GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

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|---|---|---|---|
| Subject name and code | Modern Programming Environments, PG_00053918 | | |
| Field of study | Automatic Control, Cybernetics and Robotics | | |
| Date of commencement of studies | October 2024 | Academic year of realisation of subject | 2026/2027 |
| Education level | first-cycle studies | Subject group | Optional subject group<br>Subject group related to scientific research in the field of study |
| Mode of study | Full-time studies | Mode of delivery | at the university |
| Year of study | 3 | Language of instruction | Polish |
| Semester of study | 5 | ECTS credits | 3.0 |
| Learning profile | general academic profile | Assessment form | assessment |
| Conducting unit | Department of Decision Systems and Robotics -> Faculty of Electronics, Telecommunications and Informatics | | |
| Name and surname of lecturer (lecturers) | Subject supervisor | dr hab. inż. Tomasz Stefański | |
| | Teachers | dr hab. inż. Tomasz Stefański | |

| Lesson types and methods of instruction | Lesson type | Lecture | Tutorial | Laboratory | Project | Seminar | SUM |
|---|---|---|---|---|---|---|---|
| | Number of study hours | 15.0 | 0.0 | 15.0 | 0.0 | 0.0 | 30 |
| | E-learning hours included: 0.0 | | | | | | |

| Learning activity and number of study hours | Learning activity | Participation in didactic classes included in study plan | Participation in consultation hours | Self-study | SUM |
|---|---|---|---|---|---|
| | Number of study hours | 30 | 4.0 | 41.0 | 75 |

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| Subject objectives | Introduce modern parallel-programming environments based on the example of the CUDA technology created by Nvidia. |

**Learning outcomes**

| Course outcome | Subject outcome | Method of verification |
|---|---|---|
| [K6_W03] knows and understands, to an advanced extent, the construction and operating principles of components and systems related to the field of study, including theories, methods and complex relationships between them and selected specific issues - appropriate for the curriculum | The student can write programs in C / C ++ languages that use graphics cards. | [SW1] Assessment of factual knowledge |
| [K6_W04] knows and understands, to an advanced extent, the principles, methods and techniques of programming and the principles of computer software development or programming devices or controllers using microprocessors or programmable elements or systems specific to the field of study, and organisation of systems using computers or such devices | The student understands the principles of parallel programming and can write programs that use graphics cards. | [SW1] Assessment of factual knowledge |
| [K6_U04] can apply knowledge of programming methods and techniques as well as select and apply appropriate programming methods and tools in computer software development or programming devices or controllers using microprocessors or programmable elements or systems specific to the field of study | The student can write engineering programs in the CUDA environment. | [SU1] Assessment of task fulfilment<br>[SU4] Assessment of ability to use methods and tools |
| [K6_W01] knows and understands, to an advanced extent, mathematics necessary to formulate and solve simple issues related to the field of study | The student can write programs that process large amounts of data in parallel. | [SW1] Assessment of factual knowledge |

**Subject contents**

1. Introduction to the CUDA architecture and development environment.
2. Presentation of the compiler (nvcc), debugger (cuda-gdb) and profiler in CUDA.
3. Parallel programming model: kernels, threads, blocks of threads, memory hierarchy, heterogeneous programming, computing capabilities of graphics cards from NVIDIA.
4. CUDA C programming interface.
5. Code optimization.
6. Overview of programming libraries available in CUDA.
7. Introduction to OpenCL.

**Prerequisites and co-requisites**

Student has a basic knowledge of programming.

**Assessment methods and criteria**

| Subject passing criteria | Passing threshold | Percentage of the final grade |
|---|---|---|
| lecture | 40.0% | 20.0% |
| laboratory | 40.0% | 30.0% |
| project | 40.0% | 50.0% |

**Recommended reading**

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|---|---|
| Basic literature | - CUDA C Programming Guide<br>- CUDA Runtime API<br>- CUDA C Best Practices Guide |
| Supplementary literature | - CUDA Compiler Driver NVCC<br>- CUDA Visual Profiler<br>- CUDA-gdb debugger<br>- CUDA-memcheck memory checker |
| eResources addresses | Adresy na platformie eNauczanie: |

**Example issues/ example questions/ tasks being completed**

1. CUDA parallel programming model.
2. Memories on the graphics card.
3. The use of shared memory.
4. Streams in CUDA.
5. Events in CUDA.

**Work placement**

Not applicable