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)				Testarea automată şi validarea circuitelor integrate			
2.2 Course Lecturer				Conf. Dr. Alexandru Antonescu			
2.3 Instructor for practical activities				Conf. Dr. Alexandru Antonescu			
2.4 Year of studies	4	2.5 Semester	2	2.6. Evaluation type	V	2.7 Course regime	Op
2.8 Course type		S	2.9 Course code	04.S.08.A.416		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.					36
Tutoring					00
Examinations					4
Other activities (if any):					18

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	Fundamentals of Electrical Engineering 1 Fundamentals of Electrical Engineering 2 Signals and Systems Measurements in Electronics and Telecommunications Electronic Devices Basic Electronic Circuits Passive Components and Circuits Microprocessor Architecture Analogic Integrated Circuits Electronic Measuring Instruments Microcontrollers Fundamentals of Data Acquisition Systems
4.2 Results of learning	General knowledge of measurement techniques, test and measurement equipments, electrical circuits, electrical signals, industrial equipments. General knowledge about sensors and transducers, measurements, measuring instrumentation, electrical circuits, electrical signals, automation, electronics and microcontrollers.

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

5.1 Course	The lectures will take place in a room equipped with video projector and computer/laptop.
5.2 Seminary/ Laboratory/Project	Compulsory presence at laboratory classes, according to current university regulations. The laboratory will take place in a room with specific equipment, which must include computers (for the works that contain simulations and for accessing the didactic material - files that contain the activities in the laboratory). The presence of the three-phase network is necessary for works such as the one for evaluating the quality of electricity. Example of devices and equipment necessary to carry out laboratory activities: single-phase and three-phase data acquisition system, direct voltage calibrator (analog and digital), devices for measuring temperature in electrical installations, earth socket, equipment for compensating the power factor power, etc.

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)*

The course provides the theoretical and practical knowledge (concepts, principles, equipments and standards) regarding the testing and design of equipments and processes.
Create the following skills and abilities:
- understanding how is made various measurement instruments and devices;
- understanding and solving a wide range of testing problems using techniques, equipment and software testing according to actual standards;
- using classical measurement and control instruments and advanced automated test equipments;
- understanding and applying of testing procedures in predictive maintenance;
- testing of electrical installations and power quality analysis in accordance with actual standards;
- understanding boundary scan testing implemented in integrated circuits and circuit boards;
- understanding of built in self testing procedures;

- knowing of communication standards used for programmable instruments and programming of these instruments to perform measurements;
- application of manual and automated calibration procedures and evaluation of measurement uncertainty.

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	1. Use of fundamentals related to electronic devices, circuits, systems, instruments and technology 2. Description of the operation of electronic devices and circuits and the fundamental methods of measuring basic electrical quantities 3. Diagnostics / troubleshooting of electronic circuits, equipment and systems 4. Use of electronic tools and specific methods for characterizing and evaluating the performance of electronic circuits and systems 5. Solving technological problems in applied electronics 6. Defining the principles and methods underlying the manufacture, adjustment, testing and maintenance of devices and equipment in the field of applied electronics 7. Explain and interpret production processes and maintenance activities of electronic equipment, identify test points and measure electrical quantities. 8. Application of management principles for the organization of production, operation and service activities in the fields of applied electronics 9. The use of criteria and methods for evaluating the quality of production and service activities in the fields of applied electronics
Transversal (General) Competences	1. Methodical analysis of the problems encountered in the activity and the identification of already established solutions in order to fulfill the professional tasks. 2. Adaptation to new technologies, professional and personal development through long-term learning using printed documentation, specialized software and electronic resources in both Romanian and English.

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.* • Lists the most important stages that marked the development of the field of measurements and scientific instrumentation. • Defines the notions specific to the field of testing and measurements. • Describes the methods used to perform automated testing. Highlights the advantages and disadvantages of different testing methods as well as their appropriate choice for an equipment or process.

