



Subject card

Subject name and code	Programmable Systems Engineering, PG_00047897						
Field of study	Informatics						
Date of commencement of studies	October 2026	Academic year of realisation of subject				2028/2029	
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 -> Faculties of Gdańsk University of Technology						
Name and surname of lecturer (lecturers)	Subject supervisor		dr inż. Miron Kłosowski				
	Teachers		dr inż. Miron Kłosowski				
Lesson types	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	

Subject contents	<p>Course content – lecture</p> <p>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.</p>		
Prerequisites and co-requisites			
Assessment methods and criteria	Subject passing criteria	Passing threshold	Percentage of the final grade
	Midterm colloquium	50.0%	30.0%
	Practical exercise	50.0%	70.0%
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		
Example issues/ example questions/ tasks being completed	<p>Sample lab exercises:</p> <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. 		
Practical activities within the subject	Not applicable		

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