SYLLABUS

1. Data about the program of study

1.1	Institution	Technical University of Cluj-Napoca
1.2	Faculty	Electronics, Telecommunications and Information Technology
1.3	Department	Applied Electronics
1.4	Field of study	Electronics and Telecommunications Engineering
1.5	Cycle of study	Bachelor of Science
1.6	Program of study/Qualification	Telecommunications Technologies and Systems/ Engineer
1.7	Form of education	Full time
1.8	Subject code	TST-E103.00

2. Data about the subject

2.1	Subject name					Virtual Instrumentation					
2.2	Subject area					Supervisory Control and Data Acquisition					
2.3	Course responsible/lecturer					Assoc. Prof. Gabriel Chindris, Ph.D					
2.4	Teachers in charge of applications					Assistant Prof. Rajmond Jano, Ph.D					
2.5	Year of study	III	2.6	Semester	1	2.7	Assessment	Exam	2.8	Subject category	DS/ FAC

3. Estimated total time

Year/ Sem.	Subject name	No. of weeks	Course	Applications			Course	Applications			Indiv. study	TOTAL	Credits
			[hours/week]				[hours/sem.]						
				S	L	P		S	L	P			
III / 1	Virtual Instrumentation	14	2		2		28		28		48	104	4

3.1	Number of hours per week	4	3.2	of which, course	2	3.3	applications	2
3.4	Total hours in the curriculum	56	3.5	of which, course	28	3.6	applications	28

Individual study	Hours
Manual, lecture material and notes, bibliography	20
Supplementary study in the library, online and in the field	-
Preparation for seminars/laboratory works, homework, reports, portfolios, essays	22
Tutoring	3
Exams and tests	3
Other activities	0

3.7	Total hours of individual study	48
3.8	Total hours per semester	104
3.9	Number of credit points	4

4. Pre-requisites (where appropriate)

4.1	Curriculum	N / A
4.2	Competence	Fundamentals of data acquisition systems, A?D and D/A conversion systems, microcontroller/microprocessor systems and programming fundamentals.

5. Requirements (where appropriate)

5.1	For the course	Amphitheatre, Cluj-Napoca
5.2	For the applications	Laboratory, Cluj-Napoca

6. Specific competences

Professional competences	Theoretical knowledge (what the student must know):	Open/closed loop control systems, P-PI-PID control systems, signal conditioning and biasing of industrial sensors/transducers, LADDER diagrams, state-machine diagrams, data-flow programming, industrial network design, fundamentals of designing SCADA microsystems, implementing safety procedures in industrial control.
	Acquired skills (what the student is able to do):	After completing the discipline, the students will be able to: - design a closed loop control system; - design a biasing/signal conditioning circuitry for thermocouples, thermisors, RTD and IC sensors; - design a closed loop control system for DC, BLDC and ACservo motors; - design safety circuits/procedures for industrial control; - design SCADA microsystems;
	Acquired abilities: (what type of equipment the student is able to handle)	After completing the discipline, the students will be able to: - use the lab instrumentation (data acquisition systems, real-time systems, cRIO, PXI and LabVIEW); - advanced use of LabVIEW; - design SCADA application in LabVIEW; - acquire, analyze and present experimental data; - store and analyze the numerical data obtained through experiments;
	In accordance with Grila1 and Grila2 RNCIS	C2. To apply basic methods for signal acquisition and processing C3. To apply knowledge, concepts and basic methods regarding computing systems' architecture, microprocessors, microcontrollers, programming languages and techniques
Cross competences (Grila1 and Grila2 RNCIS)		N.A.

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

7.1	General objectives	Developing the competences in Virtual Instrumentation.
7.2	Specific objectives	1. Recognizing and understanding basic concepts specific to SCADA. 2. Developing skills and abilities necessary for the use of SCADA. 3. Developing skills and abilities for acquire, analyze and present experimental data.

8. Content

8.1. Lecture (syllabus)		Teaching methods	Notes
1	Course description. SCADA and Virtual Instrumentation.	Presentation, heuristic conversation, exemplification, problem presentation, teaching exercise, case study, formative evaluation	Use of .ppt presentation, projector, blackboard
2	Open loop control systems, closed loop control systems.		
3	P-PI-PID control systems.		
4	SCADA: architectures.		
5	Industrial sensors and transducers for temperature.		
6	Signal conditioning for temperature measurements: evaluation of performance and error.		
7	Actuators and DC/AC motors control.		
8	Advanced A/D techniques: dithering and interpolation. Sources of error in A/D systems.		
9	Embedded SCADA architectures.		
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.		

8.2. Applications (lab)		Teaching methods	Notes
1	Introduction. Safety measures in SCADA lab.	Didactic and experimental proof, didactic exercise, team work	Use of laboratory instrumentation, experimental boards, computers, white/magnetic board
2	LabVIEW intro.		
3	LabVIEW loops.		
4	LabVIEW data types.		
5	I/O and files in LabVIEW.		
6	Data acquisition in LabVIEW.		
7	Lab test 1.		
8	Acquire, analyze and present: LabVIEW.		
9	Matlab/ Simulink interfaces.		
10	Real-time and network distributed programming.		
11	Industrial networks and LabVIEW.		
12	GUI design.		
13	Lab test 2		
14	Lab recovery and finalization of laboratory activity		

Bibliografie

1. Gabriel Chindriș, Horia Hedeșiu - Proiectarea Grafica a Sistemelor de Control Pentru Aplicatii Industriale – Editura Mediamira, ISBN 978-973-713-242-0, 160p., Cluj-Napoca, 2009
2. *** - LabVIEW User Guide

Materiale didactice virtuale

1. *** - LabVIEW Lessons for intermediate users.

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

Competences acquired will be used in the following COR occupations (Electronics Engineer; Telecommunications Engineer; Electronics Design Engineer; System and Computer Design Engineer; Communications Design Engineer) or in the new occupations proposed to be included in COR (Sale Support Engineer; Multimedia Applications Developer; Network Engineer; Communications Systems Test Engineer; Project Manager; Traffic Engineer; Communications Systems Consultant).

10. Evaluations

Activity type	10.1	Assessment criteria	10.2	Assessment methods	10.3	Weight in the final grade
Course		The level of acquired		- Summative evaluation		- E, max 10 pct

		theoretical knowledge and practical skills		written exam (theory)		40%
Applications		The level of acquired abilities		- Continuous formative evaluation - practical lab tests T1 and T2;		-T1, T2, max. 10 pct 60%
10.4 Minimum standard of performance						
T1,T2 ≥ 5 și E ≥ 5 și 0,4E+0,3T1+0,3T2 ≥ 4.5						

Date of filling in
1.10.2018

Course responsible
Assoc. Prof. Gabriel Chindris, PhD

Teachers in charge of applications
Assistant Prof. Rajmond Jano, PhD