



## 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                   | Telecommunications  |
| 1.4 Domain of studies            | Electronic Engineering, Telecommunications and Information Technology |
| 1.5 Cycle of studies             | Masters   |
| 1.6 Programme of studies         | Electric Vehicle Propulsion and Control                               |

### 2. Date despre disciplină

|   |   |                 |                   |                      |                      |                   |    |
|---|---|-----------------|-------------------|----------------------|----------------------|-------------------|----|
| 2.1 Course name (ro)<br>(en)            | Aplicații ale microprocesoarelor pentru sisteme de calcul în timp real<br>Microprocessor Applications for Real Time Systems |                 |                   |                      |                      |                   |    |
| 2.2 Course Lecturer                     | S.l./Lect. Dr. Georgian Nicolae   |                 |                   |                      |                      |                   |    |
| 2.3 Instructor for practical activities | S.l./Lect. Dr. Georgian Nicolae   |                 |                   |                      |                      |                   |    |
| 2.4 Year of studies                     | 2   | 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.M3.O.24-25 |                      | 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 | 1.00 | 3.3 seminary/laboratory | 2     |
| 3.4 Total hours in the curricula   | 42.00 | Out of which: 3.5 course | 14   | 3.6 seminary/laboratory | 28    |
| 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. |       |                          |      |                         | 53    |
| Tutoring   |       |                          |      |                         | 3     |
| Examinations   |       |                          |      |                         | 3     |
| Other activities (if any):   |       |                          |      |                         | 0     |
| 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 | not applicable |
|----------------|----------------|



|                         |                |
|-------------------------|----------------|
| 4.2 Results of learning | not applicable |
|-------------------------|----------------|

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

|                                     |   |
|-------------------------------------|---|
| 5.1 Course                          | <ul style="list-style-type: none"> <li>Room equipped with a video projector.</li> </ul>   |
| 5.2 Seminary/<br>Laboratory/Project | <ul style="list-style-type: none"> <li>Room equipped with computers and specific software.</li> <li>Compulsory presence at laboratory classes, according to current POLITEHNICA Bucharest regulations.</li> </ul> |

**6. General objective** (*Referring 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 curricula of the study programme, etc. will be described in a general manner*)

Study of the basic concepts in CISC and RISC general microprocessor architecture: registers, memory management, addressing techniques, data transfer, instruction set, input/output strategies. The students should have the possibility to approach any specific microprocessor architecture, either general or dedicated.

**7. Competences** (*Proven capacity to use knowledge, aptitudes and personal, social and/or methodological abilities in work or study situations and for personal and professional growth. They reflect the employers requirements.*)

|  |  |
|--|--|
| <b>Specific Competences</b>              | <p><b>C2. Design of hardware, software and telecommunication systems</b><br/> <b>C2.1.</b> Description of the structure and of the architecture for hardware, software and telecommunication systems<br/> <b>C2.2.</b> Explaining the purpose and the operation details for hardware, software and telecommunication systems<br/> <b>C4.</b> Using programming technologies and environments</p> |
| <b>Transversal (General) Competences</b> | <ul style="list-style-type: none"> <li>Honorable, responsible and ethical behavior to ensure the reputation of the profession.</li> <li>Awareness of the need for continuous training; efficient use of resources and learning techniques for personal and professional development.</li> </ul>  |

**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 accomplishments 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.*)



|                                    |   |
|------------------------------------|---|
| <b>Knowledge</b>                   | <p><i>The result of knowledge acquisition through learning. The knowledge represents the totality of facts, principles, theories and practices for a given work or study field. They can be theoretical and/or factual.</i></p> <ul style="list-style-type: none"> <li>• Defines specific characteristics of general purpose microprocessors</li> <li>• Lists the main architecture attributes for x86</li> <li>• Classify instructions into the three categories</li> <li>• Describes the activation of functional blocks within instructions</li> <li>• Highlight the main differences between CISC and RISC</li> </ul>   |
| <b>Skills</b>                      | <p><i>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 instrumentation).</i></p> <ul style="list-style-type: none"> <li>• Uses specific principles in the development of applications for computing systems</li> <li>• Adequately interprets causal relationships between instructions, instruction format, and timing</li> <li>• Identifies solutions and develops plans to solve the proposed problem</li> <li>• Analyze, compare and group microprocessors based on their main characteristics</li> <li>• Motivate the identified solutions and the ways of solving them</li> <li>• Formulates conclusions on developed applications</li> </ul>  |
| <b>Responsibility and autonomy</b> | <p><i>The student's capacity to autonomously and responsibly apply their knowledge and skills.</i></p> <ul style="list-style-type: none"> <li>• Demonstrates responsiveness to new learning contexts</li> <li>• Demonstrates collaboration with other colleagues and teaching staff in carrying out teaching activities</li> <li>• Demonstrates autonomy in organizing the learning context and the problem situation to be solved</li> <li>• Demonstrates social responsibility through involvement in academic community events</li> <li>• Contributes through new solutions related to the specialized field to improve the quality of social life</li> <li>• 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</li> <li>• Apply principles of professional ethics in the analysis of the technological impact of the proposed solutions in the specialized field on the environment</li> <li>• Analyzes and exploits opportunities for entrepreneurial development in the specialized field</li> <li>• Demonstrates real-life situation management skills</li> </ul> |

**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 course lectures are performed in a lecture hall equipped with multimedia facilities. Course materials are: course notes and presentations. All materials are available in electronic format on the POLITEHNICA Bucharest "Moodle" platform.



