



Subject card

Subject name and code	Basics of Microelectronic Systems, PG_00038895						
Field of study	Space and Satellite Technologies						
Date of commencement of studies	February 2024	Academic year of realisation of subject			2024/2025		
Education level	second-cycle studies	Subject group					
Mode of study	Full-time studies	Mode of delivery			at the university		
Year of study	1	Language of instruction			Polish		
Semester of study	2	ECTS credits			3.0		
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 hab. inż. Waldemar Jendernalik				
	Teachers		dr hab. inż. Waldemar Jendernalik				
Lesson types and methods of instruction	Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
	Number of study hours	15.0	0.0	15.0	15.0	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		0.0		0.0	45
Subject objectives	The aim of the course is to familiarize student with the basic knowledge and skills in the field of microelectronic systems design in CMOS technology using a non-standard method (ie. full-custom method) and in the technology of programmable FPGAs.						
Learning outcomes	Course outcome		Subject outcome			Method of verification	
	K7_W12		Student knows the basic methods and techniques of designing complex electronic systems in large scale integration technologies.			[SW1] Assessment of factual knowledge	
	[K7_K03] Can analyse and implement assigned tasks while maintaining high technical standards. Is able to work and interact in a group, taking on different roles. Adheres to the principles of professional ethics and respects the diversity of views and cultures.		Student can implement assigned tasks from the area covered by this course taking into account technical aspects as well as economic, cultural, ethical and legal conditions.			[SK5] Assessment of ability to solve problems that arise in practice	
	K7_W07		Student knows methods of fabricating microelectronic circuits (integrated circuits) and their applications. He knows the application and construction of FPGA programmable systems. He knows computer tools for simulation of electronic circuits.			[SW1] Assessment of factual knowledge	
	K7_U08		Student designs microelectronic systems: performs computer simulation of their behavior using circuit simulators, designs the layout of an integrated circuit. Student designs digital circuits based on HDL description: simulates the behavior of circuits in HDL simulators, implements and tests the design in a real FPGA system.			[SU4] Assessment of ability to use methods and tools [SU1] Assessment of task fulfilment	

Subject contents	<p>LECTURE. Microelectronic circuits, their definition and history. Fabrication technology of microelectronic circuits, its limitations and cost. Field effect and a field effect transistor from the inventor's point of view. Implementation of basic logic functions in "silicon". Information processing in the analog and digital domains - limitations, advantages and disadvantages. Combination and sequential digital circuits, their definition, synthesis and examples. Computer tools (CAD) to support the design of microelectronic systems at the "silicon" level (circuit simulators, silicon microstructure layout editors), their capabilities and cost. Hardware description languages (HDL) - basic syntax course, examples.</p> <p>LABORATORY. Examination of a simple digital circuit: - computer simulations of an electrical diagram, - layout design of an integrated circuit, - extraction of layout parasitics and verification (ie. post-layout) simulations.</p> <p>PROJECT. Design of a simple digital circuit in FPGA: - a project based on an electrical diagram, - project based on HDL description.</p>		
Prerequisites and co-requisites	Knowledge of the basics of electrical circuits. Knowledge of mathematical analysis in the basic scope.		
Assessment methods and criteria	Subject passing criteria	Passing threshold	Percentage of the final grade
	practical exercises	50.0%	70.0%
	quiz	50.0%	30.0%
Recommended reading	Basic literature	<p>P.E. Allen, D.R. Holberg „CMOS Analog Circuits Design,” Oxford University Press, USA 2002.</p> <p>B. Pankiewicz, W. Jendernalik „Projektowanie full-custom układów scalonych CMOS w środowisku Cadence Virtuoso,” skrypt, Wydawnictwo Politechniki Gdańskiej, 2016.</p> <p>B. Pankiewicz, M. Wójcikowski, „Języki modelowani i symulacji”, skrypt, Wydawnictwo Politechniki Gdańskiej, Gdańsk 2015.</p>	
	Supplementary literature	Marek Zwoliński, „Projektowanie układów cyfrowych z wykorzystaniem języka VHDL”, Wydawnictwa Komunikacji i Łączności WKŁ, Warszawa 2007.	
	eResources addresses	Adresy na platformie eNauczanie: Podstawy układów mikroelektronicznych 2024/2025 - Moodle ID: 30779 https://enauczanie.pg.edu.pl/moodle/course/view.php?id=30779	
Example issues/ example questions/ tasks being completed			
Work placement	Not applicable		

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