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).* - Use of fundamental knowledge related to the construction and specific elements of an automatic test equipment. - Understanding and using the fundamental concepts in the field of testing and measurement, developing specific algorithms for their implementation. - Solving electronic technology problems of production processes, maintenance (adjustment, testing, troubleshooting) of equipment and installations in the field of testing and development of projects of medium complexity in the specialty. - The ability to communicate and collaborate with specialists from other fields (due to the fact that surveying/measurement is present in different fields), in the sense of ensuring an interface between the technical problems encountered by them and the solutions to those problems. - The ability to function as a leader of a team that may consist of people with different specializations and skill levels. - The ability to make decisions in order to solve current or unpredictable problems that appear in the process of operating industrial equipment and processes. - The ability to ensure the planning and management of projects in the field of testing and measurement. - The ability to inform and document for personal and professional information by reading specialized literature. - The ability to communicate and present the working principle of a technical test/measurement system, both in Romanian and in English. - Flexibility in the use of new elements and technologies within a team where members together achieve a well-defined goal while assuming different roles or tasks.
Responsability and autonomy	*The student's capacity to autonomously and responsably apply their knowledge and skills.* • Select appropriate bibliographic sources and analyze them. • Respect the principles of academic ethics, correctly citing the bibliographic sources used. • Demonstrates responsiveness to new learning contexts. • Demonstrates autonomy in organizing the learning situation/context or the problem situation to be solved. • Demonstrates social responsibility through active involvement in student social life/involvement in academic community events. • Promotes/contributes through new solutions related to the specialized field to improve the quality of social life. • Realizes the value of his contribution in the field of engineering to the identification of viable/sustainable solutions to solve problems in social and economic life (social responsibility). • Apply principles of professional ethics/deontology in the analysis of the technological impact of the proposed solutions in the specialized field on the environment. • Analyzes and capitalizes on business/entrepreneurial development opportunities in the specialized field. • Demonstrates real-life situation management skills (collaborative vs. conflict time management). Avoiding conflict situations and discouraging them. In the case of managerial activity, the orientation is more towards a leader's attitude, not a manager's.

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.)*

The teaching is carried out through the method of expository communication and the problematization method.
Modern teaching methods (video projector) are used to present course notes, and application notes and demonstration programs are available on the computer in the laboratory.
Course notes and presentations are also available to students in electronic format (Moodle).
Starting from the analysis of students' learning characteristics and their specific needs, the teaching process will explore both expository (lecture, exposition) and conversational-interactive teaching methods, based on discovery learning models facilitated by direct exploration and indirect of reality (experiment, demonstration, modelling), but also on action-based methods, such as exercise, practical activities and problem solving.
Lectures will be used in the teaching activity, based on Power Point presentations or different video sequences that will be made available to the students. Each lecture will begin with the recapitulation of the chapters already covered, with an emphasis on the concepts covered in the previous lecture.
Presentations use images and diagrams so that the information presented is easy to understand and assimilate.
This discipline covers information and practical activities designed to support students in their learning efforts and the development of optimal collaborative and communicative relationships in a climate conducive to discovery learning.
Teaching is carried out through the experimentation method, using dedicated test equipment (which includes hardware and/or software components) and specialized educational software applications. Students use a simulator through which they test the created programs.
Teamwork skills will be practiced to solve different learning tasks.

10. Contents

COURSE		
Chapter	**Content**	**No. hours**
1	Introduction to testing processes. Evolution of test systems and applications.	2
2	Review of principles and methods of various instruments and devices used in test/measurement systems.	4
3	Predictive testing and maintenance. Principles, advantages, disadvantages. Applications. Corrective maintenance. Predictive maintenance.	2
4	Non-invasive infrared testing techniques. Equipment for thermography. Applications of thermal inspections in predictive maintenance.	4
5	Testing of electrical installations according to the electrical safety standard EN61557. Electrical systems. Security categories and rules. EN61557 requirements and test methods. Applications in predictive maintenance.	4
6	Electricity quality analysis according to EN50160 and EN61000-4-30 standards. Power quality definitions and measurement principles. Requirements and test methods. Applications in predictive maintenance.	4
7	Data bus testing. Operating parameters specified by communication standards RS-232, RS-485, CAN, USB, Ethernet, etc. Applications in predictive maintenance.	2
8	Testing of electronic components and printed circuit boards. Test methods. Automated Test Equipment (ATE). Advantages disadvantages.	2

9	Testing systems with programmable tools. Standard Commands for Programmable Instruments (SCPI). Structure of programmable instruments. Syntax of SCPI messages. GPIB bus (IEEE488.1). LXI standard (LAN extension for instruments). Test system architecture. Applications. Advantages disadvantages.	2
10	Final test	2
	Total:	28

Bibliography:

