SYLLABUS

1. Data about the program of study

1.1	Institution	The Technical University of Cluj-Napoca
1.2	Faculty	Electrical Engineering
1.3	Department	Electrotechnics and Measurements
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, Applied Electronics/ Engineer
1.7	Form of education	Full time
1.8	Subject code	TST-E24.00, EA-E24.00

2. Data about the subject

2.1	Subject name					Electronics and Telecommunications Measurements					
2.2	Subject area					Electronics and Telecommunications Engineering					
2.3	Course responsible/lecturer					Assoc. Prof. Rodica Holonec, PhD					
2.4	Teachers in charge of applications					Assoc. Prof. Rodica Holonec, PhD Assistant Valentin Zaharia, PhD					
2.5	Year of study	II	2.6	Semester	2	2.7	Assessment	Exam	2.8	Subject category	DID/DOB

3. Estimated total time

Year / Sem.	Subject name	No. of weeks	Course [hours/week]	Applications [hours/week]			Course [hours/sem.]	Applications [hours/sem.]			Indiv. study	TOTAL	Credits
				S	L	P		S	L	P			
II / 2	Electronics and Telecommunications Measurements	14	2	1	1		28	14	14		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	28
Supplementary study in the library, online and in the field	
Preparation for seminars/laboratory works, homework, reports, portfolios, essays	18
Tutoring	1
Exams and tests	1
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	Relations and theorems for electric circuits, operating principles for electronic devices: diode, operational amplifier; use of electronic devices in electronic circuits; analysis methods for electronic circuits;

5. Requirements (where appropriate)

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

6. Specific competences

Professional competences	Theoretical knowledge (what the student must know):	After completing the discipline, the students will be able to: -Understand the principles of electronic instrumentation. -Understand the main specifications of a measuring system -Explain basic concepts and definitions in measurement. -Explain the operation and design of electronic instruments for parameter measurement -Design and configure a measurement diagram or system using the proper measurement method and devices
	Acquired skills (what the student is able to do):	After completing the discipline, the students will be able to: -Use the electronic measurement devices: The oscilloscopes, The transistors curve tracers, electronic voltmeters, electronic counters -Record, process and analyze the experimental measurement data -Interpret the measurement data -Configure an experimental diagram choosing the correct measurement method and devices - Compare simulation results with experimental values
	Acquired abilities: (what type of equipment the student is able to handle)	After completing the discipline, the students will have skills in : -Using the measurement devices; ac and dc measurement bridges, analogue and digital oscilloscope, transistor curve tracer, analogue and digital multimeters, the electronic counters -Utilizing a PC-based hardware that provides interaction with external signals, sensors and devices. -Programming virtual instruments in LabVIEW (Laboratory Virtual Instrumentation Engineering Workbench) -basic level
	In accordance with Grila1 and Grila2 RNCIS	C1. To use the fundamental elements regarding electronic devices, circuits, systems, instrumentation and technology C2. To apply basic methods for signal acquisition and processing C4. To design, implement and operate data, voice, video and multimedia services, based on the understanding and application of fundamental concepts from the field of communications and information transmission. C5. To select, install, configure and exploit fixed and mobile telecommunications equipment. To equip a site with common telecommunications networks.
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 regarding the principle, use, and design of electronic and telecommunications measuring methods and devices.
7.2	Specific objectives	1. Understand the principles of electronic and instrumentation. 2. Developing skills and abilities necessary for the use of electronic measuring devices. 3. Developing skills and abilities for design and configure a measurement system using the proper electronic and telecommunications methods and devices

