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	39

2. Data about the subject

2.1	Subject name			DAQ and Interfaces	
2.2	Course responsible/ lecturer			L. PhD. Eng. Calin Muresan – calin.muresan@ethm.utcluj.ro	
2.3	Teachers in charge of Seminars/ Laboratory/ Project			L. PhD. Eng. Calin Muresan – calin.muresan@ethm.utcluj.ro	
2.4 Year of study	3	2.5 Semester	1	2.6 Type of assessment *(E – exam, C – colloquium, V – verification)*	E
2.7 Subject category	*DF – fundamental, DD – in the field, DS – specialty, DC – complementary*				DD
	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	1	3.3 Laboratory	2	3.3 Project	0
3.2 Total hours per semester	70	of which	3.5 Course	28	3.6 Seminar	14	3.6 Laboratory	28	3.6 Project	0

3.7 Individual study:	
(a) Manual, lecture material and notes, bibliography	20
(b) Supplementary study in the library, online and in the field	20
(c) Preparation for seminars/laboratory works, homework, reports, portfolios, essays	20
(d) Tutoring	10
(e) Exams and tests	10
(f) Other activities	

3.8 Total hours of individual study *[sum (3.7(a) to 3.7(f))]*	80
3.9 Total hours per semester *[sum of 3.4 and 3.8]*	150
3.10 Number of credit points	6

4. Prerequisites (where applicable)

4.1	Curriculum	Electrical measurements, Electronic devices and circuits
4.2	Competences	

5. Requirements (where appropriate)

5.1	For the course	The course is held in Cluj-Napoca
5.2	For the applications	The applications are held in Cluj-Napoca

6. Specific competences

		Ability to analyze, design, implement and integrate complex procurement systems and data transmission
Professional competences		Explanation of the means and methods of measurement, as well as the way of operating instruments, devices and installations for measuring various technical quantities
		The design of electrical installations to include measuring devices and digital data acquisition systems
		Application of the basic principles of measurement and data acquisition techniques for determining electrical and non-electrical quantities in electrical systems
		Appropriate use of measuring devices and data acquisition systems for performance evaluation and monitoring of electrical systems
Cross competences		Identification of the objectives to be achieved, the available resources, the conditions for their completion, work stages, working times, deadlines and related risks
		Responsible execution of professional duties.
		Identifying roles and responsibilities in a multidisciplinary team and applying communication techniques and effective work within the team
		The ability to work in inter- and multi-disciplinary teams, to communicate effectively and to understand professional and ethical responsibilities. (Communication and teamwork.)
		The efficient use of information sources and communication resources and assisted professional training (Internet portals, specialized software applications, databases, online courses, etc.) both in Romanian and in a language of international circulation
		Aware of the need for continuous training.

7. Discipline objectives (based on specific competencies acquired)

7.1	General objective	The use of data acquisition systems and their programming
7.2	Specific objectives	Explanation on the operation of data acquisition systems, architectures, signal conditioning circuits, multiplexers, analog-to-digital and digital-to-analog converters, sampling and storage circuits, analog signal reconstruction, quantization noise reduction, oversampling, interfaces and specialized acquisition software of data.

8. Contents

8.1. Course (Lectures)		Number of hours	Teaching methods	Additional remarks
1	Architecture of data acquisition systems. Parallel and serial interfaces, RS232, RS485, USB.	2	Teaching is done interactively using multimedia equipment simultaneously with the use of the whiteboard for deducing relationships	
2	Acquisition of rapidly varying quantities, acquisition of distant quantities, gain setting, synchronous acquisition of multiple signals	2		
3	Signal conditioning circuits for passive and active sensors	2		
4	Digital to analog converters with weighted currents and R-2R resistor network.	2		
5	Applications: programmable voltage and current sources	2		

6	Applications: arbitrary shape generators; volume, contrast and brightness control; breaking frequency numerical control for active filters; numerically controlled RC networks	2	and explanations	
7	Analog to Digital Converters: parallel, with successive approximations (SAR), with integration, voltage to frequency converters.	2		
8	Metrology of A-N and N-A converters, quantization by rounding and truncation, quantization noise, unipolar and bipolar codes, characteristics and parameters of converters	2		
9	Signal sampling, sampling theorem. Correlation of ADC resolution with sampling frequency, characteristics of a sampling-memory circuit.	2		
10	Reconstruction of analog signals, reduction of quantization noises, oversampling	2		
11	Switching of analog input signals, fundamental switching schemes, operation of electronic switches, time multiplexing of signals, analog and digital multiplexing circuits.	2		
12	Multichannel data acquisition systems. PCI and USB data acquisition boards.	2		
13	Unified voltage and current signals, 4-20 mA current loop. Ways to connect the voltage reference of analog-digital converters in the case of sensors connected in a bridge.	2		
14	Organization of an acquisition program, main methods of similar processing, algorithm of acquisition and alternative processing, acquisition and processing in real time package type and by the "threshold" method,	2		

Bibliography

[1] Copîdean R., Bortoş O.P.- Interfeţe standard pentru achiziţia de date, Editura Mediamira, Cluj-Napoca, 2003

[2] Todoran Gh., Drăgan F., Copîndean R.,. Masurari Electronice. Editura U.T.PRESS. Cluj Napoca 2007, Cod ISBN 978-973-662-334-9

[3] Vlaicu C. – Sisteme de măsurare informatizate, Editura ICPE, Bucureşti, 2000.

