine Programming (*25*).	2		
6. Using Variables (*17*). Communicating Data Between Parallel Loops (*21*). Implementing Design Patterns (*21*).	2		
7. Controlling the User Interface (*23*).	2		
8. Creating and Distributing (*41*).	2		
9. NI LabVIEW and Third-Party Software Integration - MATLAB and Python (*42*).	2		
10. NI LabVIEW™ and Third-Party Hardware Integration - Raspberry Pi and Arduino (*23*).	2		
11. Add-Ons: Statechart; MathScript.	2		
12. Add-Ons: Process Identification; Control and simulation.	2		
13. Industrial applications of the technologies presented, part I.	2		
14. Industrial applications of the technologies presented, part II.	2		

Bibliography

1. National Instruments, „NI LabVIEW™ for Academia Course", Course Software Version 2024, December 2024 Edition, 480 pg., digital format.
2. Robert H. Bishop, National National Instruments, „LabVIEW 2009 Student Edition", Prentice Hall, 2009, Bibl. UTC-N 536.027.
3. John Essick, „Hands-On Introduction to LabVIEW for Scientists and Engineers", Oxford University Press, 2008, Bibl. UTC-N 536.028.
4. Peter A. Blume, „The LabVIEW Style Book", Prentice Hall, 2007, Bibl. UTC-N 541.283.
5. Ronald Larsen, „LabVIEW for Engineers", Prentice Hall, 2010, Bibl. UTC-N 541.295.
6. Stephen Philip Tubbs, „LabVIEW for Electrical Engineers and Technologists", Stephen Philip Tubbs, 2011, Bibl. UTC-N 535.886.

9.2 Seminar / laboratory / project	Hours HEI	Hours CO	Teaching methods	Obs.
1. Introduction. Signal Acquisition with Express VIs.		2	Practical activities on the equipment, the development of software applications	
2. Signal Acquisition with NI DAQmx Drivers. Signal filtering.		2		
3. Modular applications with SubVIs. Signal Generators.		2		
4. Serial Data Transmission. Storing Measurement Data.		2		
5. Design a Control System in NI LabVIEW™.		2		
6. Signal Acquisition with NI myRIO™.		2		
7. Practical exam.		2		

Bibliography

1. Silviu Folea, „Microsystems and Data Acquisition using LabVIEW™", practical applications, UTPRESS, 2024, 106 pg., ISBN 978-606-737-709-5, online.
2. Ed Doering, „NI myRIO Project Essentials Guide", 2013 National Technology and Science Press, download the latest version at http://www.ni.com/myrio/project-guide.

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 topics presented at this course are specialized ones; they are included in other universities' curricula. The NI LabVIEW™ graphical programming environment is used in industrial testing, measurement and control applications.

11. Evaluation

Activity Type	**Evaluation criteria**	**Evaluation methods**	**Weight in final grade**
11.1 Lecture	Acquired theoretical knowledge	Written exam	50 %
11.2 Seminar/ Laboratory/Project	Acquired practical skills	Practical exam	50 %
11.3 Minimum Performance Standard			
Final exam >= 5 Lab grade >= 5 mandatory to be able to take the final exam 50% Final exam + 50% Lab Grade > 5			

Date of completion: 16.05.2025	Lecturers		Signature
	Course	Prof. Eng. Silviu FOLEA, PhD	

Date of approval by the Department of Automation Council 24.11.2025	Director of the Department of Automation Prof. Eng. Honoriu VĂLEAN, PhD
Date of approval by the Faculty of Automation and Computer Science Council 28.11.2025	Dean Prof. Eng. Vlad MUREȘAN, PhD