SYLLABUS

1. Data about the program of study

1.1	Institution	Technical University of Cluj-Napoca
1.2	Faculty	Faculty of Electrical Engineering
1.3	Department	Electrotechnics and Measurements
1.4	Field of study	Electrical Engineering
1.5	Cycle of study	Bachelor of Science
1.6	Program of study/ Qualification	Electrical System Cluj-Napoca in English language
1.7	Form of education	Full time
1.8	Subject code	50

2. Data about the subject

2.1	Subject name			Virtual Instrumentation		
2.2	Course responsible/ lecturer			*Conf. Dr. ing Holonec Rodica – rodica.holonec@ethm.utcluj.ro*		
2.3	Teachers in charge of Seminars/ Laboratory/ Project			*Conf. Dr. ing Holonec Rodica – rodica.holonec@ethm.utcluj.ro*		
2.4 Year of study	III	2.5 Semester	2	2.6 Type of assessment *(E – exam, C – colloquium, V – verification)*	C	
2.7 Subject category	*DF – fundamental, DD – in the field, DS – specialty, DC – complementary*				DS	
	DI – compulsory, DO – elective, Dfac – optional				DI	

3. Estimated total time

3.1 Number of hours per week:	5	of which	3.2 Course	2	3.3 Seminar		3.3 Laboratory	2	3.3 Project	1
3.2 Total hours per semester	70	of which	3.5 Course	28	3.6 Seminar		3.6 Laboratory	28	3.6 Project	14

3.7 Individual study:	
(a) Manual, lecture material and notes, bibliography	10
(b) Supplementary study in the library, online and in the field	5
(c) Preparation for seminars/laboratory works, homework, reports, portfolios, essays	10
(d) Tutoring	2
(e) Exams and tests	3
(f) Other activities	

3.8 Total hours of individual study *[sum (3.7(a) to 3.7(f))]*	30
3.9 Total hours per semester *[sum of 3.4 and 3.8]*	100
3.10 Number of credit points	4

4. Prerequisites (where applicable)

4.1	Curriculum	Electronics, Electrical and Electronic Measurements, Computer Programming, and Programming Languages
4.2	Competences	Basic computer operation knowledge, Basic software programming knowledge, Basic English language skills

5. Requirements (where appropriate)

5.1	For the course	Video projector, Whiteboard

5.2	For the applications	Attendance at the laboratory is mandatory

6. Specific competences

Professional competences	C4. Development and use of specific software packages for applications in metrology and measurement systems: C4.1 Identifying programming languages and environments specific to data acquisition and tele-measurement. C4.2 Solving problems in the field of metrology and interpreting their solutions, using basic knowledge of computer operation and programming. C4.4 Evaluating and assessing the quality of programs used to solve metrology-related problems. C4.5 Developing computer programs for metrological applications. C5. Acquiring and processing informational signals from industrial processes: C5.1 Proper selection of methods and tools for measuring electrical and non-electrical quantities in signal acquisition, processing, and transmission in a process. C5.2 Explaining the capture, conditioning, interfacing, and acquisition of various quantities in a process using basic knowledge. C5.3 Using fundamental principles and methods to configure data acquisition and processing systems. C5.5 Developing data acquisition system projects using appropriate instrumentation.
Cross competences	CT1: Identifying objectives, available resources, completion conditions, work stages, timelines, deadlines, and associated risks. CT2: Identifying roles and responsibilities within a multidisciplinary team and applying efficient collaboration and teamwork techniques. CT3: Efficiently using information sources and communication resources (Internet portals, specialized software applications, databases, online courses, etc.) in Romanian and an international language.

7. Discipline objectives (based on specific competencies acquired)

7.1	General objective	Developing competencies in virtual instrumentation to support professional training
7.2	Specific objectives	1. Acquiring programming skills for basic algorithms used in virtual instrument applications. 2. Gaining skills in developing applications in virtual instrumentation using specific programs for signal acquisition and processing (LabVIEW - National Instruments).

8. Contents

8.1. Course (Lectures)		Number of hours	Teaching methods	Additional remarks
1	Instrumentation Systems: Definitions, Classifications, Evolution. Virtual Instrumentation - definition. Control Systems	2	PowerPoint slides, Q&A, Discussions, Online quizzes, exercises, problems	
2	Basics of Virtual Instrumentation: Data acquisition, analysis, and presentation. Configuration examples in instrumentation systems. Applications	2		
3	Software for Virtual Instrumentation: Creating, editing, and debugging a virtual instrument in	2		

