



Subject card

Subject name and code	Programmable Circuits Engineering, PG_00047914						
Field of study	Electronics and Telecommunications						
Date of commencement of studies	October 2026	Academic year of realisation of subject			2027/2028		
Education level	first-cycle studies	Subject group			Obligatory subject group in the field of study 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	2	Language of instruction			Polish		
Semester of study	4	ECTS credits			3.0		
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		3.0		27.0	75
Subject objectives	The aim of the course is to provide students with the basic knowledge and skills in the design of digital electronic circuits using FPGA technology and VHDL. As a result, students will be prepared to work in companies producing electronic equipment using FPGAs and firms producing specialized EDA software.						
Learning outcomes	Course outcome		Subject outcome		Method of verification		
	[K6_U07] can apply methods of process and function support, specific to the field of study		Student uses software supporting the design of complex logic circuits.		[SU1] Assessment of task fulfilment		
	[K6_U08] while identifying and formulating specifications of engineering tasks related to the field of study and solving these tasks, can:n- apply analytical, simulation and experimental methods,n- notice their systemic and non-technical aspects,n- make a preliminary economic assessment of suggested solutions and engineering work n		Student identifies problems with digital circuits by simulating them in VHDL.		[SU1] Assessment of task fulfilment		
	[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		Student designs digital circuits using the VHDL hardware description language. Student implements and tests digital circuits in a real hardware environment based on FPGAs.		[SU1] Assessment of task fulfilment		

Subject contents	<p>Course content – lecture</p> <p>1. Introduction to VHDL, its origin and applications. 2. Abstraction levels and description methods of digital circuits. 3. Design entity description in VHDL. 4. Assignments, signals, variables, operators. 5. Data types in VHDL. 6. Resolution function. 7. Vectors and operations on vectors. 8. Combinatorial processes. Synthesis of combinatorial logic. 9. Simulation and modelling in VHDL. 10. Conditional, case and loop statements in processes. 11. Constants and initial values of signals and variables. 12. Hierarchy and parametrization of design entities. 13. Sequential processes. 14. Synthesis of counters and frequency dividers. 15. Synthesis of shift registers. 16. State machines. State encoding. Forbidden states. 17. Meta-stability phenomenon and avoidance. 18. Attributes and their applications. 19. Type conversion in VHDL. 20. Functions and procedures in VHDL. 21. Implementation of logic functions in programmable circuits. 22. Configuration memory in programmable circuits. 23. Architecture and applications of SPLDs. 24. Architecture and applications of CPLDs. 25. Hardware description languages for SPLDs and CPLDs. 26. Architecture and applications of FPGAs. 27. Architecture and properties of input/output blocks in FPGAs. 28. Dedicated functional blocks in FPGAs. 29. Methods of functional block synthesis. 30. FPGA configuration methods. 31. Constrain driven design.</p>		
Prerequisites and co-requisites			
Assessment methods and criteria	Subject passing criteria	Passing threshold	Percentage of the final grade
	Practical exercise	50.0%	60.0%
	Midterm colloquium	50.0%	40.0%
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. PS/2 keyboard key-code readout. 3. Simple RS232 receiver and transmitter. 4. Video signal generator for VGA display. 		
Practical activities within the subject	Not applicable		

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