[4] Szekely I., Szabo W., Munteanu R. – Sisteme de achiziţie şi prelucrare a datelor, Editura Mediamira, Cluj-Napoca, 1997

[5] Copîndean R., Holonec Rodica, Drăgan F. Automate programabile. Modalitati de programare si aplicatii. Editura U.T.PRESS. Cluj Napoca 2010, Cod ISBN 978-973-662-602-9

[6] Walt Kester, Analog-Digital Conversion, Analog Devices, 2004, ISBN 0-916550-27-3

8.2. Applications - Seminar	Number of hours	Teaching methods	Additional remarks
1	Examples of the use of logical inputs and outputs	2		

2	Interfacing of outputs and inputs with different logical levels	2	Teaching is done interactively using multimedia equipment simultaneously with the use of the whiteboard for deducing relationships and explanations	
3	Sampled signals, applications	2		
4	Applications of Digital to Analog Converters (DAC)	2		
5	Applications of Analog to Digital Converters (ADC)	2		
6	ASK digital amplitude modulation, PSK digital phase modulation, FSK digital frequency modulation	2		
7	Remote control and monitoring applications with modems	2		

Bibliography

[1] Copîdean R., Bortoş O.P.- Interfeţe standard pentru achiziţia de date, Editura Mediamira, Cluj-Napoca, 2003

[2] Adelaida Mateescu, Ciochină S., Dumitru N., Şerbănescu A., Stanciu L. –Prelucrarea numerică a semnalelor. Editura Tecnică, Bucureşti 1997.

8.2. Applications - Seminar		Number of hours	Teaching methods	Additional remarks
1	Testing the parallel interfaces of the personal computer. Applications: relay control, digital output control,	2	PC are used to which they interfaced various modules with electronic circuits and acquisition boards	
2	Reading individual digital inputs, reading digital inputs using registers, stepper motors	2		
3	R-2R Digital to analog converter. The command of MP4725 DAC using Arduino Nano microcontroller, the command of the ESP32 microcontroller integrated DAC.	2		
4	Digital-to-analog converter, applications: programmable voltage source, programmable current source, arbitrary shape signal generator	2		
5	Analog-to-digital converter with dual slope integration. Parallel flash ADC.	2		
6	Software made logic for Analog-to-digital converters with counting, tracking and successive approximations.	2		
7	RS 232 serial interface, testing. USB Serial Interface, Testing. Applications: communication with the Protek 506 digital multimeter, control of a heating element for thermostating a process.	2		
8	Applications of serial interfaces: counting programs, frequency measurement, signal period measurement.	2		
9	Digital processing of sampled signals, changing the sampling rate through digital processing of sequences.	2		

10	4051 analog and digital multiplexing circuits.	2		
11	Acquisition and generation of signals using dedicated audio interface and software.	2		
12	Using unified voltage and current signals, 4-20 mA current loop.	2		
13	Sampling-memory circuits, made with transmission gates and specialized circuits	2		
14	Programming the FX1S programmable automaton, using logic inputs and outputs, timers and counters.	2		

Bibliography

[1] Copîdean R., Bortoş O.P.- Interfeţe standard pentru achiziţia de date, Editura Mediamira, Cluj-Napoca, 2003 Analog-Devices – NI Dynamic Signal Acquisition User Manual, National Instruments, 371235H-01, Austin, Texas, 2010

[2] Bus-Powered Multifunction DAQ USB Device, NI USB-6008/6009, User Guide and Specifications, Manual nr. 371303M-01, Austin, Texas, 2012

[3] NI Dynamic Signal Acquisition User Manual, National Instruments, 371235H-01, Austin, Texas, 2010

[4] National Instruments,DAQ S Series User Manual, NI 6110/6111/6115/6120/6122/6123/6132/6143 Simultaneous Multifunction Input/Output Devices, nr. 370781H-01, Austin, Texas, 2009

[5] Texas Instruments Linear Circuits, Data Acquisition and Conversion, Data Book, Volume 2 ,1989,

[6] Integrated Circuits. Data Book, vol. II, 1994

[7] Dobrotă V., Meciu E., Giurgiu M. – Aplicaţii în sisteme cu microprocesoare din familia Intel 80x86, Editura Terra, Cluj-Napoca, 1992

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

National Instruments, Mitsubishi Electric, Energobit, Emerson, Bosh

10. **Assessment**

Activity type	10.1 Assessment criteria	10.2 Assessment methods	10.3 Weight in the final grade (%)
10.4 Course		Multiple answer test	80%
10.5 Seminar, Laboratory	Minimum attendance 80%	Problem solving. Test of application on a PC	5% +15%
10.6 Minimum standard of performance: GC>5, GS>5, GL>5			

Date of completion	Lecturers	Title/ Surname/ Name:		Signature
14.06.2024	Course	*L. PhD. Eng. Calin Muresan*		
	Applications Seminar/ Laboratory/ Project	*L. PhD. Eng. Calin Muresan*		

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