In the laboratory-type applications, the tutor makes a short theoretical presentation of the concepts that will be used in the respective laboratory, then guides the students in developing applications for the 8086 microprocessor using the emu8086 simulator. The didactic materials are the laboratory platforms included in the laboratory guide.

## 10. Contents

| <b>COURSE</b>  |   |                  |
|----------------|---|------------------|
| <b>Chapter</b> | <b>Content</b>  | <b>No. hours</b> |
| 1              | Microcomputer Structure. Definitions                            | 2                |
| 2              | Overview of a CISC, General Purpose Microprocessor Core         | 2                |
| 3              | Fundamentals of a Typical CISC Architecture                     | 2                |
| 4              | Fundamentals of a Typical RISC Architecture                     | 2                |
| 5              | Input/Output Strategies   | 2                |
| 6              | Time-Dimension of a General Purpose Microprocessor Architecture | 2                |
| 7              | An Overview of Intel x86 Architecture (IA-32) in Real Mode      | 2                |
|                | <b>Total:</b>   | 14               |

**Bibliography:**  
C. Burileanu, Microprocessor Applications for Real Time Systems , suport de curs electronic, <https://curs.upb.ro/2021/>  
C. Burileanu, “Arhitectura microprocesoarelor”, Editura Denix, București, 1994.  
C. Burileanu s.a., “Microprocesoarele x86 – o abordare software”, Ed. “Grupul microInformatica”, Cluj-Napoca, 1999

| <b>LABORATORY</b> |  |                  |
|-------------------|--|------------------|
| <b>Crt. no.</b>   | <b>Content</b>   | <b>No. hours</b> |
| 1                 | Introducing a development environment for x86 microprocessors: emu 8086                    | 2                |
| 2                 | Data transfer instructions and array operations for Intel x86 microprocessors in real mode | 2                |
| 3                 | Data processing instructions for Intel x86 microprocessors in real mode                    | 2                |
| 4                 | Program control instructions for Intel x86 microprocessors in real mode                    | 2                |
| 5                 | Interrupts for Intel x86 microprocessors in real mode                                      | 2                |
| 6                 | Translation of instructions from high-level programming into assembly                      | 2                |
| 7                 | Laboratory test  | 2                |
|                   | <b>Total:</b>  | 14               |

| <b>PROJECT</b>  |   |                  |
|-----------------|---|------------------|
| <b>Crt. no.</b> | <b>Content</b>  | <b>No. hours</b> |
| 1               | Development of core functions for real-time applications using the x86 architecture | 2                |
| 2               | Development of input/output procedures  | 4                |
| 3               | Implementation of functionalities according to the proposed topic                   | 6                |
| 4               | Project presentation  | 2                |



|   |               |    |
|---|---------------|----|
|   | <b>Total:</b> | 14 |
| <b>Bibliography:</b><br>Burileanu, Microprocessor Applications for Real Time Systems , suport de curs electronic,<br><a href="https://curs.upb.ro/2021/">https://curs.upb.ro/2021/</a><br><br>Elena-Diana Șandru, Horia Cucu, Corneliu Burileanu, “Arhitectura Microprocesoarelor”, Îndrumar de laborator, Editura MatrixRom (cod CNCIS: 39), București, 2018, ISBN 978-606-25-0443-4 |               |    |

### 11. Evaluation

| Activity type                    | 11.1 Evaluation criteria   | 11.2 Evaluation methods | 11.3 Percentage of final grade |
|----------------------------------|--|-------------------------|--------------------------------|
| 11.4 Course                      | - knowledge of theoretical fundamentals;<br>- solving practical problems   | Written Exam            | 40%                            |
| 11.5 Seminary/laboratory/project | - knowing how to design an algorithm to solve a given problem;<br>- knowledge of how to implement an algorithm using assembly language;<br>- demonstration of the operation of an 8086 program.    | Laboratory Test         | 20%                            |
|                                  | - knowing how to design a practical application with real-time operation for the x86 architecture<br>- solving implementation problems using the concepts assimilated in the course and laboratory | Project                 | 40%                            |
| 11.6 Passing conditions          |  |                         |                                |
| Obtaining 50% of the final grade |  |                         |                                |

### 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 content of the course is largely similar to other courses, aiming for the same objectives, lectured across the universities in the European Union. The content of the discipline is continuously updated and adapted following consultations with representatives of the business environment in Europe.

|            |                                 |  |
|------------|---------------------------------|--|
| Date       | Course lecturer                 | Instructor(s) for practical activities |
| 09.09.2022 | S.l./Lect. Dr. Georgian Nicolae | S.l./Lect. Dr. Georgian Nicolae        |



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



Date of department approval

27.10.2024

Head of department

Conf. Dr. Serban Georgica Obreja

Date of approval in the Faculty  
Council

25.10.2024

Dean

Prof. Dr. Mihnea Udrea