	LabVIEW. Sub-instruments. While Loop, For Loop, Shift Registers, Waveform Charts			
4	Basics in LabVIEW: Data arrays, array operators, waveform charts	2		
5	Basics in LabVIEW: Structures – Case, Sequence, Event, Formula Node	2		
6	Basics in LabVIEW: Strings, Clusters, I/O strings and files.	2		
7.	LabVIEW Project Architectures: Task parallelism, local/global variables, property nodes	2		
8	Components of a data acquisition system with virtual instrumentation: Signal types, examples	2		
9	Signal Conditioning: Methods and circuits for interfacing sensors and control devices with acquisition systems, using virtual instrumentation.	2		
10	Devices for data acquisition and processing: Structure, technology, multiplexers, sampling-hold circuits	2		
11	Sampling: The sampling theorem, aliasing, practical considerations. ADCs and DACs in data acquisition systems	2		
12	Analog signal generation and reading: Configuration parameters for practical applications using NI myDAQ and NI ELVIS	2		
13	Digital signal generation and reading: Configuration parameters for practical applications using NI myDAQ and NI ELVIS.	2		
14	Introduction to embedded projects with NI myRIO: Hardware and software integration.	2		

Bibliography

[1] Rodica Holonec Instrumentație virtuala-Note de curs-format electronic

[2] Holonec, Rodica, Radu Munteanu, Jr., Aplicații ale instrumentației virtuale în metrologie electrică, Mediamira Cluj-Napoca, 2003,

[3] Munteanu, R.jr, Tont Gabriela, Holonec, Rodica, Traductoare pentru sisteme de măsurare, Mediamira Cluj-Napoca, 2003

[4] Cristian Foşalău, Introducere în instrumentația virtuală, Editura CERMI Iaşi, 2010

[5] Jon B. Olansen, Eric Rosow-Virtual Bio Instrumentation Biomedical, Clinical, and Healthcare Applications in LabVIEW, 2011

[6] Thomas J. Bress Effective LabVIEW Programming, NTS Press, 2013

8.2. Applications - Laboratory/Project		Number of hours	Teaching methods	Additional remarks
1	LabVIEW Programming Environment: Basics. Implementing a Virtual Instrument (VI).	3	Collaborative computer-based exercises, Q&A Individual implementat	
2	Measurements using the NI-ELVIS workstation and virtual tools from the NI ELVIS library	3		
3	Debugging a VI: Creating sub-VIs. Analog signal generation and reading (one sample). Virtual thermometer.	3		
4	While Loop and For Loop structures. Timing, Waveform charts, shift registers	3		

5	Data Arrays: Creation, operations. Waveform Graphs. Intensity Graphs	3	ion on computers	
6	Digital signal generation and reading: Studying a circuit using a photoresistor. XY Graphs	3		
7	Clusters: Scaling clusters.	3		
8	Case Structure: Virtual instrument for controlling a 7-segment display. Digital voltmeter	3		
9	Sequence Structure. Formula Node	3		
10	Strings: File reading/writing. Reading a song.	3		
11	Data acquisition systems: Multi-sample acquisition (N samples). Data acquisition with NI-DAQmx.	3		
12	Sampling theorem and aliasing: Signal processing and analysis with express.vi tools.	3		
13	Using the NI myRIO board in virtual instrumentation applications.	2		
14	Recap exercises and problems	4		

Bibliography

[1] Rodica Holonec, Radu Adrian Munteanu, Romul Copîndean, Florin Drăgan, Instrumentație virtuală: lucrări de laborator, UT Press, 2018 Cluj-Napoca
[2] Holonec, Rodica, Radu Munteanu, Jr. – Aplicaţii ale instrumentației virtuale în metrologie electrică, Editura Mediamira Cluj-Napoca, 2003, România,
[3] Cristian Foşalău Introducere în instrumentația virtuală Editura CERMI, Iasi 2010
[4] National Instruments, LabVIEW Fundamentals, August 2005.
[5] National Instruments, Getting Started with LabVIEW, August 2006
[6] Jovitha Jerome, Virtual Instrumentation using LabVIEW New Delhi-110001, 2010
[7] National Instruments, LabVIEW Basics I Introduction Course Manual, May 2006
[8] National Instruments, LabVIEW Basics II Development Course Manual, September, 2007 Edition
[9] MyRIO project essentials_guide, 2020 Edition

9. Alignment of course content with expectations of the epistemic community, professional associations, and representative employers in the field

The competencies acquired will be essential for employees involved in designing, simulating, and testing systems using hardware and software elements of virtual instrumentation.

10. Assessment

Activity type	10.1 Assessment criteria	10.2 Assessment methods	10.3 Weight in the final grade (%)
10.4 Course	Solving a multiple-choice test. Solving numerical problems related to virtual instrumentation.	Written exam	80%
10.5 Laboratory	Practical application of learned knowledge in different contexts. Problem-solving through creativity and originality.	Solution verification and application testing	20%
10.5 Project			
10.6 Minimum standard of performance: Understanding basic concepts and terminology; Solving problems. Final Grade Calculation: 80% final exam + 20% laboratory. Passing Condition: Final grade ≥ 5.			

Date of completion	Lecturers	Title/ Surname/ Name:	Signature
September 2024	Course	Conf. Dr. ing Rodica Holonec	
	Applications Seminar/ Laboratory/ Project	Conf. Dr. ing Rodica Holonec	

Date of approval in the ETHM Department Council September 2024	**Head of Department:** Prof. Eng. MICU Dan Doru, PhD
Date of approval in the Faculty of Electrical Engineering Council September 2024	**Dean:** Assoc. Prof. Eng. CZIKER Andrei, PhD