**SYLLABUS**

### 1. Data about the program of study

| 1.1 Institution | The Technical University of Cluj-Napoca |
|---|---|
| 1.2 Faculty | Faculty of Automation and Computer Science |
| 1.3 Department | Computer Science |
| 1.4 Field of study | Computer Science and Information Technology |
| 1.5 Cycle of study | Bachelor of Science |
| 1.6 Program of study/Qualification | Computer science/ Engineer |
| 1.7 Form of education | Full time |
| 1.8 Subject code | 55.1 |

### 2. Data about the subject

| 2.1 Subject name | | | | *Input/Output Systems and Peripheral Devices* | |
|---|---|---|---|---|---|
| 2.2 Course responsible/lecturer | | | | Prof. Dr. Eng. Zoltan Francisc Baruch – Zoltan.Baruch@cs.utcluj.ro | |
| 2.3 Teachers in charge of seminars/ laboratory/ project | | | | Prof. Dr. Eng. Zoltan Francisc Baruch – Zoltan.Baruch@cs.utcluj.ro Dr. Eng. Cristinel Mocan – Cristi.Mocan@cs.utcluj.ro | |
| 2.4 Year of study | IV | 2.5 Semester | 2 | 2.6 Type of assessment (E - exam, C - colloquium, V - verification) | E |
| 2.7 Subject category | *DF – fundamentală, DD – în domeniu, DS – de specialitate, DC – complementară* | | | | DS |
| | *DI – Impusă, DOp – opțională, DFac – facultativă* | | | | DOp |

### 3. Estimated total time

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

| 3.3 Individual study: | |
|---|---|
| (a) Manual, lecture material and notes, bibliography | 34 |
| (b) Supplementary study in the library, online and in the field | 12 |
| (c) Preparation for seminars/laboratory works, homework, reports, portfolios, essays | 18 |
| (d) Tutoring | |
| (e) Exams and tests | 5 |
| (f) Other activities: | 0 |

| 3.4 Total hours of individual study (suma (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)

| 4.1 Curriculum | Computer Programming, Computer Architecture |
|---|---|
| 4.2 Competence | Competences of disciplines Computer Programming and Computer Architecture |

### 5. Requirements (where appropriate)

| 5.1. For the course | Projector, computer |
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| 5.2. For the applications | Computers, the Microsoft Visual Studio programming environment |

### 6. Specific competence

| 6.1 Professional competences | **C4** – Improving the performances of the hardware, software and communication systems (2 credits) **C4.1** – Identifying and describing the defining elements of the performances of the hardware, software and communication systems **C4.2** – Explaining the interaction of the factors that determine the performances of the hardware, software and communication systems **C4.3** – Applying the fundamental methods and principles for increasing the performances of the hardware, software and communication systems |
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| | **C4.4** – Choosing the criteria and evaluation methods of the performances of the hardware, software and communication systems |
| | **C4.5** - Developing performance based professional solutions for hardware, software and communication systems |
| | **C5** – Designing, managing the lifetime cycle, integrating and ensuring the integrity of hardware, software and communication systems (3 credits) |
| | **C5.1** – Specifying the relevant criteria regarding the lifetime cycle, quality, security and the computing system's interaction with the environment and the human operator |
| | **C5.2** - Using interdisciplinary knowledge for adapting an information system to application domain requirements |
| | **C5.3** – Using fundamental principles and methods for ensuring the security, the safety and ease of exploitation of the computing systems |
| | **C5.4** - Adequate utilization of quality, safety and security standards in information processing |
| | **C5.5** - Realization of a project including problem identification and analysis, design and development, while proving the understanding of the basic quality needs and requirements |
| 6.2 Cross competences | N/A |

## 7. Discipline objective (as results from the *key competences gained*)

| | |
|---|---|
| 7.1 General objective | Knowledge of operation and performance parameters for input/output interfaces and peripheral devices; ability to communicate with controllers of peripheral devices |
| 7.2 Specific objectives | - Using basic methods and principles for enhancing performance of computer systems<br>- Designing input/output interfaces for connecting various devices to the computer<br>- Designing and implementing in software input/output protocols<br>- Writing system programs for controlling input/output interfaces |

