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)				Circuite integrate digitale			
2.2 Course Lecturer				Prof. Dr. Monica Dascălu			
2.3 Instructor for practical activities				Prof. Dr. Monica Dascălu, As. Costin-Andrei Brătan			
2.4 Year of studies	2	2.5 Semester	2	2.6. Evaluation type	E	2.7 Course regime	Ob
2.8 Course type		D	2.9 Course code	04.D.04.O.017		2.10 Tipul de notare	Nota

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

3.1 Number of hours per week	4.5	Out of which: 3.2 course	2	3.3 seminary/laboratory	2.5
3.4 Total hours in the curricula	63	Out of which: 3.5 course	28	3.6 seminary/laboratory	35
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.					52
Tutoring					0
Examinations					5
Other activities (if any):					5

3.7 Total hours of individual study	62.00
3.8 Total hours per semester	125
3.9 Number of ECTS credit points	5

4. Prerequisites (if applicable) (where applicable)

4.1 Curriculum	Programming, Electronic Devices
4.2 Results of learning	Any procedural programming language, logic algebra, binary arithmetic, MOS transistor in commutation

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

5.1 Course	Projector
5.2 Seminary/ Laboratory/Project	Computers with selected EDA tools

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)*

Introduction to the digital field with specific techniques of analysis, simulation and synthesis, understanding the fundamental principles of digital circuits. Presentation of functional digital blocks. Familiarity with medium-complexity digital circuits and digital development boards. Use of electronic devices in switching mode.

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	Upon completion of this course, students will be able to understand and explain the operation of a digital scheme of medium complexity, have the ability to describe digital schematics in a hardware description language, test through simulation, and implement these circuits on development boards. Students will also have the ability to select functional building blocks and application-specific circuit types.
Transversal (General) Competences	Students will better understand and be able to apply some concepts and general methodologies, such as simulation and synthesis. They will have the ability to generate practical solutions to some concrete problems and check their adequacy.

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.* Application of logical algebra in the description and design of combinational circuits, the main types of digital circuits, memory operation and implementation, sequential functional blocks, the theory of automata and the implementation of simple finite state machines (FSM).
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).* The students will be able to describe, simulate and design combinational and sequential circuits, including FSMs. They will be able to understand digital schemes and develop digital applications.

Responsability and autonomy	*The student's capacity to autonomously and responsably apply their knowledge and skills.* The correct operation of the circuits according to the intended functionality will be emphasised.

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 methodolody will approach the discipline from simple to complex, with a large number of practical examples to facilitate understanding of the theory. The slideshows presentation will be used minimally, so that the explanation follows a rhythm that can be understood and assimilated by students during classes.

Student participation will be encouraged through optional weekly assignments (rewarded with bonus points in case of very good solutions), and random testing of the elements taught in the course/seminar. Students who wish will receive individual feedback for all applicative activities and all homework.

The examples from the seminar and laboratory will be synchronized with the subject taught in the course and correlated with the results of the tests and homeworks, to ensure the gradual deepening of the subject.

10. Contents

COURSE		
Chapter	**Content**	**No. hours**
1	Introduction in digital electronics	1
2	Logic functions and logic circuits	4
3	Functional combinatory blocks	3
4	Programmable logic devices	2
5	CMOS digital gates	2
6	Memories	4
7	Simple sequential circuits	2
8	Finite state machines	4
9	Applications	2
10	FPGA	2
	Total:	28

Bibliography:

Monica Dascalu, Circuite Integrate Digitale – teorie şi aplicaţii, Editura MemoBooks, 2022 (şi suportul de curs de pe platforma Moodle)
Dan Nicula: ELECTRONICA DIGITALA - Carte de învatatura postat la http://www.dannicula.ro/ed_ci/

LABORATORY		
Crt. no.	**Content**	**No. hours**
1	Introduction to Vivado tool. Verilog description of digital signals.	2

2	Digital synthesis in FPGA. Programming the educational boards	2
3	Behavioral vs. structural HDL descriptions. Test modules.	2
4	Logical functional descriptions. Processes in Verilog: always and assign	2
5	Delays in logic circuits. Tristate logic	2
6	Latches, flipflops and registers	2
7	RTL descriptions for digital memories	2
8	Counters and their applications	4
9	Finite state machines	4
10	Recap	2
11	Practicum	2
	Total:	28

SEMINARY

Crt. no.	**Content**	**No. hours**
1	Logic functions and logic circuits	2
2	Functional combinatory blocks	2
3	Finite state machines	3
	Total:	7

Bibliography:

Monica Dascalu, Circuite Integrate Digitale – teorie și aplicații, Editura MemoBooks, 2022
Monica Dascălu, CID – Îndrumar de laborator, volum electronic pe platforma Moodle

11. Evaluation

Activity type	11.1 Evaluation criteria	11.2 Evaluation methods	11.3 Percentage of final grade
11.4 Course	elementary understanding and application of the notions taught in the course	quiz	10%
	1. Knowledge of fundamental theoretical notions. 2. Knowledge of digital functional blocks: definition, operation and applications 3. The ability to describe a digital circuit in Verilog 4. Ability to functionally describe digital circuits of small and medium complexity	final exam	40%

11.5 Seminary/laboratory/project	1. Verilog description of digital circuits 2. Circuit testing by simulation 3. Use of design and synthesis tools 4. Programming the FPGA boards and checking their correct operation	continuous evaluation and practical test	50%
11.6 Passing conditions			
Laboratory and seminary: - mandatory attendance at application hours. Lost works can NOT be retake (nor in other days, with other classes, etc.). Maximum number of absences in exceptional circumstances: 2. - Minimum grade at the laboratory for promotion: 50% of the total laboratory grade, of which 1/3 at the test. Exam: Grade limit to pass: 50% of the final exam grade (20 points) Minimum total grade for promotion (laboratory, course tests, exam): 50 points In order to pass the discipline (laboratory and exam) the student must make a correct functional application (either at simulation level or implementation on boards)			

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 discipline teaches the main theoretical and practical elements necessary for the design of low and medium complexity digital systems using the Verilog HDL language providing certain skills that can be considered assets for hiring students in companies specialized in digital design and verification.

Date	Course lecturer	Instructor(s) for practical activities
	Prof. Dr. Monica Dascălu	Prof. Dr. Monica Dascălu

Date of department approval	Head of department
22.10.2025	Prof. Dr. Claudius Dan

Date of approval in the Faculty Council — Dean

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