SYLLABUS

1. Data about the program of study

1.1 Institution	Technical University of Cluj-Napoca
1.2 Faculty	Faculty of Electronics, Telecommunications and information Technology
1.3 Department	Applied Electronics
1.4 Field of study	Electronic Engineering, Telecommunications and Information 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	*34.00*

2. Data about the subject

2.1 Subject name	Fundamentals of Data Aquisition Systems						
2.2 Subject area	Theoretical area Methodological area Analytic area						
2.3 Course responsible	Assoc.Prof.Liviu Viman, PhD Eng. Liviu.Viman@ael.utcluj.ro						
2.4 Teacher in charge with seminar / laboratory / project	Assoc.Prof.Liviu Viman, PhD Eng. Liviu.Viman@ael.utcluj.ro Assoc.Prof. Septimiu Pop, PhD Eng Septimiu.Pop@ael.utcluj.ro Assist. Prof. Vlad Bande, PhD Eng. Vlad.Bande@ael.utcluj.ro Eng. Alexandru Flutur, PhD. Stud. Alexandru.Flutur@ael.utcluj.ro						
2.5 Year of study	III	2.6 Semester	1	2.7 Assessment	E	2.8 Subject category	DD/DI

3. Estimated total time

3.1 Number of hours per week	5	of which: 3.2 course	2	3.3 seminar / laboratory	1+2
3.4 To Total hours in the curriculum	70	of which: 3.5 course	28	3.6 seminar / laboratory	42
Distribution of time					hours
Manual, lecture material and notes, bibliography					25
Supplementary study in the library, online specialized platforms and in the field					7
Preparation for seminars / laboratories, homework, reports, portfolios and essays					19
Tutoring					2
Exams and tests					2
Other activities:					

3.7 Total hours of individual study	55
3.8 Total hours per semester	125
3.9 Number of credit points	5

4. Pre-requisites (where appropriate)

4.1 curriculum	Signal Spectral Analysis; Signal Sampling and Quantifying, Analysis and Design of Electronic Circuits with Transistors and Operational Amplifiers, Boolean Algebra, Analysis and Design of Digital Combinatorial and Sequential Circuits.

4.2 competence	Computer usage, Electronic Lab Tools usage (Digital Multimeter, Scope, etc.)

5. Requirements (where appropriate)

5.1. for the course	Amphitheatre, Cluj-Napoca
5.2. for the seminars / laboratories / projects	Laboratory, Cluj-Napoca

6. Specific competences

Professional competences	C2. Application of basic methods for the signals 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 Application of the basic knowledge, concepts and methods regarding the architecture of computing systems, microprocessors, microcontrollers, programming languages and techniques • 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 C4. Design and use of low complexity hardware and software applications specific to the applied electronics • C4.1 Defining the concepts, principles and methods used in the fields: computer programming, high-level and specific languages, CAD techniques for making electronic modules, microcontrollers, computer systems architecture, programmable electronic systems, graphics, reconfigurable hardware architectures • C4.2 Explanation and interpretation of the specific requirements of the hardware and software structures in the fields: computer programming, high-level and specific languages, CAD techniques for making electronic modules, microcontrollers, computer systems architecture, programmable electronic systems, graphics, reconfigurable hardware architectures
Cross competences	N.A.

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

7.1 General objective	The development of skills in designing, modeling and simulation of mixt (analog and digital) electronic circuits and systems
7.2 Specific objectives	1. Understanding the types type, structure and performances of AD/DA conversion circuits 2. Specify, design, analyze and test the data acquisition system based on application requirements

