



Subject card

Subject name and code	Programmable Systems Engineering, PG_00047897						
Field of study	Informatics						
Date of commencement of studies	October 2021		Academic year of realisation of subject		2023/2024		
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	3		Language of instruction		Polish		
Semester of study	6		ECTS credits		4.0		
Learning profile	general academic profile		Assessment form		assessment		
Conducting unit	Department of Microelectronic Systems -> Faculty of Electronics, Telecommunications and Informatics						
Name and surname of lecturer (lecturers)	Subject supervisor		dr inż. Miron Kłosowski				
	Teachers		dr inż. Piotr Kurgan				
			dr inż. Miron Kłosowski				
Lesson types and methods of instruction	Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
	Number of study hours	15.0	0.0	30.0	0.0	0.0	45
	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	45		2.0		53.0	100
Subject objectives	The aim of the course is to provide students with the basic knowledge and skills in the design of digital electronic systems using FPGA technology and VHDL. As a result, students will be prepared to work in companies producing electronic systems using FPGAs and students will be able to participate in specialized EDA software development.						

Learning outcomes	Course outcome	Subject outcome	Method of verification
	[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	Student describes the properties of hardware description languages. Student knows the basics of the VHDL hardware description language. Student understands the processes of synthesis and simulation. Student is able to determine the conditions for the synthesis of the code in VHDL. Student knows the basics of the SystemC environment.	[SW1] Assessment of factual knowledge
	[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 designs digital circuits using VHDL and SystemC hardware description languages. Student simulates the behavior of designed systems using VHDL and SystemC simulators. Student implements and tests digital systems in a real hardware-software environment based on FPGAs.	[SU1] Assessment of task fulfilment
	[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	Student describes the architecture and applications of SPLD and FPGA digital programmable circuits. Student describes FPGA configuration methods.	[SW1] Assessment of factual knowledge
	[K6_W05] Knows and understands, to an advanced extent, methods of supporting processes and functions, specific to the field of study	Student describes techniques to support the design of complex logic circuits.	[SW1] Assessment of factual knowledge
	[K6_W42] Knows and understands, to an advanced extent, architecture, design principles and methods of hardware and software support for local and distributed information systems, including computing systems, databases, computer networks and information applications, as well as the principles of human cooperation with computers and computer-aided teamwork	Student describes hardware techniques of algorithm acceleration.	[SW1] Assessment of factual knowledge
Subject contents	1. Introduction to VHDL, origin and applications. 2. Abstraction levels and description methods of digital circuits. 3. Design entity description in VHDL. 4. Assignments, signals, variables and operators in VHDL. 5. Data types in VHDL. 6. Resolution function. 7. Vectors and operations on vectors in VHDL. 8. Combinatorial processes. Synthesis of combinatorial logic in VHDL. 9. Project simulation in VHDL. 10. Conditional, case and loop statements in processes. 11. Constants and initial values of signals and variables. 12. Hierarchy and configuration of design entities. 13. Sequential processes in VHDL. 14. State machines. State encoding. Forbidden states. 15. Type conversion in VHDL. 16. Functions and procedures in VHDL. 17. Introduction to SystemC environment. 18. Applications of SystemC environment. 19. System design with hardware-software partitioning. 20. System on Chip technology. 21. Soft-processors - architecture and applications. 22. Programmable circuits taxonomy. 23. Architecture of FPGAs. 24. Configuration methods of FPGAs. 25. Hardware functional blocks in FPGAs. 26. "Reconfigurable computing" as a programming paradigm. 27. Applications of RC in signal processing. 28. Applications of RC in image processing. 29. Applications of RC in teleinformatics. 30. Applications of RC in supercomputers. 31. Algorithm representation in RC. 32. Arithmetic systems in RC. 33. "Network on Chip" technology.		
Prerequisites and co-requisites			
Assessment methods and criteria	Subject passing criteria	Passing threshold	Percentage of the final grade
	Practical exercise	50.0%	70.0%
	Midterm colloquium	50.0%	30.0%
Recommended reading	Basic literature	Zwoliński Mark, "Projektowanie układów cyfrowych z wykorzystaniem języka VHDL", Wydawnictwa Komunikacji i Łączności WKŁ, Warszawa 2007.	
	Supplementary literature	No requirements	

	eResources addresses	Adresy na platformie eNauczenie: Inżynieria systemów programowalnych 2023/24 - Moodle ID: 34973 https://enauczenie.pg.edu.pl/moodle/course/view.php?id=34973
Example issues/ example questions/ tasks being completed	Sample lab exercises: <ol style="list-style-type: none"> 1. Simple LED display driver. 2. Simple RS232 receiver and transmitter. 3. Video signal generator for VGA display. 4. Embedded system based on FPGA. 	
Work placement	Not applicable	