SYLLABUS

1. Data about the program of study

1.1 Institution	The Technical University of Cluj-Napoca
1.2 Faculty	Faculty of Automation and Computer Science
1.3 Department	Computer Science
1.4 Field of study	Computer Science and Information Technology
1.5 Cycle of study	Bachelor of Science
1.6 Program of study/Qualification	Computer Science and Information Technology/ Engineer
1.7 Form of education	Full time
1.8 Subject code	15.

2. Data about the subject

2.1 Subject name	***Electronic Measurements and Sensors***				
2.2 Course responsible/lecturer	Assoc. Professor Rodica Holonec, Phd eng - Rodica.Holonec@ethm.utcluj.ro				
2.3 Teachers in charge of seminars/ laboratory/ project	Assoc. Professor Septimiu Crișan - Septimiu.Crisan@ethm.utcluj.ro Eng. Phd. Student Rapolti Laszlo - Laszlo.Rapolti@ethm.utcluj.ro				
2.4 Year of study	II	2.5 Semester	3	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	4	of which:	Course	2	Seminars		Laboratory	2	Project	
3.2 Number of hours per semester	56	of which:	Course	28	Seminars		Laboratory	28	Project	
3.3 Individual study:										
(a) Manual, lecture material and notes, bibliography										16
(b) Supplementary study in the library, online and in the field										6
(c) Preparation for seminars/laboratory works, homework, reports, portfolios, essays										10
(d) Tutoring										10
(e) Exams and tests										2
(f) Other activities:										-

3.4 Total hours of individual study (suma (3.3(a)…3.3(f)))	44
3.5 Total hours per semester (3.2+3.4)	100
3.6 Number of credit points	4

4. Pre-requisites (where appropriate)

4.1 Curriculum	Mathematics, Physics, Theory of electric circuits;
4.2 Competence	Basic Knowledge in Mathematics, Physics, Electrical and Electronic Engineering

5. Requirements (where appropriate)

5.1. For the course	Multimedia means. Online: collaborative platforms (Teams, etc.). Onsite: blackboard, projector, computer Course attendance by students is not mandatory, but is recorded by the teaching staff in charge of the course, for the correct assessment of the relevance of its evaluation by students at the end of the course
5.2. For the applications	Laboratory classroom equipped with specific measuring devices and sensors. Attendance at the laboratory is mandatory

6. Specific competence

6.1 Professional competences	**C1 –** Operating with basic Mathematical, Engineering and Computer Science concepts (2 credits) **C1.1 –** Recognizing and describing concepts that are specific to the fields of calculability, complexity, programming paradigms, and modeling computational and communication systems **C1.2 –** Using specific theories and tools (algorithms, schemes, models, protocols, etc.) for explaining the structure and the functioning of hardware, software and communication systems **C1.3 –** Building models for various components of computing systems **C1.4 –** Formal evaluation of the functional and non-functional characteristics of computing systems **C1.5 –** Providing a theoretical background for the characteristics of the designed systems **C2 –** Designing hardware, software and communication components (2 credits) **C2.1 –** Describing the structure and functioning of computational, communication and software components and systems **C2.2 –** Explaining the role, interaction and operation of hardware, software and communication components **C2.3 –** Construction of hardware and software components of computing systems using design methods, languages, algorithms, data structures, protocols and technologies **C2.4 –** Evaluating the functional and non-functional characteristics of the computing systems using specific metrics **C2.5 –** Implementation of hardware, software and communication components
6.2 Cross competences	1. Identification of the objectives to be achieved, the available resources, the conditions for their completion, work stages, working times, deadlines and related risks. 2. Responsible execution of professional duties

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

7.1 General objective	The purpose of the course is to make the student's first engineering contact with the technique of electrical and electronic measurements, knowledge of the field of non-electrical measurements, the main quantities and measuring methods, as well as the integration of sensors in modern technological systems
7.2 Specific objectives	After completing the course, students will be able to: • To know how to identify measuring devices and to read the indication of a measuring device • To know how to use measuring devices according to the measured quantity • To know how to read a measurement scheme • To know how to interpret the result of a measurement and the related error • To be able to estimate the quality and precision of the measurement process • To choose sensors for a certain practical situation • To implement a system for measuring a non-electric quantity • To evaluate the accuracy of measurements • To optimize measurement systems

8. Contents

8.1 Lectures	Hours	Teaching methods	Notes
1.Electronic Measurements. General and Introductory Elements. Methods and Means of Measurement. Examples.	2		

2. The Structure of measuring Devices. Metrological Characteristics of Sensors and Measuring devices.	2	Onsite or online teaching (according to the regulations), presentations, interactive means	The teaching process uses multimedia presentations (powerpoint), onsite or online interaction (according to the regulations) with students on the issues addressed, materials distributed to students, consultation hours, case studies.
3. Physical Quantities, Measurement Units and Standards. Measurement Errors and Uncertainties. Calculation Examples.	2		
4. Analog Electronic Measuring Devices. Measuring Signal Conditioning Circuits. Examples. Measurement Bridges. Applications.	2		
5. Digital Measuring Devices. Examples. Applications. Measuring Devices with Microprocessor.	2		
6. Analog to Digital Converters. Digital to Analog Converters. Digital Voltmeters. Virtual Instruments.	2		
7. The Analog and Digital Oscilloscope	2		
8. DC Microvoltmeters with Modulation/Demodulation. Wave Analyzers.	2		
9. Measurement Systems using Measurement Information Conversion.	2		
10. Transducers and Sensors. Principles. Operation. Applications.	2		
11. Sensors for Measuring Electrical Quantities. Examples. Applications.	2		
13. Sensors for Electrical Measurement of Non-electric Quantities. Examples. Applications.	2		
12. Analog and Digital Sensors. Potentiometers. Variable-Inductance and Capacitance Sensors. Temperature sensors. Encoders.	2		
14. Fiber Optic and Laser Sensors. Sensors for Special Applications (biophysics, biomedicine).	2		

