GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

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|---|---|---|---|
| Subject name and code | Hardware and Software Integration, PG_00067085 | | |
| Field of study | Electronics and Telecommunications | | |
| Date of commencement of studies | October 2026 | Academic year of realisation of subject | 2029/2030 |
| 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 | 4 | Language of instruction | Polish |
| Semester of study | 7 | ECTS credits | 3.0 |
| Learning profile | general academic profile | Assessment form | exam |
| Conducting unit | Metrology and Electronic Systems Department -> Faculty of Electronics Telecommunications and Informatics -> Faculties of Gdańsk University of Technology | | |
| Name and surname of lecturer (lecturers) | Subject supervisor | dr hab. inż. Grzegorz Lentka | |
| | Teachers | dr hab. inż. Grzegorz Lentka | |

**Lesson types**

| 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 | 3.0 | 42.0 | 75 |

**Subject objectives**

Getting familiar with rules and methods tasks for hardware and software on a microsystem level, techniques of effective usage of resources of programmable components, methods and tools for co-design, co-debugging and co-testing of hardware and software.

**Learning outcomes**

| Course outcome | Subject outcome | Method of verification |
|---|---|---|
| [K6_U03] can design, according to required specifications, and make a simple device, facility, system or carry out a process, specific to the field of study, using suitable methods, techniques, tools and materials, following engineering standards and norms, applying technologies specific to the field of study and experience gained in the professional engineering environment | Student assigns tasks for hardware and software on a microsystem level. Student develops and debugs software on selected hardware platforms using software and hardware debugging tools. | [SU1] Assessment of task fulfilment<br>[SU4] Assessment of ability to use methods and tools |
| [K6_W10] knows and understands, to an advanced extent, the parameters, functions, and methods of analysis, design, and optimization of electronic circuits and systems, the definitions of error and measurement uncertainty, measurement methods, including time, frequency, and phase measurements, the properties of converters, and methods of digital signal processing, as well as the basic processes occurring in the life cycle of technical devices, objects, and systems, and methods of supporting processes and functions, specific to the field of study | Student knows the methods to estimate requirements for memory, computing power, power consumption.<br>Clasifies the solutions using project requirements as a guide. | [SW1] Assessment of factual knowledge<br>[SW3] Assessment of knowledge contained in written work and projects |

<table>
<tr><td>Subject contents</td><td>Course content – lecture<br>Assigning tasks for hardware and software on a microsystem level. Requirements definition and selection of the realization technology. The rules of determination of critical requirements Multi-level interfaces (like USB and CAN) as an example of a hardware software co-design. Redundant design: design for testability. CAD software for hardware-software co-design. The use of CPLD, FPGA and ISP technology for hardware reconfiguration by software means. Effective usage of the resource of embedded controllers: effective addressing modes, multi-instructions, bit-instructions. Hardware-software optimization of power consumption of micropower systems. Soft-processors: an example of hardware-software co-design. Optimal assigning of tasks for pSoC. Development of a software: low level and high level software libraries Multitasking in microsystems. Hardware-software testing and debugging methods. Debugging tools for hardware-software: software simulators, debuggers, and hardware emulators. The construction and the use of Logic State Analyzers (LSA) The use of ICD technique for debugging software on target hardware.<br>Course content – laboratory<br>Using CAD tools for hardware-software co-design. Using in-System Programmability (iSP) technique for hardware reconfiguration by software means. Effective usage of the resource of embedded controllers: effective addressing modes, multi-instructions, bit-instructions. Development of a software: low level and high level software libraries. Multitasking in microsystems. Debugging tools for hardware-software: software simulators, debuggers, hardware emulators, Logic State Analyzers (LSA). The use of ICD technique for debugging software on target hardware.</td></tr>
<tr><td>Prerequisites and co-requisites</td><td>No requirements</td></tr>
<tr><td>Assessment methods and criteria</td><td>
<table>
<tr><th>Subject passing criteria</th><th>Passing threshold</th><th>Percentage of the final grade</th></tr>
<tr><td>Activity/homeworks</td><td>0.0%</td><td>10.0%</td></tr>
<tr><td>Test during semester</td><td>50.0%</td><td>60.0%</td></tr>
<tr><td>Lab exercises</td><td>60.0%</td><td>30.0%</td></tr>
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</td></tr>
<tr><td>Recommended reading</td><td>
<table>
<tr><td>Basic literature</td><td>1. Ed Sutter: Embedded Systems Firmware Demystified, CMP 2002.<br>2. J. J. Labrosse: Embedded Systems Building Blocks, Second Edition: Complete and Ready-to-Use Modules in C, CMP 1999.<br>3. J. Staunstrup, W. Wolf: Hardware/Software Co-Design: Principles and Practice, Springer US 2010.</td></tr>
<tr><td>Supplementary literature</td><td>1. M. Barr, A. Massa: Programming Embedded Systems: With C and GNU Development Tools, 2nd Edition, O'Reilly Media 2006</td></tr>
<tr><td>eResources addresses</td><td></td></tr>
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<tr><td>Example issues/ example questions/ tasks being completed</td><td></td></tr>
<tr><td>Practical activites within the subject</td><td>Not applicable</td></tr>
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