Universitatea Naţională de Ştiinţă şi Tehnologie Politehnica Bucureşti
Facultatea de Electronică, Telecomunicaţii şi
Tehnologia Informaţiei

COURSE DESCRIPTION

1. Program identification information

1.1 Higher education institution	**National University of Science and Technology Politehnica Bucharest**
1.2 Faculty	**Electronics, Telecommunications and Information Technology**
1.3 Department	**Electronic Devices, Circuits and Architectures**
1.4 Domain of studies	Electronic Engineering, Telecommunications and Information Technology
1.5 Cycle of studies	Bachelor/Undergraduate
1.6 Programme of studies	Microelectronics, Optoelectronics and Nanotechnologies

2. Date despre disciplină

2.1 Course name (ro) (en)				Măsurări în electronică şi telecomunicaţii Measurements in Electronics and Telecommunications			
2.2 Course Lecturer				Conf. Dr. Radu-Ovidiu Preda			
2.3 Instructor for practical activities				Conf. Dr. Radu-Ovidiu Preda			
2.4 Year of studies	1	2.5 Semester	II	2.6. Evaluation type	E	2.7 Course regime	Ob
2.8 Course type		D	2.9 Course code	04.D.02.O.013		2.10 Tipul de notare	Nota

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

3.1 Number of hours per week	3.5	Out of which: 3.2 course	2	3.3 seminary/laboratory	1.5
3.4 Total hours in the curricula	49	Out of which: 3.5 course	28	3.6 seminary/laboratory	21
Distribution of time:					hours
Study according to the manual, course support, bibliography and hand notes Supplemental documentation (library, electronic access resources, in the field, etc) Preparation for practical activities, homework, essays, portfolios, etc.					47
Tutoring					0
Examinations					4
Other activities (if any):					0

3.7 Total hours of individual study	51.00
3.8 Total hours per semester	100
3.9 Number of ECTS credit points	4

4. Prerequisites (if applicable) (where applicable)

4.1 Curriculum	Completion and/or passing of the following courses: Fundamentals of Electrical Engineering 1, Physics 1
4.2 Results of learning	Not applicable

5. Necessary conditions for the optimal development of teaching activities (where applicable)

5.1 Course	The course takes place in a classroom with a video projector that facilitates sharing information from a laptop. The room must also be equipped with a blackboard, since certain demonstrations and numerical examples are solved with chalk. The course is interactive, encouraging questions in class and obtaining answers from students to help them understand the concepts taught.
5.2 Seminary/ Laboratory/Project	Laboratory work is carried out in teams of 2 students, with access to a Tektronix TDS1001 oscilloscope, a GW-Instek SFG-2110 generator, a GW-Instek GDM-8246 digital multimeter, an analog millivoltmeter, a power supply, as well as test boards (of the “solderless breadboard” type) on which they must assemble circuits from discrete components and then measure various parameters of those circuits.

6. General objective *(Reffering to the teachers' intentions for students and to what the students will be thought during the course. It offers an idea on the position of course in the scientific domain, as well as the role it has for the study programme. The course topics, the justification of including the course in the currcula of the study programme, etc. will be described in a general manner)*

Within the course, students learn basic techniques and measuring instruments used in electronics. These are foundational skills expected of an electronics engineer capable of working in design as well as in operation or service. The aim is to acquire specific engineering skills for estimating measurement errors and to understand instrument parameters and the situations in which they are, or are not, important.

7. Competences *(Proven capacity to use knowledge, aptitudes and personal, social and/or methodological abilities in work or study situations and for personal and proffesional growth. They refflect the empolyers requirements.)*

Specific Competences	Demonstrates possession of basic/advanced knowledge in the field of measurements. Understands measuring instrument parameters and the situations in which they are, or are not, important. Acquires specific engineering skills for estimating measurement errors. Applies in practice the knowledge acquired in the field of measurement instrumentation. Uses standard measurement methods and instruments to perform diagnostics on an electronic circuit and identifies solutions to address issues encountered. Oral and written communication in Romanian: uses the scientific vocabulary specific to the field for effective written and oral communication.
Transversal (General) Competences	**Works in a team and communicates effectively,** coordinating efforts with others to solve medium-complexity problem situations. **Autonomy and critical thinking:** the ability to think scientifically, to search for and analyze data independently, and to extract and present conclusions / identify solutions. **Capacity for analysis and synthesis**: presents acquired knowledge in a synthetic manner as a result of a systematic analysis process.

