



## Subject card

Subject name and code	Digital Circuits, PG_00047653						
Field of study	Informatics						
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	2	ECTS credits			4.0		
Learning profile	general academic profile	Assessment form			assessment		
Conducting unit	Department of Decision Systems and Robotics -> Faculty of Electronics Telecommunications and Informatics -> Faculties of Gdańsk University of Technology						
Name and surname of lecturer (lecturers)	Subject supervisor	dr inż. Janusz Kozłowski					
	Teachers	mgr inż. Tomasz Nowak inż. Tymoteusz Skrzyński mgr inż. Michał Kopczyński dr inż. Janusz Kozłowski dr inż. Krzysztof Cisowski mgr inż. Tymoteusz Byrwa mgr inż. Jakub Kłopotek Głowczewski inż. Michał Kolada					
Lesson types	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	7.0		48.0	100	
Subject objectives	Assimilation of theorems of Boolean algebra.  Expanding knowledge on canonical realizations of logic functions.  Learning methods of implementation of logic circuits.						

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 got fundamental knowledge on architectures of 8-bit microprocessors. Student got familiar with practical applications of simple programmable circuits.	[SW1] Assessment of factual knowledge
	[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 got preliminary knowledge on simple assembly languages. Student got familiar with methods used for testing of software.	[SW1] Assessment of task fulfilment
	[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 learned the principles of designing the combinational and sequential circuits. Student got familiar with methods used for testing of digital circuits.	[SU1] Assessment of task fulfilment
Subject contents	<p>Course content – lecture</p> <p>Notions and definitions. Mathematical description based on state transition tables and state diagrams. Basic codes (natural, BCD, etc.). Gray code, its properties and applications.</p> <p>Postulates and theorems of the Boolean algebra. Proving Boolean tautologies. Venn diagrams.</p> <p>Canonical forms of Boolean functions. Minimization of functions in Karnaugh maps.</p> <p>Functionally complete systems. Basic logic gates. Canonical realization of Boolean functions using NAND and NOR gates.</p> <p>Multiplexers and demultiplexers. Designing the digital multiplexing circuits.</p> <p>Synthesis of combinational circuits. Application of error correcting codes: codes with parity bits, Hamming code.</p> <p>Synthesis of iterative circuits: description using state transition tables and state diagrams.</p> <p>Synthesis of sequential synchronous circuits: Moore and Mealy models.</p> <p>The synchronous D, T, JK and RS flip-flops: principle of operation and triggering.</p> <p>Synthesis of sequential asynchronous circuits: elimination of static hazard and races.</p> <p>Fundamental information about microprocessor systems and assembly language programming.</p>		
Prerequisites and co-requisites			

Assessment methods and criteria	Subject passing criteria	Passing threshold	Percentage of the final grade
	Final test on theory. It is necessary to score at least 25 out of total amount of 50 pts. Time for the test: 60 minutes.	50.0%	50.0%
	Solving design problems. It is necessary to score at least 10 out of total amount of 20 pts. Number of tasks: 2.	50.0%	20.0%
	Laboratory tasks. It is necessary to score at least 15 out of total amount of 30 pts. Number of laboratory exercises: 5.	50.0%	30.0%
Recommended reading	Basic literature	<p>Barski M., Jędruch W.: Układy cyfrowe i mikroprocesory – skrypt. Wyd. PG 1985.</p> <p>Barski M., Jędruch W., Niedźwiecki M., Raczyński P., Sarzyński B.: Układy cyfrowe i mikroprocesory – zadania. Wyd. PG 1984.</p> <p>Traczyk W.: Układy cyfrowe. Podstawy teoretyczne i metody syntezy. Elektronika-Informatyka-Telekomunikacja, WNT 1982.</p>	
	Supplementary literature	Nelson V.P., Nagle H.T., Carroll B.D., Irwin J.D.: Digital Logic Circuit Analysis and Design. Prentice-Hall 1985.	
	eResources addresses		
Example issues/ example questions/ tasks being completed	<ol style="list-style-type: none"> <li>1. Perform an algorithmic decimal-to-binary conversion of a given number (e.g. 183.17).</li> <li>2. Present Mealy graph of the iterative circuit subtracting two binary numbers.</li> <li>3. Implement the synchronous D flip flop using the synchronous T flip flop and logic gates.</li> <li>4. Present input-output waveforms illustrating principle of operation of synchronous D flip flops triggered by the leading edge of clock and triggered by the level of clock.</li> <li>5. An asynchronous circuit forwards each third impulse from input to output. Present input-output waveforms and define system states. Draw coded Moore graph of the circuit.</li> </ol>		
Practical activities within the subject	Not applicable		

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