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	Masters
1.6 Programme of studies	Microsystems

2. Date despre disciplină

2.1 Course name (ro) (en)				Verificare functionala a circuitelor Functional circuit verification			
2.2 Course Lecturer				Conf. Dr. Alexandru Antonescu			
2.3 Instructor for practical activities				Conf. Dr. Alexandru Antonescu			
2.4 Year of studies	2	2.5 Semester	1	2.6. Evaluation type	E	2.7 Course regime	Ob
2.8 Course type		DA	2.9 Course code	UPB.04.M3.O.03-20		2.10 Tipul de notare	Nota

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

3.1 Number of hours per week	3	Out of which: 3.2 course	2	3.3 seminary/laboratory	1
3.4 Total hours in the curricula	42	Out of which: 3.5 course	28	3.6 seminary/laboratory	14
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.					
Tutoring					
Examinations					
Other activities (if any):					

3.7 Total hours of individual study	58.00
3.8 Total hours per semester	100
3.9 Number of ECTS credit points	4

4. Prerequisites (if applicable) (where applicable)

4.1 Curriculum	Fundamental Courses in Electronic Devices, Electronic Component Models for Spice, Modeling of Active Microelectronic Components
4.2 Results of learning	Introduction to manual and automated testing, presentation of laboratory equipment for automated testing. Knowledge of implementing test support circuits in analog circuits. Implementation of test methods for analog integrated circuits

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

5.1 Course	The course will take place in a room equipped with a video projector or on the MSTeams platform.
5.2 Seminary/ Laboratory/Project	The project will be carried out in a room with specific equipment, which must include: computers, INTERNET connection, SPICE type electronic circuit simulator or on the MSTeams platform, students having computers with a SPICE type simulator installed.

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 is aimed mainly at graduates with a bachelor's degree in the field of Electronic Engineering, Telecommunications and Information Engineering, Electrical Engineering and Applied Engineering Sciences.

Verification and characterization of integrated circuits is one of the most important steps in their development. This discipline introduces the role of test engineer and verification engineer for mixed electronic circuits. A DFT module is developed in the laboratory to emulate a real DFT used in production testing.

The skills provided by studying the discipline fall within the area of those necessary for the research and development of new devices and integrated circuits, made with modern methods and technologies.

Placement in semester 1 takes into account the cognitive sequence necessary to train a high-performance specialist in the field of microsystems, as well as the interdisciplinary nature of the master's program.

The discipline can be seen as fundamental for ensuring engineering skills for research and development or design in the field of complex integrated microsystems.

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	Knowledge of a modern project management system with emphasis on the role of a test engineer. Presentation of manual and automated testers and their specific programming methods. Analysis of a production process starting from quality indices such as cp, cpk and yield. Basic troubleshooting of unwanted behaviors of mixed circuits. Development of a DFT block.

Transversal (General) Competences	- Developing the experimental skills necessary for the technological realization, modeling and characterization of new micro and nanoelectronic devices and circuits; - Responsible execution of tasks in a multidisciplinary team, assuming roles at different hierarchical levels; - Identifying the need for continuous training and the efficient use of information sources and communication resources and assisted professional training (Internet portals, specialized software applications, databases, online courses, etc.) both in Romanian and in an international language. - Using an editing and simulation program (Cadence) for electronic circuits.

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.* Understanding the role of a test engineer within an electronic circuit development team. · Understanding a datasheet associated with an electronic device. · Developing an automated test algorithm. Design and implement a DFT module. Understanding the role of a test engineer within an electronic circuit development team. Understanding a datasheet associated with an electronic device. Developing an automated test algorithm.
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).* Work productively in a team to carry out the project. • Develop a scientific text in writing the project • Solve practical applications within the project • Interpret causal relationships appropriately • Analyze and compare models • Identify solutions and develop the discipline project. • Formulate conclusions from the experiments carried out. • Argue the solutions identified within the project.
Responsability and autonomy	*The student's capacity to autonomously and responsably apply their knowledge and skills.* • Selects appropriate bibliographic sources and analyzes them. • Respects the principles of academic ethics, correctly citing the bibliographic sources used. • Demonstrates receptivity to new learning contexts. • Demonstrates collaboration with other colleagues and teachers in carrying out teaching activities • Demonstrates autonomy in organizing the learning situation/context or the problem situation to be solved • Promotes/contributes through new solutions, related to the specialty field. • Is aware of the value of his contribution in the field of engineering in identifying viable/sustainable solutions • Applies ethical principles

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 the 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 and indirect exploration of reality (experiment, demonstration, modeling), 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 various Internet pages that will be made available to students. Each course will begin with a recapitulation of the chapters already covered, with an emphasis on the notions covered in the last course.

The 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 in developing optimal collaborative and communication relationships in a climate favorable to discovery learning.

The practice of active listening and assertive communication skills, as well as feedback construction mechanisms, will be considered, as ways of behavioral regulation in various situations and adapting the pedagogical approach to the learning needs of students.

The ability to work in a team will be practiced to solve various learning tasks.

The attention of students will be checked through quick tests (quizzes) during or at the end of the course in certain courses.

10. Contents

COURSE		
Chapter	**Content**	**No. hours**
1	Introduction to Project Management The Role of the Test Engineer in the Development of an Electronic Device/Circuit	2
2	General description of the circuit testing process - Presentation of the production cycle - Difference between prototype characterization and production testing	4
3	Generating a Test Plan - Structure of a Test Plan - Structure of a Test Diagram - Converting a Catalog Sheet into a Test Plan	2
4	Generarea unui plan de testare - Structura unui plan de testare - Structura unei diagrame de testare - Conversia unei foi de catalog intrun plan de testare	4

5	Analysis of the production process using statistical indicators - Definition of cp/cpk - Definition of LSL, USL, Z LSL, Z USL - Relationship between the stability of the production process (yield) and the values of cp, cpk	4
6	Specific types of measurements - Continuity, leakage currents, consumption currents - Voltage references - Specific associated errors	6
7	Measurement accuracy - Specific terminology - Calibration - Primary analysis of measurement data - Use of automated testing systems - Use of specific laboratory equipment	6
	Total:	28

Bibliography:

M. Burns and G. Roberts: An introduction to mixed-signal IC test and measurements; Oxford University Press, 2001; ISBN 0-19-514016-8
W. K. Lam: Hardware Design Verification: Simulation and Formal Method-Based Approaches, Prentice Hall Publishing House, ISBN 9780131433472
M, Stephens, D. Rosenberg: Design Driven Testing, Apress, 2011; ISBN 1430229446

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11. Evaluation

Activity type	11.1 Evaluation criteria	11.2 Evaluation methods	11.3 Percentage of final grade
11.4 Course	General testing process knowledge	Final written exam	50%
	Testting process quality analysis	Midterm	20%
11.5 Seminary/laboratory/project	Constructing a functional DFT module	Midterm	30%
11.6 Passing conditions			
Obtaining 50% of the lab and project score 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 increasing complexity of electronic circuits and systems, as well as the need to reduce costs and research-design-manufacturing cycles, have required the development of computer-aided simulation, design and optimization techniques, in the form of various software tools.

The discipline provides graduates with skills appropriate to the needs of current qualifications and a modern, quality and competitive scientific and technical training.

Graduates are thus provided with a modern, quality and competitive scientific and technical training, which allows them to be quickly employed after graduation, being perfectly aligned with the policy of the Politehnica University of Bucharest, both in terms of content and structure, as well as in terms of the skills and international openness offered to students.

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