



SYLLABUS

1. Data about the program of study

1.1 Institution	Technical University of Cluj-Napoca
1.2 Eaculty	Faculty of Electronics, Telecommunications and information
1.2 Faculty	Technology
1.3 Department	Applied Electronics
1.4 Field of study	Electronic Engineering, Telecommunications and Information
1.4 Field of Study	Technologies
1.5 Cycle of study	Bachelor of Science
1.6 Program of study / Qualification	Applied Electronics / Engineer
1.7 Form of education	Full time
1.8 Subject code	48.00

2. Data about the subject

2.1 Subject name		Virtua	Virtual Instrumentation					
2.2 Subject area		Superv	Supervisory Control and Data Acquisition					
2.3 Course responsible	e		Assoc. Prof. Gabriel CHINDRIS, PhD. Eng. – gabriel.chindris@ael.utcluj.ro					
2.4 Teacher in charge laboratory / project	witł	n seminar /	Assist. Prof. Ionel BACIU, PhD Eng. – <u>ionel.baciu@ael.utcluj.ro</u>			uj.ro		
2.5 Year of study	IV	2.6 Semeste	r	1	2.7 Assessment	۷	2.8 Subject category	DS/DI

3. Estimated total time

3.1 Number of hours per week	4	of which:	3.2 course	2	3.3 seminar / laboratory	2
3.4 To Total hours in the curriculum	56	of which:	3.5 course	28	3.6 seminar / laboratory	28
Distribution of time						
Manual, lecture material and notes, bibliography						
Supplementary study in the library, online specialized platforms and in the field						10
Preparation for seminars / laboratories, homework, reports, portfolios and essays						14
Tutoring						
Exams and tests						3
Other activities:						0
3.7 Total hours of individual study 44						

3.8 Total hours per semester1003.9 Number of credit points4

4. Pre-requisites (where appropriate)

4.1 curriculum	Passive and active electronic devices; Analog and Digital electronics fundamentals.
4.2 competence	Fundamentals of data acquisition systems, A/D and D/A conversion systems, microcontroller/microprocessor systems and programming fundamentals, graphical representation of data, beginner skills in using computers and peripherals.





5. Requirements (where appropriate)

5.1. for the course	Amphitheatre, TUCN
5.2. for the seminars / laboratories / projects	Laboratory, TUCN

6. Specific competences

Professional competences	 C2. To apply basic methods for signal acquisition and processing C2.1 Temporal, spectral and statistical characterization of signals C2.2 Explaining and interpreting the methods of acquisition and processing of signals C2.3 Use of simulation environments for signal analysis and processing C2.4 Use of the specific method and tools for signal analysis C3. To apply knowledge, concepts and basic methods regarding computing systems' architecture, microprocessors, microcontrollers, programming languages and techniques C3.3 Solving concrete practical problems including elements of data structures and algorithms, programming and use of microprocessors or microcontrollers C3.4 Development of programs for a general and / or specific programming language, starting from the specification of the requirements and until the execution, debugging and interpretation of the results in correlation with the processor used C3.5 Projects involving hardware (processors) and software (programming) components
Cross competences	N.A.

7. Discipline objectives (as results from the key competences gained)

7.1 General objective	Developing competences in Virtual Instrumentation.
7.2 Specific objectives	 Recognizing and understanding basic concepts specific to SCADA. Developing skills and abilities necessary for the use of SCADA. Developing skills and abilities for acquire, analyze and present experimental data.

8. Contents

8.1 Lecture (syllabus)	Teaching methods	Notes
1. Course description. SCADA and Virtual Instrumentation.	Duccontation	lies of ant
2. Open loop control systems, closed loop control systems.	Presentation,	Use of .ppt
3. P-PI-PID control systems.	neuristic	presentation,
4. SCADA: architectures.	exemplification	whiteboard
5. Industrial sensors and transducers for temperature.		winteboard.