8. Contents

8.1. Lecture (syllabus)		Teaching methods	Notes
1	Measurement fundamentals. Terms and definitions. The structure of a complex instrumentation system. Sensors	Presentation, heuristic conversation, exemplification, problem presentation, teaching exercise, case study, formative evaluation	Use of .ppt presentation, projector, blackboard
2	Fundamentals of Metrology. Measurement Units. Measurements Standards. Traceability. Measurement terminology. Errors and Uncertainties. The Measuring Instrument Specifications.		
3	Random Errors Analysis. Basic Concepts in Probability. Normal Distribution. Central Limit Theorem. The Evaluation of Uncertainties in Measurements		
4	Meters. Analog Meters-Classifications and Symbols. Types of Analog Instruments. Voltmeters. Ammeters. Wattmeters, Ohmmeters		
5	Measurements with Bridges and Potentiometers. Wheatstone Bridge. Principle. Applications. Types of AC bridges. Potentiometers.		
6	Amplification in Instrumentation. Operational Amplifiers. Basic circuits. Instrumentation Amplifiers. Current to Voltage, Resistance to Voltage Converters. Bridge Amplifiers.		
7	Electronic Voltmeters. DC Electronic Voltmeters. Types of AC Electronic Voltmeters. Lock-in Amplifiers. Principles and Applications		
8	Electronic Counters. Digital measurement of frequency and time		
9	Digital Multimeters. Computing Measuring Systems. Data Acquisition Boards. Sample and Hold Circuits. Nyquist theorem.		
10	Data Acquisition Boards Components. Digital to Analog Converters. Analog to Digital Converters. Virtual Instruments		
11	The Analog Oscilloscope: The Cathode Ray Tube, Vertical Deflection, The Sensitivity of Y Channel, The Attenuator on Channel Y.		
12	The Analog Oscilloscope: The Horizontal or Time Base Channel. The Double Channeled Oscilloscope. The Digital Oscilloscope		
13	Power Measurement. Definitions. DC and AC Power Measurements. Digital Wattmeters		
14	Spectral Analyzers. Overview. Working principles and architectures Real-Time Spectrum Analyzers. Performance Criteria. Applications		
8.2. Applications (lab and seminar)		Teaching methods	Notes
1 L	Analog Measurement Devices	Exposure applications didactic exercise, team work	Use of laboratory instruments Computer LabView, white board
2 L	The Extension of the Domain of Measurement at the Analogue Instruments		
3 L	Digital Measurement Devices		
4 L	The Oscilloscope. Basics and Measuring Principles		
5 L	Digital Measurement of Time and Frequency		
6 L	Virtual Instrumentation: LabView - Basic Operations		
7 L	Introduction to Data Acquisition Systems		
1 S	Measurement Fundamentals. Measurement Units. Significant Figures Meter Loading - Voltage Measurement		
2 S	Errors Computation. Errors in Single Measurements. Direct and Indirect Measurements.	Exposure	Blackboard, Video-

3.S	Random Errors Analysis. Repeated Measurements. Statistical Parameters	Exercises Case studies	projector, computer Excel
4 S	Measurement Uncertainties Computation. Parameters of Periodic Signals		
5 S	Measurements using bridges. DC Bridges. AC Bridges		
6 S	The oscilloscope.		
7 S	Phase Measurement. The Gilbert Cell.		

Bibliography

1. Rodica Holonec, Electrical Measurements and Instrumentation, Editura Mediamira, Cluj-Napoca, 2003, 259 p, ISBN 973-9357-42-3
2. Todoran,Gh.,Copandean,R; Masurari Electrice si Electronice.Editura Mediamira; Cluj Napoca. 2003. 282p. ISBN 973-9357-61-X.
3. Munteanu,R.,Todoran,Gh.; Teoria si practica prelucrarii datelor de masurare; Editura Mediamira 1997.Cluj Napoca. 350p ISBN 973-9358-09-8.
4. Todoran, Gh. Masurari numerice; Editura UTPRES Cluj Napoca 1997.200p,ISBN 973-98380-3-0
5. Antoniu M., Masurari electronice. Metrologie, aparate de masura analogice, Ed. SATYA, Iasi, 1999. ISBN 973-9178-22-7
6. Antoniu M., St. Poli, E. Antoniu, Marurari electronice. Aparate si sisteme de masura numerice, Ed. SATYA, Iasi, 2000, ISBN 973-97945-4-8
1. 7. Antoniu M, Măsurări electronice: Măsurări la frecvenţe joase, înalte şi optice Ed. SATYA, Iasi, 569p ISBN 973-98708-3-X

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		Final exam (E)-Theoretical questions and exercises (3 hours)		- Written examination		60%
Applications		Mid exam (ME)-Exercises (2 hours).		Written examination		20%
		Practical circuit (P)		Checking of functionality		10%
		Homework (HW)		Verification of results		10%
10.4 Minimum standard of performance						
G=(E+ME+P+HW)/100; Condition to take the credits: G≥5;						

Date of filling in 25.01.2015

Course responsible
Assoc. Prof. Rodica HOLONEC, PhD

Teachers in charge of applications
Assistant Valentin ZAHARIA, PhD

Date of approval in the department
25.01.2015

Head of department
Prof. Calin MUNTEANU, PhD.