SYLLABUS

1. Program information

1.1 Higher education institution	Technical University of Cluj-Napoca
1.2 Faculty	Faculty of Electronics, Telecommunications and Information Technology
1.3 Department	Bases of Electronics
1.4 Field of study	Electronic engineering, telecommunications and information technologies
1.5 Cycle of study	Bachelor of Science
1.6 Study program / Qualification	Electronic engineering, telecommunications and information technologies/ Engineer
1.7 Form of education	IF – full-time education

2. Course information

2.1 Course title	Electronics and Telecommunications Measurements					Course code	23.00
2.2 Course coordinator	*Assoc. Prof. Holonec Rodica – rodica.holonec@ethm.utcluj.ro*						
2.3 Seminar/ laboratory/ project/ practical activity coordinator	*Assist. Rapolti Laszlo – Laszlo.Rapolti@ethm.utcluj.ro*						
2.4 Year of study	II	2.5 Semester	2	2.6 Type of assessment			E
2.7 Course status	Formative category						DD
	Optionality						DOB

3. Estimated total time

3.1 Hours per week	4	of which:	3.2 Lecture	2	3.3 Seminar	1	3.3 Laboratory	1	3.3 Project		3.3 Practical training	
3.4 Hours per semester	56	of which:	3.5 Lecture	28	3.6 Seminar	14	3.6 Laboratory	14	3.6 Project		3.3 Practical training	

3.7 Time distribution (hours per semester) for individual study and assessment:	
(a) Assessment	16
(b) Study using textbook, course materials, bibliography, and notes	6
(c) Additional documentation in the library, on specialized electronic platforms, and in the field	10
(d) Preparation for seminars/laboratories, assignments, reports, portfolios and essays	10
(e) Tutoring	2
(f) Other activities	-

3.8 Total hours of individual study and assessment (sum of (3.7(a)...3.7(f))	44
3.9 Total hours per semester (3.4+3.8)	100
3.10 Number of credits	4.0

4. Prerequisites (where applicable)

4.1 curriculum	Basic knowledge of Mathematics, Physics, Electrical Circuits and Fundamentals of Electronics.
4.2 competencies	Ability to perform basic electrical calculations, interpret electrical circuits and use elementary engineering concepts.

5. Requirements (where applicable)

5.1. for the development of the lecture	Multimedia classroom equipped with computer, projector and presentation facilities. Course materials are available through the university learning platform. Course attendance is recommended to facilitate understanding of theoretical concepts and engineering applications.
5.2. for the development of the seminar/ laboratory/ project	Seminar and laboratory rooms equipped with electrical and electronic measuring instruments, data acquisition equipment and computers. Students are expected to actively participate in seminar and laboratory activities, prepare the assigned work in advance and submit the required laboratory reports.

6. Specific competencies acquired

Professional competencies	C1 Use of fundamental elements related to electronic devices, circuits, systems, instrumentation and technology C1.1 Description of the operation of electronic devices and circuits and of the fundamental methods for measuring electrical quantities C1.2 Analysis of low-/medium-complexity electronic circuits and systems for their design and measurement C1.3 Diagnosis/troubleshooting of electronic circuits, equipment and systems C1.4 Use of electronic instruments and specific methods to characterize and evaluate the performance of electronic circuits and systems C1.5 Design and implementation of low-/medium-complexity electronic circuits using CAD-CAM technologies and standards in the field C2 Application of basic methods for signal acquisition and processing C2.1 Time-domain, spectral and statistical characterization of signals C2.2 Explanation and interpretation of signal acquisition and processing methods C2.3 Use of simulation environments for signal analysis and processing C2.4 Use of specific methods and instruments for signal analysis C4 Design and use of low-complexity hardware and software applications specific to applied electronics C4.3 Identification and optimization of hardware and software solutions for problems related to industrial electronics, medical electronics, automotive electronics, automation, robotics and consumer-goods production C4.5 Design of dedicated equipment in the fields of applied electronics, using microcontrollers, programmable circuits or computer systems with a simple architecture, including the related programs C5 Application of basic knowledge, concepts and methods from: power electronics, automatic systems, electrical energy management and electromagnetic compatibility C5.1 Definition of the specific elements that characterize electronic devices and circuits in the fields of: power electronics, automatic systems, electrical energy management, medical electronics, automotive electronics and consumer goods C5.2 Qualitative and quantitative interpretation of the operation of circuits in the fields of: power electronics, automatic systems, electrical energy management, medical electronics, automotive electronics and consumer goods; analysis of operation from the standpoint of electromagnetic compatibility
	C5.3 Preparation of technical specifications, installation and operation of equipment in the fields of applied electronics: power electronics, automatic systems, electrical energy management, medical electronics, automotive electronics and consumer goods C5.4 Evaluation, based on technical quality and environmental impact criteria, of equipment in the fields of applied electronics: power electronics, automatic systems, electrical energy management, medical electronics, automotive electronics and consumer goods
Transversal competencie	