Bibliography

1. Rodica Holonec, Electrical Measurements and Instrumentation, Editura Mediamira, Cluj-Napoca, 2003, 259 p, ISBN 973-9357-42-3
2. Dragomir, N.D., TÂRNOVAN, I.G., Crişan, T.E. – Electrical Measurement of Non-Electric Quantities. Vol. I. Editura MEDIAMIRA, Cluj-Napoca, România, 2002. ISBN 973-9358-75-6.
3. Tarnovan, I. G. – Metrologie electrică şi instrumentaţie. Editura MEDIAMIRA, Cluj-Napoca, România, 2003. ISBN 973-9357-39-3.
4. Munteanu, R., Târnovan, I.G., Dragomir,N.D., Popovici, O. – Electrotehnică și convertoare energetice, Ed.Mediamira, Cluj-Napoca, 1997.
5. Dragomir,N.D., col. – Măsuri şi traductoare. Curs. Vol.1. Măsurarea mărimilor electrice; vol.2 : Traductoare şi măsurarea electrică a mărimilor neelectrice. Lito IPC, Cluj-Napoca, 1989.
6. Dragomir,N.D., col. – Măsurarea electrică a mărimilor neelectrice. Vol.1 – 4 : Măsurarea mărimilor geometrice. Măsurarea mărimilor termice şi fotometrice, Măsurarea mărimilor mecanice Ed.Mediamira, Cluj-Napoca, 1999 – 2004.
7. Todoran, Gh.,Copîndean,R; Masurari Electrice si Electronice.Editura Mediamira; Cluj Napoca. 2003. 282p. ISBN 973-9357-61-X.

8.2 Applications – Seminars/Laboratory/Project	Hours	Teaching methods	Notes
1. Analog Measurement Devices	2	The teaching process uses multimedia presentations (PowerPoint), onsite or online interaction (according to the regulations) with students on the	Experimental circuits, Computer
2. Digital Measurement Devices	2		
3. Domain Extension of Analog Measurement Instruments	2		
4. Single-phased A.C. Circuits Measurements	2		
5. The Wheatstone Bridge	2		
6. Temperature Measurement	2		
7. Flow and Level Measurement	2		
8. Angular Speed Measurement	2		
9. Displacement Measurement	2		
10. Virtual Instrumentation1: Introduction in LabView	2		

11. Virtual Instrumentation2. Using LabVIEW and NI ELVIS for studying different transducers (sensors and actuators)	2	issues addressed, materials distributed to students, consultation hours, case studies.	LabView software, NI hardware
12. Virtual instrumentation 3. Data acquisition	2		
13. Virtual instrumentation 4. LabVIEW Signal Processing Applications	2		
14. Submission of reports/evaluation	2		

Bibliography

1. Munteanu,R., Dragomir,N.D., TÂRNOVAN,I.G., Holonec,Rodica, Bortoş,P. – Tehnici de măsurare. Îndrumător de laborator. Atelierul de multiplicare al U.T.C.-N., 1995.
2. Rodica Holonec, B. Tebrean, I.G. Tarnovan, Gh. Todoran, Electronic Measurements: Laboratory Manual Editura U.T. PRESS, Cluj-Napoca 2010, ISBN.978-973-662-600
3. Dan Iudean, Radu Munteanu jr., Mircea Buzdugan, Eudor Flueraș, Alex Crețu „Măsurări electrice și electronice –Îndrumător de laborator”- 2016, Editura Mediamira
4. Rodica Holonec, Radu Adrian Munteanu, Romul Copîndean, Florin Drăgan, Instrumentație virtuală: lucrări de laborator, UT Press, 2018 Cluj-Napoca
5. I. Târnovan, - Metrologie şi instrumentaţie electrică, Ed. Mediamira, 2003.
6. R Munteanu jr., col. – Traductoare pentru sisteme de măsurare, Ed. Mediamira, 2003.
7. N. Patachi, Nicolae D. Dragomir, Radu Munteanu, Gh. Todoran, Ioan Tarnovan „Masurări și traductoare, - îndrumător de laborator”-, 1986
8. Bird, J. – “Electrical Circuit Theory and Technology”, Elsevier, Oxford, 2004
9. Webster, J., Eren, H. – “Measurement, Instrumentation and Sensors Handbook” CRC Press 2014

**Se vor preciza, după caz: tematica seminariilor, lucrările de laborator, tematica și etapele proiectului.*

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

The content of the discipline is consistent with the one from other universities in the country and abroad.
For a better adaptation to the requirements of the labour market, the content of the discipline has been updated in accordance with the opinions of some representatives of the business environment in the field.

10. Evaluation

Activity type	Assessment criteria	Assessment methods	Weight in the final grade
Course	Final exam (E)-Theoretical questions and exercises (3 hours)	Online examination	100%
Seminar	-		
Laboratory	Activity and attendance during classes laboratory.	Evaluation of reports from laboratory works	0%
Project			
Minimum performance standard: Completion of the laboratory is mandatory for entering the exam. • Passing condition: Exam grade ≥ 5			

Date of filling in:	**Titulari**	**Titlu Prenume NUME**	**Semnătura**
10.06.2023	Course	Assoc. Prof. Rodica Holonec, PhD eng	
	Applications	Assoc. Prof. Septimiu Crisan, PhD eng	
		Phd. Student Rapolti Laszlo	

Date of approval in the department 20.06.2023	Head of department Prof.dr.ing. Rodica Potolea
Date of approval in the Faculty Council 26.06.2023	Dean Prof.dr.ing. Liviu Miclea