



Subject card

Subject name and code	Hardware and Software Integration, PG_00048101						
Field of study	Electronics and Telecommunications						
Date of commencement of studies	October 2023	Academic year of realisation of subject			2026/2027		
Education level	first-cycle studies	Subject group			Optional subject group 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			2.0		
Learning profile	general academic profile	Assessment form			assessment		
Conducting unit	Department of Metrology and Optoelectronics -> Faculty of Electronics, Telecommunications and Informatics						
Name and surname of lecturer (lecturers)	Subject supervisor	dr hab. inż. Grzegorz Lentka					
	Teachers	dr hab. inż. Grzegorz Lentka					
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		2.0		18.0	50
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. Estimates requirements for memory, computing power, power consumption. Student develops and debugs software on selected hardware platforms using software and hardware debugging tools.			[SU1] Assessment of task fulfilment [SU4] Assessment of ability to use methods and tools		
	[K6_W32] Knows the parameters, functions and methods of analysis, design and optimization of analogue and digital circuits and electronic systems	Chooses methods and tools for co-design, codebugging and co-testing of hardware and software. Presents and uses techniques of effective usage of resources of programmable components. Explains methods of software development.			[SW1] Assessment of factual knowledge		
Subject contents	1. Introduction: course outline, course grading, references. 2. Assigning tasks for hardware and software on a microsystem level. 3. Requirements definition and selection of the realization technology. 4. The rules of determination of critical requirements 5. Multi-level interfaces (like USB and CAN) as an example of a hardware software co-design. 6. Redundant design: design for testability. 7. CAD software for hardware-software co-design 8. The use of CPLD, FPGA and ISP technology for hardware reconfiguration by software means. 9. Effective usage of the resource of embedded controllers: effective addressing modes, multi-instructions, bit-instructions. 10. Hardware-software optimization of power consumption of micropower systems. 11. Soft-processors: an example of hardware-software co-design. 12. Optimal assigning of tasks for pSoC. 13. Development of a software: low level and high level software libraries 14. Multitasking in microsystems 15. Hardware-software testing and debugging methods. 16. Debugging tools for hardware-software: software simulators, debug-gers, hardware emulators. 17. The construction and the use of Logic State Analyzers (LSA) 18. The use of ICD technique for debugging software on target hardware. 19. Summary						

Prerequisites and co-requisites	No requirements		
Assessment methods and criteria	Subject passing criteria	Passing threshold	Percentage of the final grade
	Test during semester	50.0%	60.0%
	Lab exercises	0.0%	30.0%
	Activity/homeworks	0.0%	10.0%
Recommended reading	Basic literature	1. Ed Sutter: Embedded Systems Firmware Demystified, CMP 2002 2. J. J. Labrosse: Embedded Systems Building Blocks, Second Edition: Complete and Ready-to-Use Modules in C, CMP 1999 3. J. Staunstrup, W. Wolf: Hardware/Software Co-Design: Principles and Practice, Springer US 2010	
	Supplementary literature	1. M. Barr, A. Massa: Programming Embedded Systems: With C and GNU Development Tools, 2nd Edition, O'Reilly Media 2006	
	eResources addresses	Adresy na platformie eNauczanie:	
Example issues/ example questions/ tasks being completed			
Work placement	Not applicable		