**Universitatea Națională de Știință și Tehnologie Politehnica București**
**Facultatea de Electronică, Telecomunicații și**
**Tehnologia Informației**

# COURSE DESCRIPTION

## 1. Program identification information

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|---|---|
| 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 | Micro and Nanoelectronics |

## 2. Date despre disciplină

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 2.1 Course name (ro)<br>(en) | | | | Procesare digitala in microsisteme | | | |
| 2.2 Course Lecturer | | | | Prof. Dr. Monica Dascălu | | | |
| 2.3 Instructor for practical activities | | | | Prof. Dr. Monica Dascălu | | | |
| 2.4 Year of studies | 1 | 2.5 Semester | I | 2.6. Evaluation type | E | 2.7 Course regime | Ob |
| 2.8 Course type | | DA | 2.9 Course code | UPB.04.M1.O.03-01 | | 2.10 Tipul de notare | Nota |

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

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|---|---|---|---|---|---|
| 3.1 Number of hours per week | 3 | Out of which: 3.2 course | 2.00 | 3.3 seminary/laboratory | 1 |
| 3.4 Total hours in the curricula | 42.00 | 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<br>Supplemental documentation (library, electronic access resources, in the field, etc)<br>Preparation for practical activities, homework, essays, portfolios, etc. | | | | | 52 |
| Tutoring | | | | | 0 |
| Examinations | | | | | 3 |
| Other activities (if any): | | | | | 3 |

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| 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)

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| 4.1 Curriculum | Going through and promoting the following disciplines:<br>• Digital Integrated Circuits<br>• Architecture of computer systems |
| 4.2 Results of learning | Description and simulation of digital circuits in Verilog HDL |

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

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| 5.1 Course | The course will take place in a room equipped with a projector |
| 5.2 Seminary/ Laboratory/Project | The project needs specific equipment, which must include:<br>FPGA boards<br>Computers<br>Design/programming software |

**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)*

Familiarization with digital processing techniques and technological platforms used in microsystem design

**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.)*

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| **Specific Competences** | Demonstrates that he/she has advanced knowledge and skills in the field of digital electronics<br>Applies the appropriate algorithms to the application type<br>Selects the optimal hardware deployment |
| **Transversal (General) Competences** | Capacity for analysis and synthesis: summarises the results of the documentation.<br>Respects the principles of academic ethics: in the documentation activity correctly cites the bibliographic sources used. |

**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.)*

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|---|---|
| **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.*<br>At the end of this course, students will be able to understand, describe and apply the different categories of algorithms and techniques used in digital processing |

| | |
|---|---|
| **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).*<br><br>Selects the appropriate techniques and algorithms for each application<br>Describe in an HDL language the digital components<br>Choose the hardware solution appropriate to each type of algorithm |
| **Responsability and autonomy** | *The student's capacity to autonomously and responsably apply their knowledge and skills.*<br>Respects ethical principles in research and documentation development. |

**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.)*

Emphasis will be placed on synchronizing the material taught in the course with the subject of practical applications.

Each course will have a clearly stated theme, correlated with the material previously taught. Suggestive examples of practical applications that build on the concepts taught will be included. Each course will end with a short Quiz solved together with the students, to recapitulate some notions taught.

Emphasis will be placed on assisting students individually in the learning process, through optional weekly assignments where teaching staff will provide feedback to students who request it. All assessment components will include feedback to improve performance on subsequent tests.

In the practical applications, methods specific to the seminar and practical works will be used alternately, allowing students to more easily assimilate the concepts taught and apply their knowledge through individual study.

**10. Contents**

| **COURSE** | | |
|---|---|---|
| **Chapter** | **Content** | **No. hours** |
| 1 | Introduction – the specifics of the domain | 2 |
| 2 | Verilog HDL | 4 |
| 3 | Numerical processing techniques and algorithms | 8 |
| 4 | Digital signal processing techniques and algorithms | 6 |
| 5 | Artificial intelligence methods | 2 |
| 6 | Connectivity, data conversion and standards | 2 |
| 7 | Hardware solutions | 2 |

| | | |
|---|---|---|
| | **Total:** | 28 |

**Bibliography:**
Monica Dascălu, Procesare digitală în Microsisteme, platforma Moodle
Monica Dascalu, Circuite Integrate Digitale – teorie și aplicații, Editura MemoBooks, 2022

**Bibliography:**
Monica Dascălu, Procesare digitală în Microsisteme, platforma Moodle
Monica Dascalu, Gheorghe Stefan: VeriLab, proiectarea circuitelor digitale in Verilog, Editura Politehnica Press, 2016

**11. Evaluation**

| Activity type | 11.1 Evaluation criteria | 11.2 Evaluation methods | 11.3 Percentage of final grade |
|---|---|---|---|
| 11.4 Course | Individual documentation in the field of standards | homework | 20% |
| | Knowledge of the course content | exam | 40% |
| 11.5 Seminary/laboratory/project | Submitting a functional project with proper documentation | Oral presentation and practical demo | 40% |
| 11.6 Passing conditions | | | |
| Get 50% of the total score for the project<br>Attendance at project hours<br>A functional project with proper documentation<br>Get 50% of the activity 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 subject matter teaches the main theoretical and practical elements necessary for the design of digital systems of medium complexity using the Verilog HDL language with the help of FPGA. Sudeteners will learn to use FPGA in the design of microsystems which will be useful to them if they want to work in the field.

| Date | Course lecturer | Instructor(s) for practical activities |
|---|---|---|
| 01.09.2024 | Prof. Dr. Monica Dascălu | Prof. Dr. Monica Dascălu |

Date of department approval — Head of department

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31.10.2024 Prof. Dr. Claudius DAN

Date of approval in the Faculty Council Dean

01.11.2024 Prof. Dr. Mihnea Udrea