

COURSE DESCRIPTION

1. Program identification information

1.1 Higher education institution	Politehnica University of Bucharest
1.2 Faculty	Faculty of Electronics, Telecommunications and Information Technology
1.3 Department	Telecommunications
1.4 Domain of studies	Electronic Engineering, Telecommunications and Informational Technologies
1.5 Cycle of studies	Licence
1.6 Program of studies/Qualification	Telecommunication Technologies and Systems (TSTeng)

2. Course identification information

2.1 Name of the course		Measurements in Electronics and Telecommunications					
2.2 Lecturer		Lect. eng. Ioana MARCU, PhD					
2.3 Instructor for practical activities		Lect. eng. Ioana MARCU, PhD					
2.4 Year of studies	I	2.5 Semester	2	2.6 Evaluation type	Exam	2.7 Course choice type	Compulsory

3. Total estimated time (hours per semester for academic activities)

3.1 Number of hours per week, out of which	3.5	3.2 course	2	3.3 practical activities	1.5
3.4 Total hours in the curricula, out of which	49	3.5 course	28	3.6 practical activities	21
Distribution of time					hours
Study according to the manual, course support, bibliography and hand notes					10
Supplemental documentation (library, electronic access resources, in the field, etc)					8
Preparation for practical activities, homework, essays, portfolios, etc.					33
Tutoring					0
Examinations					4
Other activities					0
3.7 Total hours of individual study		55			
3.9 Total hours per semester		104			
3.10 Number of ECTS credit points		4			

4. Prerequisites (if applicable)

4.1 curricular	Fundamentals of Electrical Engineering 1, Physics, Passive Components and Circuits (CPP)
4.2 competence-based	Basic knowledge of mathematics

5. Requisites (if applicable)

5.1 for running the course	Not applicable, according to current PUB regulations.
5.2 for running of the applications	Compulsory presence at laboratory classes, according to current PUB regulations.

6. Specific competences

Professional competences	C1. Using of fundamental elements that refer to the electronic devices, circuits and instrumentation C2. Application, in typical situations, of basic methods of signal acquisition and processing
Transversal competences	Not the case

7. Course objectives (as implied by the grid of specific competences)

7.1 General objective of the course	The purposes of this course are to provide knowledge related to different techniques and measurement equipment used in electronics area, as well as design and implementations of complex circuits made with different components. For these circuits measurement of basic and particular parameters should be determined.
4.2 Specific objectives	The specific objectives of the course are related to gathering specific engineering skills to estimate measurement and implementation errors, understanding the parameters for measurement equipment and their relevance in the measurement process.

8. Content

8.1 Lectures	Teaching techniques	Remarks
Introduction: Periodic signals: shapes and parameters. Exercises.	Teaching is based on the usage of video projection (for communication and demonstration) for presentation of charts, graphs, main ideas and so on, as well as sheets for calculations, demonstrations, etc. The course has an interactive nature, aiming at asking questions and getting answers from the students, which helps them to understand the concepts taught. The course materials are the course notes and handouts and proposed exercises (both theoretically and computer-aided solved). All materials are available in electronic form via the course site (Moodle).	2 hours
Instruments for periodic signals measurement: types of electronic measurement systems, signal generators; oscilloscope (basic presentation). Exercises.		2 hours
Oscilloscope: analog oscilloscope (TEKTRONIX 2235). General configuration of analog oscilloscope: Y channel, synchronization system and time-base, display, cathode ray tube, X channel. General configuration of digital oscilloscope.		4 hours
Detailed presentation of Y channel: functions, main settings and adjustments, performance parameters, amplitude-frequency characteristics, main blocks, functionality modes.		4 hours
Detailed presentation of X channel: synchronization system and time-base, conditions for signals' synchronization (exercises), other adjustments and working modes of time-base system. Block diagram of X channel. Double time-base oscilloscope.		4 hours
Voltage and currents measurements: general aspects, measurement units, quadri-ports, frequency-amplitude characteristics for low-pass/high-pass filter (exercises). Measurement errors: relative error, absolute error, reference error, error propagation. Exercises.		4 hours
Periodic signal parameters: mean value, root-mean square value, absolute mean value, shape/peak factor. Exercises. AC/DC voltage measurements. Exercises.		2 hours
Impedance measurements: impedance characterization, dissipative reactors, series-to-parallel equivalence. Exercises.		4 hours