1. Oancea Constantin Daniel, Robotics, suport de curs electronic, https://curs.upb.ro/2021/course/view.php?id=9130
2. R. Stoian, R. Popovici, A. Hălăngau, R. Dumitrescu, „Testarea echipamentelor, instalatiilor si proceselor. Lucrări practice”, Editura Politehnica Press, Bucureşti, ISBN 978-606-527-125-3, 2010.
3. Rodica Stoian, Proceduri de evaluare si exprimare a incertitudinii de masurare, Editura Foton International, 2001.
4. Rodica Stoian, Standarde de comunicatie pentru instrumentatie programabila, Ed. Printech, 1999.
5. Fluke Corporation, The Snell Group, “Introduction to Thermography Principles”, American Technical Publishers, Inc., Illinois, USA, 2009.
6. Harry Bleeker, Frans de Jong, Peter van den Eijnden, Boundary-Scan Test: A Practical Approach, Springer, 1st Edition, 244 Pages, 2009.
7. Glen A. Mazur, Electric Motor Drive Installation and Troubleshooting, Amer Technical Pub, 473 Pages, ISBN 978-0826912527, 2008.
8. Kenneth P Parker, The Boundary-Scan Handbook, Springer, 3rd edition, 408 Pages, 2003.
9. B. Nadeau-Dostie, ed., Design for At-Speed Test, Diagnosis and Measurement, Boston: Kluwer Academic Publishers, 2000.
10. S. Mourad, Y. Zorian, Principles of Testing Electronic Systems, John Wiley & Sons Inc., 2000.
11. C. D. Oancea, Instrumentatie, Editura MatrixRom, Bucuresti, 2013.
12. C. Vlaicu, C. D. Oancea, Arhitectura Sistemelor de Măsurare Numerice (Design of Digital Measurement System), Editura MatrixRom, Bucuresti, 2018.
13. Carmen Ionescu Golovanov, Masurarea marimilor electrice in sistemul electroenergetic, Editura Academiei Romane, Editura AGIR, Bucuresti, 2009.

LABORATORY

Crt. no.	Content	No. hours
1	Testing of equipment and installations using thermography/thermovision.	2
2	Testing of electrical installations	2
3	Calibrator	2
4	Power quality analysis	2
5	Phase shift measurement	2
6	Programmable measuring instruments. SCPI	2
7	Laboratory knowledge check	2
	Total:	14

Bibliography:
1. Oancea Constantin Daniel, Robotics, suport de curs electronic, https://curs.upb.ro/2021/course/admin.php?courseid=9132
2. Oancea Constantin Daniel, Instrumentatie. Note de aplicatii, Matrix Rom Publishing House, Bucureşti, 2013
3. Constantin-Daniel Oancea, Industrial proccess monitoring. Laboratory exercises. MatrixRom Printing House, Bucureşti, 2016
4. Brânduşa Pantelimon, Constantin Iliescu, Marcel-Marian Stanciu, Laurenţiu Ilie, Constantin-Daniel Oancea, Octavian-Mihai Ghiţă, Viorica Simion, Corneliu Buzatu, Electric and electronic measurements. Practice, Printech Edition, Bucharest 2000
5. Constantin-Daniel OANCEA, Constantin VLAICU, Computer aided measurement, Laboratory exercises, UPB Printing House, Bucharest, 2005
6. R. Stoian, R. Popovici, A. Hălăngau, R. Dumitrescu, „Testarea echipamentelor, instalatiilor si proceselor. Lucrări practice”, Editura Politehnica Press, Bucureşti, ISBN 978-606-527-125-3, 2010.

11. Evaluation

Activity type	11.1 Evaluation criteria	11.2 Evaluation methods	11.3 Percentage of final grade
11.4 Course	- knowledge and understanding of fundamental theoretical notions in the field of design and operation of test equipment. - comparative analysis of different types of test methods	Final check given at the end of the semester. The topics cover the chapters until the end of the semester.	20%
	- knowledge and understanding of fundamental theoretical notions in the field of design and operation of test equipment. - comparative analysis of different types of test methods	Midterm. The topics cover the half of the lectured chapters.	30%
11.5 Seminary/laboratory/project	- acquiring and understanding the knowledge taught; - practical application of algorithms for testing; - capacitatea de a aplica noţiunile teoretice pentru rezolvarea unor probleme practice;	Laboratory test. Monitoring of activity and involvement in laboratory work. Laboratory test.	50%
11.6 Passing conditions			
• 50% of the total score. • 50% of the score related to the activity during the semester.			

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)

The course curriculum responds to the current needs and requirements for the evolution and development of manufacturing systems, offering graduates of the Applied Electronics (ELA) study program the chance to work in extremely different fields: automation and industrial equipment, the automotive industry, etc.
Graduates are provided with adequate skills with the needs of current qualifications and a modern, high-quality and competitive scientific and technical training, which will allow them to be quickly employed after graduation. This is in accordance with the requirements of the Polytechnic University of Bucharest, both from the point of view of content and structure, as well as from the point of view of the skills and international openness offered to students.
• Through the activities carried out, students develop skills to offer solutions to some problems and to propose ideas for improving existing methods in the field of measurements and instrumentation.
• Knowledge / aspects / phenomena described in specialized literature were taken into account in the development of the content of the discipline.
• The course has a content similar to the subjects with this specific taught in other faculties of U.P.B.

Date	Course lecturer	Instructor(s) for practical activities
25.09.2025	Conf. Dr. Alexandru Antonescu	Conf. Dr. Alexandru Antonescu

Date of department approval	Head of department
26.09.2025	Prof. Dr. Claudius Dan

Date of approval in the Faculty Council	Dean
26.09.2025	Prof. Dr. Mihnea Udrea