8. Learning outcomes *(Synthetic descriptions for what a student will be capable of doing or showing at the completion of a course. The learning outcomes reflect the student's acomplishments and to a lesser extent the teachers' intentions. The learning outcomes inform the students of what is expected from them with respect to performance and to obtain the desired grades and ECTS points. They are defined in concise terms, using verbs similar to the examples below and indicate what will be required for evaluation. The*

learning outcomes will be formulated so that the correlation with the competences defined in section 7 is highlighted.)

Knowledge	*The result of knowledge aquisition through learning. The knowledge represents the totality of facts, priciples, theories and practices for a given work or study field. They can be theoretical and/or factual.* **Enumerates** the most important stages that marked the development of the field. **Defines** concepts specific to the field. **Describes/classifies** concepts/processes/phenomena/structures. **Highlights consequences and relationships.**
Skills	*The capacity to apply the knowledge and use the know-how for completing tasks and solving problems. The skills are described as being cognitive (requiring the use of logical, intuitive and creative thinking) or practical (implying manual dexterity and the use of methods, materials, tools and intrumentation).* **Selects** and groups relevant information in a given context. **Works** productively in a team. **Experimentally verifies** identified solutions. **Solves** practical applications. **Interprets** causal relationships appropriately. **Analyzes and compares** practical solutions to problems in the field. **Identifies solutions** and develops plans/projects for solving them. **Formulates** conclusions for the experiments carried out. **Argues for** the identified solutions/modes of resolution.
Responsability and autonomy	*The student's capacity to autonomously and responsably apply their knowledge and skills.* **Demonstrates receptiveness** to new learning contexts. **Shows collaboration** with colleagues and teaching staff in the conduct of didactic activities. **Demonstrates autonomy** in organizing the learning situation/context or the problem situation to be solved. **Promotes/contributes through new solutions related to the field of specialization** to improve the quality of social life. **Becomes aware of the value of one's contribution in engineering** to identifying viable/sustainable solutions to solve problems in social and economic life (social responsibility).

9. Teaching techniques *(Student centric techniques will be considered. The means for students to participate in defining their own study path, the identification of eventual fallbacks and the remedial measures that will be adopted in those cases will be described.)*

Starting from the analysis of students' learning characteristics and their specific needs, the teaching process will explore both expository methods (lecture, presentation) and conversational-interactive methods, based on discovery learning models facilitated by direct and indirect exploration of reality (experiment, demonstration, modeling), as well as action-based methods such as exercises, practical activities, and problem solving.
To facilitate understanding and assimilation of the concepts taught in the course part, interactive lectures will be delivered (containing images, figures, and diagrams), consisting of PowerPoint presentations of the taught notions, as well as numerical examples and demonstrations of their applicability in real life. To more clearly illustrate the measuring instruments described in the course and later used in the laboratory, specialized websites (including YouTube) with tutorials on the functionality and handling of these instruments will be presented. The teaching is gradual, starting from high-school-level electric physics notions and progressing to the introduction of more complex concepts in the field. Teaching is interactive, and a continuous dialogue with students is maintained to encourage thinking and the free expression of their

opinions/knowledge.
This course covers information and practical activities designed to support students in their learning efforts and in developing optimal relationships of collaboration and communication in a climate favorable to discovery learning.
Attention will be paid to practicing active listening and assertive communication skills, as well as mechanisms for constructing feedback as a means of behavioral regulation in diverse situations and of adapting the pedagogical approach to students' learning needs.
The ability to work in a team to solve various learning tasks will be practiced.

10. Contents

COURSE		
Chapter	**Content**	**No. hours**
1	Signals and instruments for their generation: Periodic signals: forms and parameters, electronic measurement systems, types of electronic circuits, signal generators	4
2	The oscilloscope: general configuration of an analog oscilloscope: Y channel, triggering system and timebase, display, cathode-ray tube, X channel; general configuration of a digital oscilloscope; detailed presentation of the Y channel of an oscilloscope: functions, main settings and adjustments, performance parameters, amplitude–frequency characteristic, functional blocks, operating modes; detailed presentation of the X channel of an oscilloscope: triggering system and timebase, conditions for signal synchronization, other adjustments and operating modes of the timebase; block diagram of the X channel; dual timebase oscilloscope	8
3	Measuring voltages and currents: general aspects, units of measurement, two-ports, frequency response, integrating/differentiating circuits; measurement errors: relative error, absolute error, reported error, error propagation; parameters of periodic signals: average value, root mean square (RMS), absolute mean value, form/crest factors; measuring AC/DC voltages.	8
4	Measuring impedances: characterization of impedances, dissipative reactors, series/parallel equivalence, measuring resistances in DC: Wheatstone bridge; measuring complex impedances: AC bridges, classifications, bridges for measuring capacitors (Sauty, Nernst), bridges for measuring inductors (Maxwell, Hay, Owen); the Q-meter	7
	Total:	28