Resistances measurements in direct current: Wheatstone bridge. Exercises.		
Complex impedance measurement: alternative voltage bridges, classifications, bridges for measuring capacitors (Sauty, Nernst), bridges for measuring coils (Maxwell, Hay, Owen). Exercises.		2 hours
Bibliography 1) R. Stănculescu, M. Stanciu, “Măsurări Electrice și Electronice- partea I”, litografia UPB, 1998 2) S. Ciochină, “Măsurări Electrice și Electronice – partea I”, litografia UPB, 1995 3) B. M. Oliver, J.M. Cage, “Electronic Measurements and Instrumentation”, Mc. Graw-Hill, 1971 4) Course website available in english: http://electronica.curs.pub.ro/2016/course/view.php?id=99 (Holder: Ioana Marcu)		
8.2 Practical applications	Teaching techniques	Remarks
Generating and visualization of signals	Laboratory work is done in teams of two students each, with Tektronix TDS1001 oscilloscope available, a RIGOL generator, a GW-Instek GDM-8246 digital multimeter, an analog millivoltmeter, a power supply and test boards (type "solderless breadboard") that they use to assemble circuits from discrete components, and then to measure various parameters. The didactical materials are the theoretical and practical instructions from the lab guide.	3 hours
Measurements using the oscilloscope		3 hours
Building and measuring circuits on a breadboard		3 hours
Measuring the transfer function		3 hours
Voltage measurements		3 hours
Impedance measurements		3 hours
Building and measuring an audio oscillator; recap		3 hours
Bibliography: 1) Lab platforms available at: http://ham.elcom.pub.ro/metc/index.html 2) M. Stanciu, A. Păun, Ș. Obreja, I. Marcu , ș.a. „Instrumente Electronice de Măsură – îndrumar de laborator”, Editura Electronica 2000, București, 2008 (97 pag.), ISBN 978-973-7860-10-1 3) Lab support available at: http://electronica.curs.pub.ro/2016/course/view.php?id=99 (Holder Ioana Marcu)		

9. Bridging the course content with the expectations of the epistemic community representatives, professional associations and employers representatives for the domain of the program

The course of Measurements in Electronics and Telecommunications represents a crucial step in the complex area of Electronics and Telecommunications so that the achieved knowledge and notions from this course will stand as a solid base for the future specialized engineers graduating this faculty.

The main goal of this course, knowledge of basics techniques and measurement equipments used in electronics domain, stands as a basic ground expected from the future engineers in order for them to be able to work both in designing, exploiting and service area.

This provides graduates with the appropriate skills and training requirements according to current qualifications, and a modern, high quality and competitive scientific and technical training, enabling them acquiring a working place after the graduation. The course fits therefore perfectly to the Bucharest Polytechnic University policy, considering both its content and structure, and the skills and international openness it offers to students.

10. Evaluation

Type of activity	10.1 Evaluation criteria	10.2 Evaluation methods	10.3 Weight in the final mark
10.4 Lectures	- knowledge of the theoretical aspects related to functioning of electronic measurement equipment; - analytical and numerical solving capabilities of exercises including measurement errors computations.	- final exam: the subjects cover the entire course material, being a synthesis between the comparative theoretical knowledge and the application of the theory when solving problems and exercises.	40%
10.5 Practical applications	- 7 lab studies + practical test in the day of the final exam	The final lab exam consists of a practical examination, during which the student must design, implement and measure basic parameters for a certain circuit built on the breadboard.	60%
10.6 Minimal performance standard			
- theoretical identification and determination of the main circuits used for voltages and currents measurement as well as for impedances measurements (real or complex) and basic parameters computation for the circuits; - design, implementation and practical functioning of circuits on breadboard; use and manage of corresponding measurement equipment in order to determine specific parameters of the circuits.			

Date 25.09.2017 Lecturer Lect. eng. I. Marcu, PhD



Instructor for practical activities
Lect. eng. I. Marcu, PhD



Date of department approval

26.09.2017

Director of Department,

Assoc. Prof. Eng. E. Popovici