6. Signal conditioning for temperature measurements:	problem				
evaluation of performance and error.	presentation,				
7. Actuators and DC/AC motors control.	teaching				
8. Advanced A/D techniques: dithering and interpolation.	exercise, case				
Sources of error in A/D systems.	study, formative				
9. Embedded SCADA architectures.	evaluation.				
10. Real-time programming techniques for SCADA.					
11. Network distributed computing for industrial control.					
12. SCADA software design. Safety in SCADA.					
13. SCADA applications review.					
14. Recapitulation. Preparation for the final exam.					
Bibliography					
1.Gabriel Chindris, Horia Hedesiu – Proiectarea grafica a sisten	nelor de control pentru	aplicatii			
industriale, Ed. Mediamira, ISBN 978-973-713-242-0, Cluj-Napo	oca, 2009;				
2.George C. Barney – Intelligent Instrumentation – ISBN 0-13-4	68216 (2001)				
3. Richard C. Dorf – Modern Control Systems - ISBN 0-13-14573	33-0 (2005)	-			
8.2 Seminar / laboratory / project	Teaching methods	Notes			
1. Introduction. Safety measures in SCADA lab.					
2. LabVIEW intro.					
3. LabVIEW loops.					
4. LabVIEW data types.					
5. I/O and files in LabVIEW.	Didactic and	Use of laboratory			
6. Data acquisition in LabVIEW.	Didactic and	Instrumentation,			
7. Half semester laboratory test. (test T1)	experimental	experimental			
8. Acquire, analyze and present: LabVIEW.	didactic exercise,	podrus,			
9. Matlab/Simulink interfaces.		white/magnetic			
10. Real-time and network distributed programming.		hoard			
11. Industrial networks and LabVIEW.		board			
12. UI & UX design.					
13. End of semester laboratory test. (test T2)					
14. Laboratory work recovery and finalization of activity					
Bibliography					
1. Ionel Horea Baciu, Alexandra Fodor – Instrumentatie Virtuala – support teoretic pentru lucrările de					
laborator					
2. Mahesh L. Chugani – LabVIEW Signal Processing - ISBN 0-13-972449-4 (2001)					
3. National Instruments Corp – LabVIEW Core 1 Course Manua	Part Number 325290	A-01 October			
	, 1 art Hamber 525250				
2009 Edition	, i al citaling ci 323230				

2009 Edition

9. Bridging course contents with the expectations of the representatives of the community, professional associations and employers in the field

The discipline content and the acquired skills are in agreement with the expectations of the professional organizations and the employers in the field, where the students carry out the internship stages and/or occupy a job in the field of industrial process control and monitoring and the expectations of the national organization for quality assurance (ARACIS).

As a result of bridging course content with professional associations and employers in the field, National Instruments Inc. is granting for each student a free one year SW license is provided (NI LabVIEW, 1000





EUR/user) and a free CLAD exam presentation (Certified LabVIEW Application Developer – NI professionals: 500 EUR/student).

10. Evaluation

	10.1 Association	10.2 Assessment	10.3 Weight in			
Activity type		methods	the final grade			
10.4 Course	The level of acquired theoretical knowledge	Summative evaluation	40%			
	and practical skills	written exam (E)	40%			
10.5 Seminar/		- Continuous formative				
Laboratory	The level of acquired knowledge and abilities	Evaluation and practical	60%			
		lab tests T1 and T2;				
10.6 Minimum st	andard of performance					
Quality level:						
Minimum knowl	edge:					
✓ Knowled	ge of open/closed loop control systems					
✓ Knowled	ge of P-PI-PID control systems					
🗸 Knowled	ge of signal conditioning and biasing of industria	al sensors/transducers				
 Knowled 	ge of LADDER diagrams, state-machine diagram	S				
🗸 Knowled	ge of fundamentals of designing SCADA microsy	stems, implementing safe	ety procedures in			
industria	l control					
Minimum compe	etences:					
✓ To be ab	le to design a closed loop control system					
✓ Design a	biasing/signal conditioning circuitry for thermo	couples, thermistors, RTD	and IC Sensors			
✓ Design a	closed loop control system for DC, BLDC and AC	C-servo motors				
✓ U se the	lab instrumentation (data acquisition systems, r	eal-time systems, cRIO, P	XI and			
✓ LabVIEW	(); •					
Quantitative lev						
• 11,12≥	5 and $E \ge 5$ and $0,4E+0,311+0,312 \ge 4.5$					
The mini	mum standard performance should cover basic	knowledge in SCADA and	instrumentation			
and begi	nner level of proficiency for a LabVIEW user.					
Written	exam topics are scaled as follows:					
0	L topic for minimal standard performance;					
0	 1 topic with medium difficulty level; 					
0	Ladvance topic;					
The prace	tical laboratory work and tests are scaled as foll	OWS:				
0	Minimal standard performance is acquired by at and passing T1;	tending and completing A	LL lab activities			
0	[2 is aimed for medium and advanced users. Stil	I, it can be passed with m	inimal			
ŀ	nowledges acquired in previous steps.	•				

Date of filling in:	Responsible	Title Surname NAME	Signature
10.06.2025	Course	Assoc. Prof. Gabriel CHINDRIS, PhD Eng.	
		Assist. Prof. Ionel BACIU, PhD Eng.	





Date of approval in the Department of Applied Electronics	Head of Department Prof. Dorin PETREUS, PhD Eng.
18.06.2025	
Date of approval in the Council of Faculty of Electronics, Telecommunications and Information Technology	Dean Prof. Ovidiu Aurel POP, PhD Eng.
25.06.2025	

Universitatea Tehnică din Cluj-Napoca • Facultatea de Electronică, Telecomunicații și Tehnologia Informației Str. George Barițiu nr. 26-28, 400027, Cluj-Napoca, Tel: 0264-401224, Tel/Fax: 0264-591689, http://www.etti.utcluj.ro