Bibliography:
1) R. Stănculescu, M. Stanciu, "Măsurări Electrice şi Electronice – partea I", litografia UPB, 1998
2) S. Ciochină, "Măsurări Electrice şi Electronice – partea I", litografia UPB, 1995
3) Curs disponibil în format electronic pentru studenţi la adresa:
https://archive.curs.upb.ro/2022/course/view.php?id=9867 (titular Radu-Ovidiu Preda)

LABORATORY		
Crt. no.	**Content**	**No. hours**
1	Signal generation and visualization	3
2	Measurements with the oscilloscope	3
3	Building and measuring circuits on the test board	3
4	Measuring direct and alternating voltages	3
5	Measuring amplitude–frequency characteristics	3

6	Measuring impedances	3
7	Building and measuring an audio oscillator. Review.	3
	Total:	21

Bibliography:

1) Platforme de laborator disponibile la adresa: http://ham.elcom.pub.ro/metc/index.html
2) M. Stanciu, Ş. Obreja, A. Păun, „Măsurări în electronică şi telecomunicaţii. Îndrumar de laborator”, Editura Electronica 2000, ISBN 978-973-7860-09-5, 2008.
3) M. Stanciu, Ş. Obreja, A. Păun, R. U. Mihnea, I. Marcu, R. O. Preda, I. Pirnog, „Instrumentaţie electronică de măsură – Îndrumar de laborator”, Editura Electronica 2000, ISBN 978-973-7860-10-1, 97 pag., 2008.

11. Evaluation

Activity type	11.1 Evaluation criteria	11.2 Evaluation methods	11.3 Percentage of final grade
11.4 Course	- understanding the theory associated with the operation of electronic measuring equipment; - analytical and numerical problem-solving skills for exercises and problems, including the calculation of measurement errors	Final written exam. The subjects cover the entire syllabus, synthesizing the comparative theoretical coverage with the explanation of application models through exercises and problems.	40

11.5 Seminary/laboratory/project	- completion of 7 laboratory works - testing the operation of different measuring instruments; - building basic electronic circuits on the test board; - measuring and understanding the parameters of various discrete components; - measuring voltages, currents, passive components, etc., using different measuring instruments.	Laboratory work, including a theoretical component and a practical component. The theoretical component is checked by test; the practical component is evaluated by verifying the student's manner of solving (implementation, testing, operation, measurement) a practical problem.	30
	Solving (assembly, testing, operation, measurement) by the student of a practical problem.	Practical laboratory test	30
11.6 Passing conditions			
Obtaining 50% of the total score. Obtaining 50% of the score related to laboratory activity.			

12. Corroborate the content of the course with the expectations of representatives of employers and representative professional associations in the field of the program, as well as with the current state of knowledge in the scientific field approached and practices in higher education institutions in the European Higher Education Area (EHEA)

Measurements in Electronics and Telecommunications represent a key point in the complex field of Electronics and Telecommunications, so the concepts and skills acquired in this course will provide a solid foundation for the future specialist engineers trained in this faculty.
The objective of the course—namely, understanding basic measurement techniques and measuring instruments used in electronics—comprises fundamental knowledge expected of an electronics engineer capable of working both in design and in operation or service.
The aspects integrated in this course have a strong correlation with subsequent courses such as Analog and Digital Communications (ADC) and Electronic Measurement Instrumentation (EMI).
Since the practical part of this course is highly developed, students gain skills in handling electronic devices and components, learn to read electronic schematics, and determine measurement errors within certain configurations. Thus, those passionate about electronics will later be able to use the knowledge gained to design robots, electronic cars, etc., and will be able to collaborate with major companies in the field that emphasize the practical implementation of contracted projects.
Graduates are thus provided with competencies aligned with current qualification needs and with modern, high-quality, and competitive scientific and technical training that enables rapid employment after graduation, the course being perfectly integrated into the policy of the University Politehnica of Bucharest,

both in terms of content and structure, and in terms of the skills and international openness offered to students. Through the activities carried out, students develop the ability to offer solutions to problems and to propose ideas to improve the existing situation in the field of measurement instrumentation.

Date	Course lecturer	Instructor(s) for practical activities
21.09.2025	Conf. Dr. Radu-Ovidiu Preda	Conf. Dr. Ionuț Pirnog

Date of department approval	Head of department Prof. Dr. Claudius Dan
Date of approval in the Faculty Council	Dean Prof. Mihnea UDREA