# Syllabus

## 1. Data about the program of study

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| 1.1 Institution | Technical University of Cluj-Napoca |
| 1.2 Faculty | Automation and Computer Science |
| 1.3 Department | Automation |
| 1.4 Field of study | Systems Engineering |
| 1.5 Cycle of study | Bachelor of Science |
| 1.6 Program of study/Qualification | Automation and Applied Informatics (English) |
| 1.7 Form of education | Full time |
| 1.8 Course cod | 18.00 |

## 2. Data about the subject

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|---|---|---|---|---|---|---|
| 2.1 Subject name | *Digital Electronics* | | | | | |
| 2.2 Course responsible/lecturer | Sl.dr.ing Gabriel Harja - Gabriel.Harja@aut.utcluj.ro | | | | | |
| 2.3 Teachers in charge of applications | Sl.dr.ing Gabriel Harja - Gabriel.Harja@aut.utcluj.ro | | | | | |
| 2.4 Year of study | 2 | 2.5 Semester | 1 | 2.6 Assessment *(E/C/V)* | | E |
| 2.7 Type of subject | *DF – fundamental, DD – in the field, DS – specialty, DC – complementary* | | | | | DD |
| | *DI – compulsory, DO – elective, Dfac – optional* | | | | | DI |

## 3. Estimated total time

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 3.1 Number of hours per week | 4 | of which: | Course | 2 | Seminar | 0 | Laboratory | 2 | Project | 0 |
| 3.2 Number of hours per semester | 56 | of which: | course | 28 | Seminar | 0 | Laboratory | 28 | Project | 0 |

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| 3.3 Individual study | |
| (a) Manual, lecture material and notes, bibliography | 23 |
| (b) Supplementary study in the library, online and in the field | 17 |
| (c) Preparation for seminars/laboratory works, homework, reports, portfolios, essays | 17 |
| (d) Tutoring | 6 |
| (e) Exams and tests | 6 |
| (f) Other activities: | 0 |

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|---|---|
| 3.4 Total hours of individual study (sum of (3.3(a)…3.3(f))) | 69 |
| 3.5 Total hours per semester (3.2+3.4) | 125 |
| 3.6 Number of credit points | 5 |

## 4. Pre-requisites (where appropriate)

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| 4.1 Curriculum | Mathematical Analysis, Fundamentals of Electronic Circuits, Computer Programming |
| 4.2 Competence | Basic electronics circuits, computer operating, differential equations |

## 5. Requirements (where appropriate)

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| 5.1. For the course | To be admitted to the assessment, a student must accumulate a minimum lecturer attendance of 70%. |
| 5.2. For the applications | Presence at laboratory is conditioned by forward laboratory report sustain and analysis. |

## 6. Specific competences

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|---|---|
| 6.1 Professional competences | • **C2** – Operating with basic concepts of computer science, information technology and communication<br><br>○ **C2.1** – Describing the structure and operation of computer systems, communication networks and their applications in systems engineering using the concepts of programming languages, software environments and technologies, software engineering and specific tools (algorithms, diagrams, models, protocols, etc.).<br><br>○ **C2.2** – Well-grounded usage of concepts from informatics and computer technology in solving well defined problems of system engineering and in applications requiring the use |

| | of hardware or software in industrial systems or information technology systems. |
|---|---|
| | o **C2.3** – Solving common problems of systems engineering using the computer science and information technology concepts for the use of dedicated software tools and computer aided design (CAD) and for the adaptation and extension of these. |
| | o **C2.4** – Selection and evaluation, as a user, of dedicated software and computer aided design (CAD) tools for applications in systems engineering, computers, information technology and communications. |
| | o **C2.5** – Using hardware - software code sign and software engineering as development methodologies, including the system level modelling. |
| 6.2 Cross competences | |

## 7. Course objectives

| 7.1 General objective | Assimilation of knowledge about fundamental concepts of impulse technique, completion and operation of digital circuits, a semiconductor memory, reconfigurable circuits, and microcontrollers. |
|---|---|
| 7.2 Specific objectives | • Design and completion schemes with digital circuits<br>• Design and completion of some application with microcontrollers |