7. Expected learning outcomes

Knowledge	- The student/graduate explains and interprets theoretical and experimental results in mathematics, physics, chemistry, economics, technical drawing and computer science. - The student/graduate describes, identifies and summarizes elementary concepts and methods related to electronic devices, circuits and instrumentation, as well as their application in concrete problems.
Skills	- The student/graduate applies evaluation criteria and methods for identifying, modelling, experimenting, analysing and qualitatively and quantitatively assessing phenomena and processes specific to the fundamental field, including by using digital technologies. - The student/graduate designs solutions, in compliance with relevant standards, for medium-complexity engineering problems that meet specified needs, while observing requirements related to public health, safety, welfare, environment, sustainability and economic factors, as well as other specific constraints. - The student/graduate uses fundamental methods for measuring electrical quantities and assesses electronic devices and circuits, as well as linear and digital integrated circuits of low/medium complexity. - The student/graduate designs, measures, evaluates performance, diagnoses and troubleshoots functional blocks composed of low/medium-complexity electronic devices and/or circuits.
Responsibility and autonomy	- The student/graduate carries out project management processes in electronics, telecommunications and information technologies, taking on different team roles and clearly and concisely describing the results, both orally and in writing.

8. Course objectives (based on the grid of specific competencies acquired)

8.1 General objective of the course	The objective of the course is to provide students with the fundamental knowledge of electronic measurement systems, instrumentation and measurement techniques used in electronics and telecommunications, together with their practical engineering applications.
8.2 Specific objectives	After completing the course, students will be able to: • Identify, select and correctly use electronic measuring instruments. • Select appropriate measurement methods for electronic signals. • Analyze measurement errors and evaluate uncertainty. • Use oscilloscopes, multimeters, spectrum analyzers and signal generators. • Perform measurements on electronic circuits and systems. • Acquire and analyze signals using computerized measurement systems. • Evaluate the performance of electronic measurement systems.

9. Contents

9.1 Lecture	No. of hours	Teaching methods	Remarks
Theory of Measurement and Metrology. Standards.	2	Multimedia presentations, interactive discussions, demonstrations and practical engineering examples.	Course materials are available through the university learning platform.
Measurement Errors and Uncertainties. Statistical Analysis of Measured Data.	2		
Analog Measuring Instruments. DC Bridges in Balanced and Unbalanced Operation.	2		
AC Bridges. Q-Meter. Impedance-Meter.	2		
Digital Measurement of Frequency and Time.	2		
Digital Voltmeters, Multimeters.	2		
Signal Generators with Frequency and Arbitrary Waveform Synthesis.	2		
Signal Conditioning in Electronic Measurement Systems.	2		
Circuits with Synchronous Detection.	2		
Signal Sampling: Real-Time, Sequential, and Random Sampling.	2		
Computerized Measurement Systems.	2		
Oscilloscope: Types, Structure, Modes of Operation.	2		
Spectrum Analyzers.	2		
Digital Power Measurement. Measurement of Distortions	2		

Bibliography

[1]. Holonec Rodica: Electrical Measurements and Instrumentation, Mediamira, 2003
[2]. Nihal Kularatna, Digital and Analogue Instrumentation testing and measurement: The Institution of Engineering and Technology, London, United Kingdom, 2008
[3]. Robert B. Northrop Introduction to Instrumentation and Measurements, 3rd Edition, CRC Press, 2017
[4]. Robert A. Witte-Spectrum and Network Measurements-SciTech Publishing, 2014
[5]. Tarnovan Ioan: Metrologie electrica si instrumentatie, Mediamira, 2003
[6]. Todoran Gh., Copandean R.: Masurari electronice-Amplificatore si convertoare de masurare, Mediamira, 2003
[7]. Holonec Rodica, Online bibliography on Teams Group