## 8. Contents

| 8.1 Lectures | Hours | Teaching methods | Notes |
|---|---|---|---|
| Introduction. Programmed I/O | 2 | | |
| Interrupt-Driven I/O. Direct Memory Access. I/O Processors | 2 | | |
| Buses. Electrical Considerations. Synchronous and Asynchronous Buses. Parallel and Serial Buses. Bus Arbitration. PCI Bus | 2 | | |
| PCI Express Bus. I$^2$C Bus. SPI Bus | 2 | | |
| Universal Serial Bus. VME Bus. Expansion Modules for Embedded Systems. VME Modules | 2 | | |
| Expansion Modules for Embedded Systems (cont.). CompactPCI Modules. Mezzanine Modules. COM Express Modules | 2 | | |
| Mid-Term Exam | 2 | - PowerPoint presentations<br>- Questions, discussions | |
| Liquid Crystal Displays. Liquid Crystals. Twisted Nematic Technology. Addressing Methods. Backlighting Types | 2 | | |
| Liquid Crystal Displays (cont.). Display Parameters. Vertical Alignment Technology. In-Plane Switching Technology | 2 | | |
| Organic LED Displays. Electronic Paper Displays | 2 | | |
| Graphics Adapters. Structure of a Graphics Adapter. Graphics Memory. Graphics Processing Units | 2 | | |
| Graphics Processing Units (cont.). Display Interfaces: HDMI; DisplayPort | 2 | | |
| Optical Discs. Classification of Optical Discs. Compact Discs. DVD Discs | 2 | | |
| Blu-Ray Discs | 2 | | |

| Bibliography | | | |
|---|---|---|---|
| 1. Baruch, Z. F., Input/Output Systems, MEGA, Cluj-Napoca, 2020, ISBN 978-606-020-242-4. | | | |
| 2. Rosch, Winn L., Hardware Bible, Sixth Edition, Que Publishing, 2003, ISBN 0-7897-2859-1. | | | |
| 8.2 Applications – Seminars/Laboratory/Project | Hours | Teaching methods | Notes |
| Serial Port (I) | 2 | | |
| Serial Port (II) | 2 | | |
| PCI Express Bus (I) | 2 | | |
| PCI Express Bus (II) | 2 | | |
| System Management Bus (I) | 2 | | |
| System Management Bus (II) | 2 | - Additional explanations - Using a programming environment for the C language | |
| Universal Serial Bus (I) | 2 | | |
| Universal Serial Bus (II) | 2 | | |
| Printers | 2 | | |
| SCSI Interface | 2 | | |
| ATA Interface (I) | 2 | | |
| ATA Interface (II) | 2 | | |
| Compact Discs. ATAPI Interface | 2 | | |
| Laboratory Colloquy | 2 | | |
| Bibliography | | | |
| 1. Lecture slides and laboratory works at http://users.utcluj.ro/~baruch/en/pages/teaching/inputoutput-systems.php | | | |

*Se vor preciza, după caz: tematica seminariilor, lucrările de laborator, tematica și etapele proiectului.*

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

The contents of the discipline have been corroborated with the contents of similar disciplines in the USA and Europe, as well as with chapters related to input/output systems of acknowledged manuals used in prestigious universities. The discipline has been evaluated by the ARACIS agency.

## 10. Evaluation

| Activity type | Assessment criteria | Assessment methods | Weight in the final grade |
|---|---|---|---|
| Course | Understanding theoretical concepts of input/output systems and the principle of operation for peripheral devices | Quizzes at the lectures | 10% |
| | | Online exam on the Teams and Forms platforms or written exam with audio and video monitoring | 60% |
| Laboratory | Ability to write communication programs with controllers of peripheral devices | Assessment of solving the assigned applications at the laboratory sessions | 30% |
| Project | | | |
| Minimum standard of performance: Finishing at least one application in each laboratory session Grade calculus: 10% Quizzes + 30% Laboratory + 60% Exam Conditions for entering the final exam: Quizzes ≥ 5, Laboratory ≥ 5 Conditions for promotion: Exam ≥ 5 | | | |

| Date of filling in: 03.03.2021 | Titular | Title First Name Last Name | Signature |
|---|---|---|---|
| | Course | Prof. Dr. Eng. Zoltan Baruch | |
| | Applications | Prof. Dr. Eng. Zoltan Baruch | |
| | | Dr. Eng. Cristinel Mocan | |

| Date of approval in the department | Head of department<br>Prof. dr. ing. Rodica Potolea |
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| **Date of approval in the Faculty Council** | Dean<br>Prof. dr. ing. Liviu Miclea |