## 8. Contents

| 8.1 Lecture | No.hours | Teaching methods | Notes |
|---|---|---|---|
| C1. Introductive notions. Definition of the pulse signal, parameters, impulse generation. | 2 | Slides presentation, explanations and demonstrations on whiteboard, discussions / or online on Teams platform | |
| C2. Switching regime of semiconductor devices. | 2 | | |
| C3. Integrated logic circuits. Generalities, technical considerations, classification, evolution of integrated logic circuits. Classification of families of logic circuits. | 2 | | |
| C4. Static parameters of logic circuits: the transfer characteristic, the noise margin, duty factor. Dynamic parameters: propagation delay time, power dissipation. | 2 | | |
| C5. TTL logic integrated circuits. TTL basic Gate, operating, parameters. | 2 | | |
| C6. Standard TTL series, parameters, interconnection rules. Open collector TTL circuits, three states circuits (TSL). | 2 | | |
| C7. TTL circuits series: high speed TTL series (HTTL), low power TTL series (LTTL), Schottky TTL series (STTL, LSTTL), advanced Schottky series (ALS, AS). | 2 | | |
| C8. Integrated MOS logic circuits. CMOS integrated inverter, static and dynamic parameters. | 2 | | |
| C9. Series of CMOS circuits. Circuits for protection, buffering circuits, quality factor. Interconnection of integrated logic circuits. | 2 | | |
| C10. Semiconductor memories. Overview, classifications. ROM Memories. | 2 | | |
| C11-12. SRAM memories. DRAM memories. | 4 | | |
| C13-14. Microcontrollers. | 4 | | |
| Bibliography<br>1.  I. Naşcu (2002): Digital circuits. Editura Mediamira, Cluj Napoca.<br>2.  I. Naşcu, V. Dădârlat, S. Folea, (1996): Digital circuits. Application guide.<br>3.  Dadarlat V., Peculea A.,( 2006) Analog and digital circuits. Cluj Napoca<br>4.  Ardelean I., si colectivul (1986): CMOS integrated circuits, E.T. Bucuresti.<br>5.  Stojanov I (1987): From TTL gate to microprocessor. E.T. Bucuresti.<br>6.  David J. Comer,Donald Corner, Fundamentals of Electronic Circuit Design, Wiley, 2003<br>7.  Anant Agarwal, Jefrey H. Lang, Foundations of Analog and Digital Electronic Circuits, Morgan Kaufmann Publishers, 2005 | | | |

| 8.2 Aplications (seminar/laboratory/project) | | No.hours | Teaching methods | Notes |
|---|---|---|---|---|
| 1 | Basic concepts in microcontroller programming | 2 | Application implementation and testing on laboratory didactic stands. Application presenting, explanations and demonstrations on whiteboard, discussions / or online on Teams platform | Mandatory attendance |
| 2 | Digital inputs/outputs | 2 | | |
| 3 | Digital inputs/outputs | 2 | | |
| 4 | BCD Display 7 Segments | 2 | | |
| 5 | Timer Modules | 2 | | |
| 6 | Timer Modules - Interrupts | 2 | | |
| 7 | External Interrupts and Input Capture | 2 | | |
| 8 | PWM modules | 2 | | |
| 9 | Analog-Numeric Converter | 2 | | |
| 10 | Basic Logic Circuits | 2 | | |
| 11 | Memory circuits | 2 | | |
| 12 | Open Collector Logic Circuits | 2 | | |
| 13 | Astable circuits | 2 | | |
| 14 | Optoelectronic Displays | 2 | | |

Bibliography
1. I. Naşcu, V. Dădârlat, S. Folea, (1996): Circuite numerice. Îndrumător de laborator.
2. G.Harja, I. Naşcu, (2018): Circuite numerice. Îndrumător de laborator.

## 9. Bridging course contents with the expectations of the representatives of the community, professional associations, and employers in the field

Lectures and applications content was discussed with field experts. Over the years the course was favourably assessed by various rating agencies: National Council for Academic Evaluation and Accreditation, Romanian Agency for Quality Assurance in Higher Education.

## 10. Evaluation

| Activity type | Assessment criteria | Assessment methods | Weight in the final grade |
|---|---|---|---|
| Course | Theory and problems questions | Written exam / online exam using Teams | 60% |
| Laboratory | Application and result presenting | Oral exam / online exam using Teams | 40% |

Minimum standard of performance:
Development of a minimal set of applications using semiconductor memories, reconfigurable circuits, and microcontrollers.

| Date of filling in: 30.05.2024 | | Title Firstname NAME | Signature |
|---|---|---|---|
| | Course | Sl.dr.ing.Gabriel HARJA | |
| | Aplications | Sl.dr.ing.Gabriel HARJA | |

Date of approval by the Department Board ……..

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Head of Departament …….
Prof.dr.ing. Honoriu VĂLEAN

Date of approval by the Faculty Council ……………

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Dean
Prof.dr.ing. Mihaela Dinsoreanu