8. Contents

8.1 Lecture (syllabus)	Teaching methods	Notes
1. Introduction to DASF. • Analog and digital quantities. • Logical levels. Binary representations.	Exposure,discussion, interactive teaching style	
2. DAC (Digital to Analog Converter): definitions, static and dynamic parameters, errors.		
3. Weighted resistor networks.		
4. R/2R resistor networks. • Combined resistor networks.		
5. Electronic devices in the DAC structure: characteristics, performances.		
6. Examples of integrated DAC circuits • Characteristics. • Applications.		
7. Bipolar DACs • BCD DAC.		
8. ADC (Analog to Digital Converter): definitions, static and dynamic parameters, errors.		
9. Parallel ADC.		
10. Feedback ADC.		
11. Intermediate quantity ADC (frequency, duty factor).		
12. Intermediate quantity ADC (time).• Sigma-Delta ADC.		
13. Electronic devices in the ADC structure: characteristics, performances.• Connecting DACs and ADCs to uP systems.		
14. Conditioning and sampling the analog signal for conversion. • Information scaling in a mixt (analog/digital/analog) transmission path.		
8.2 Seminar	Teaching methods	Notes
1. Electrical encoding of numbers	Exposure,discussion, interactive teaching style	
2. Weighted resistor networks.		
3. Combined resistor networks.		
4. DAC applications.		
5. ADC applications.		
6. Desining a data acquisition system.		
7. Combined problems, exam preparation.		
8.3 Laboratory	Teaching methods	Notes
1. Sampling theory	Exposure,discussion, interactive teaching style	
2. Sample and Hold circuits		
3. Weighted resistor networks		
4. R-2R resistor networks		
5. Combined resistor networks		
6. Resistance networks with operational amplifier output stage		
7. Integrated DAC		
8. Digitally controlled filter		
9. Feedback ADC - Counter		
10. Feedback ADC - Follower		

11. Feedback ADC – Successive Approximation Register		
12. Voltage controlled oscillator		
13. Charge compensated modulator		
14. Test		

Bibliography

1. M. Dăbâcan, – "Bazele sistemelor de achiziţie de date", Editura Casa Cărţii de Ştiinţă, ISBN 973-686-565-7, 295 pagini, Cluj-Napoca, 2004.
2. M. Dăbâcan, – "Data Acquisition Systems Fundamentals", Editura Casa Cărţii de Ştiinţă, ISBN 973-686-566-5, 295 pagini, Cluj-Napoca, 2004.
3. Materiale didactice virtuale
4. Mircea Dabacan, Liviu Viman, Vlad Bande - Bazele Sistemelor de achiziții de date – Aplicații, Cluj-Napoca, Romania: U.T.PRESS, 2021, ISBN 978-606-737-534-3, 163p.
5. Mircea Dabacan, Liviu Viman, Vlad Bande - Data Acquisitions Systems Fundamentals – Applications, Cluj-Napoca, Romania: U.T.PRESS, 2022, ISBN 978-606-737-605-0, 151p.
6. On – line references.

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 electronic circuits design, and the expectations of the national organization for quality assurance (ARACIS).

10. Evaluation

Activity type	10.1 Assessment criteria	10.2 Assessment methods	10.3 Weight in the final grade
10.4 Course	Problem solving	Exam (E)	60%
10.5.1 Seminar/	Electronic Design	Homework (H)	10%
10.5.2 Laboratory	Lab measurements	Lab test (L)	30%

10.6 Minimum standard of performance

Quality level:

Minimum knowledge:

- Knowledge of numerical representation methods.
- Knowledge of Bipolar DACs, ADC, Electronic devices in the ADC structure.
- Conditioning and sampling the analog signal for conversion. Information scaling in a mixt (analog/digital/analog) transmission path.

Minimum competences:

- Recognize the most common digital codes, use translation algorithms between various codes (including human representation).
- Design a Data Acquisition System using integrated circuits (amplifiers, DA and AD converters) and integrate with a microprocessor/microcontroller system.
- Analyze the behavior and performances of a Data Acquisition System, based on the structure.
- Generate the specs for the software needed in the Data Acquisition System

Quantitative level:

- The grade in the exam (E) must be ≥4 and the laboratory (L) must be at least 5.
- The grade for the discipline is calculated: **N = (E*0.60+ H*0.10+L*0.25) ≥5**

Date of filling in:	**Responsible**	**Title Surname NAME**	**Signature**
25.06.2024	Course	Assoc.Prof.Liviu Viman, PhD Eng.	
	Applications	Assoc.Prof.Liviu Viman, PhD Eng.	
		Assoc.Prof. Septimiu Pop, PhD Eng.	
		Assist.Prof. Vlad Bande, PhD Eng.	
		Eng. Alexandru Flutur, PhD student	

Date of approval in the Department of Applied Electronics 28.06.2024	Head of Department Prof. Dorin PETREUS, PhD Eng.
Date of approval in the Council of Faculty of Electronics, Telecommunications and Information Technology 11.07.2024	Dean Prof. Ovidiu Aurel POP, PhD Eng.