



Subject card

Subject name and code	Digital Technology I, PG_00067325						
Field of study	Automatic Control, Cybernetics and Robotics						
Date of commencement of studies	October 2026	Academic year of realisation of subject				2026/2027	
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	1	Language of instruction				Polish	
Semester of study	1	ECTS credits				6.0	
Learning profile	general academic profile	Assessment form				exam	
Conducting unit	Department of Signals and Systems -> Faculty of Electronics Telecommunications and Informatics -> Faculties of Gdańsk University of Technology						
Name and surname of lecturer (lecturers)	Subject supervisor	dr inż. Paweł Raczyński					
	Teachers	dr inż. Paweł Raczyński dr inż. Krzysztof Cisowski dr inż. Sebastian Dziedziewicz dr inż. Marcin Pazio mgr inż. Damian Kąkol					
Lesson types	Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
	Number of study hours	30.0	30.0	0.0	0.0	0.0	60
	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	60	6.0		84.0	150	
Subject objectives	The aim of the course is to learn the mathematical description and the methods of analysis and design of digital integrated circuits						
Learning outcomes	Course outcome	Subject outcome			Method of verification		
	[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	They can independently develop a concept for a designed digital system, select the appropriate functional blocks needed for its implementation, and properly connect them. They can also launch and test the designed digital system.			[SW1] Assessment of factual knowledge [SW3] Assessment of knowledge contained in written work and projects		
	[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	339/5000 Is able to independently analyze the combined and sequential digital system. He can go from his scheme to the formal description. Is able to independently design a combination or sequential digital circuit in the optimal version. He can make the technical implementation of the designed system taking into account different technologies.			[SU4] Assessment of ability to use methods and tools [SU2] Assessment of ability to analyse information [SU1] Assessment of task fulfilment		

Subject contents	<p>Course content – lecture</p> <ol style="list-style-type: none"> 1. Basic concepts, combinational and sequential circuits. 2. Mathematical description of digital circuits function tables, logical functions, automata, graphs, and transition/output tables. 3. Binary system, binary arithmetic, BIN, HEX, BCD, U1, U2 codes. 4. Boolean algebra, axioms, definitions, and theorems. 5. Logical functions, canonical forms, NPS and NPI. 6. Minimization of logical functions, Karnaugh and McCluskey table methods. 7. Synthesis of combinational circuits using AND, OR, NOT, NAND, and NOR functions. 8. Typical combinational circuits. 9. Synthesis of combinational circuits using multiplexers, mixed structures. 10. Iterative circuits, trade-off between circuit complexity and propagation time. 11. Synthesis of synchronous sequential circuits abstract synthesis, minimizing the number of internal states, state coding, types of flip-flops and their use, methods of triggering flip-flops, combinational synthesis of sequential circuits. 12. Analysis of sequential circuits, conversion between Moore and Mealy models. 13. Synthesis of asynchronous sequential circuits, differences from synchronous circuits, abstract synthesis, state coding, critical and noncritical race conditions, race protection, implementation of asynchronous circuits using SR asynchronous flip-flops and combinational circuits with feedback, protection against static and dynamic hazards. 14. Technical synthesis of digital circuits gates, flip-flops, MSI circuits implementation technologies (bipolar and CMOS), parameters and characteristics, gates with OC and TS outputs, principles of circuit interconnection. 15. Typical sequential MSI circuits, counters, registers and their typical applications, bus organization in OC and TS techniques, addressing and synchronization problems. 16. Selected digital circuits: monostable and astable flip-flops, ROM memories (ROM, PROM, EPROM, EEPROM, and PLA) and their parameters and use in implementing logical functions.
	<p>Course content – exercises</p> <ol style="list-style-type: none"> 1. Basic concepts, combinational and sequential circuits. 2. Mathematical description of digital circuits function tables, logical functions, automata, graphs, and transition/output tables. 3. The binary system, binary arithmetic, BIN, HEX, BCD, U1, U2 codes. 4. Logical functions, canonical forms, NPS and NPI. 5. Minimization of logical functions, Karnaugh and McCluskey table methods.

	<p>6. Synthesis of combinational circuits using AND, OR, NOT, NAND, and NOR functors.</p> <p>7. Synthesis of combinational circuits using multiplexers, mixed structures.</p> <p>8. Synthesis of iterative circuits.</p> <p>9. Synthesis of synchronous sequential circuits abstract synthesis, minimizing the number of internal states, state coding, types of flip-flops and their use, methods of triggering flip-flops, combinational synthesis of sequential circuits.</p> <p>10. Analysis of sequential circuits, conversion between Moore and Mealye models.</p> <p>11. Synthesis of asynchronous sequential circuits, differences from synchronous circuits, abstract synthesis, state coding, critical and noncritical race conditions, race protection, implementation of asynchronous circuits using SR asynchronous flip-flops and combinational feedback circuits, protection against static and dynamic hazards.</p>		
Prerequisites and co-requisites	No requirements		
Assessment methods and criteria	Subject passing criteria	Passing threshold	Percentage of the final grade
	2 classworks for 20 points each, test for 30 point, possibility to correct score with any subset of items at exam session	51.0%	60.0%
	open test examination	51.0%	40.0%
Recommended reading	Basic literature	<p>J. Kalisz Podstawy elektroniki cyfrowej, WKiŁ 1998.</p> <p>J. Pieńkos, J. Turczyński Układy scalone TTL w systemach cyfrowych, WKiŁ 1986 Katalogi firmowe.</p> <p>M. Barski, W. Jędruch Układy cyfrowe, podstawy projektowania i opis w języku VHDL, Wydawnictwo Politechniki Gdańskiej 2007.</p> <p>T. Łuba (red.) Synteza układów cyfrowych, WKiŁ 2003 Zasoby Internetu.</p>	
	Supplementary literature	No requirements	
	eResources addresses		
Example issues/ example questions/ tasks being completed			
Practical activities within the subject	Not applicable		

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