9.2 Laboratory	No. of hours	Teaching methods	Remarks
Digital Multimeter. Measurements of Voltage, Current, Resistance, Attenuation, and Amplification (dB). Testing Diodes and Bipolar Transistors.	1	Hands-on laboratory experiments, guided exercises and computer-assisted measurements.	Students perform experiments, analyze the obtained results and prepare laboratory reports.
Extending Measurement Ranges in Measuring Instruments.	1		
Measurement of Passive RLC Components.	1		
Measurements with the Oscilloscope.	1		
Introduction to Virtual Instrumentation.	1		
Computerized Signal Measurement. Spectrum Analyzer.	1		
Measurement of Frequency and Time. Logic Analyzer for Aperiodic Signals. Synchronization for Modulated Signals.	1		

9.2 Laboratory	No. of hours	Teaching methods	Remarks
Bibliography [1] Holonec Rodica: Electrical Measurements and Instrumentation, Mediamira, 2003 [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] Rodica Holonec, Radu Adrian Munteanu, Romul Copîndean, Florin Drăgan, Instrumentație virtuală: lucrări de laborator, UT Press, 2018 Cluj-Napoca [4] Mircea Dan Iudean, Radu Munteanu jr., Mircea Buzdugan, Eudor Flueras, Alex Cretu, Măsurări electrice şi electronice : îndrumător de laborator , Editura Mediamira, Cluj-Napoca, 2016, ISBN 978-973-713-338-0			

9.3 Seminar	No. of hours	Teaching methods	Remarks
Measurement Fundamentals. Measurement Units. Significant Figures Meter Loading - Voltage Measurement	1	Problem-solving sessions, guided exercises and interactive discussions.	Students solve engineering problems, analyze measurement results and apply theoretical concepts to practical measurement applications.
Measurement Uncertainty Computation. Direct and Indirect Measurements.	1		
Random Errors Analysis. Repeated. Measurements. Statistical Parameters	1		
Parameters of Periodic Signals. AC Voltmeters	1		
Measurements using Bridges. DC Bridges. AC Bridges	1		
The Oscilloscope. Basics. Measuring Principles	1		
Phase Measurement. Case study: The Gilbert Cell.	1		
Bibliography [1]. Holonec Rodica: Electrical Measurements and Instrumentation, Mediamira, 2003 [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]. Munteanu,R.,Todoran,Gh. Teoria si practica prelucrarii datelor de masurare.Editura Mediamira 1997.Cluj Napoca. 350p ISBN 973-9358-09-8. [4]. TARNOVAN, Ioan Gavril, Metrologie electrica si instrumentatie, Cluj-Napoca : Mediamira, 2003Vlaicu C. – Sisteme de măsurare informatizate, Editura ICPE, Bucureşti, 2000			

10. Alignment of the course contents with the expectations of the epistemic community, professional associations, and representative employers in the field related to the program

The course content and the teaching-learning-assessment methods are aligned with the current requirements of the Electronics, Telecommunications, and Information Technology Engineering field, considering the expectations of the academic and professional community, representative employers, as well as the national quality assurance standards in higher education. The course helps prepare students in line with employer expectations and the quality requirements set for engineering study programs.

11. Assessment

Activity type	**11.1 Assessment criteria**	**11.2 Assessment methods** (and type of assessment: continuous/ summative)	**11.3 Weight in final grade**
11.4 Lecture	Understanding and application of theoretical concepts; ability to analyze electronic measurement systems and solve engineering problems.	Written examination (theoretical questions and problem-solving exercises, 3 hours).	90%
11.5 Seminar/ Laboratory/ Project /Practical activity	Attendance, active participation, correct execution of experiments, quality of laboratory reports and seminar activities.	Continuous assessment based on seminar participation, laboratory performance and laboratory reports.	10%
11.6 Minimum performance standard Completion of all laboratory sessions and submission of the required laboratory reports are mandatory prerequisites for taking the final examination. Students must obtain a minimum grade of 5 (out of 10) in the written examination to pass the course.			

Completion date:	**Course coordinators**	**teaching rank, title First name LAST NAME**	**Signature**
23.06.2026	Lecture	Assoc. Prof. Holonec Rodica	
	Applications	Assist. Rapolti Laszlo	

Approval of the Head of the Department coordinating the course, only if this differs from the department organizing the study program	Head of the Electrotechnics and Measurements Department Prof. Dan D. MICU, Ph.D.

Date of approval by the Council of the Department of Bases of Electronics 26.06.2026	Head of the Bases of Electronics Department Prof. Sorin HINTEA, Ph.D.
Date of approval by the Council of the Faculty of Electronics, Telecommunications and Information Technology 30.06.2026	Dean, Prof. Ovidiu-Aurel POP, Ph.D.