GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	Digital Circuits, PG_00047653		
Field of study	Informatics		
Date of commencement of studies	October 2022	Academic year of realisation of subject	2022/2023
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		
Name and surname of lecturer (lecturers)	Subject supervisor	dr inż. Janusz Kozłowski	
	Teachers	dr inż. Krzysztof Cisowski dr inż. Janusz Kozłowski mgr inż. Jan Glinko mgr inż. Marek Grzegorek dr inż. Andrzej Marczak dr inż. Marek Tatara dr inż. Kamil Stawiarski mgr inż. Alicja Olejniczak	

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	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_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
	[K6_W42] Knows and understands, to an advanced extent, architecture, design principles and methods of hardware and software support for local and distributed information systems, including computing systems, databases, computer networks and information applications, as well as the principles of human cooperation with computers and computer-aided teamwork	Student learned the principles of operation of basic logical elements and the selected MSI circuits (registers, counters). Student got prepared for analysing the logical schemes of digital circuits.	[SW1] Assessment of factual knowledge
	[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	Student got familiar with useful binary codes and their important applications. Student got knowledge on practical application of the Boolean algebra for description of digital 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.	[SU1] Assessment of task fulfilment

Subject contents	Notions and definitions. Mathematical description based on state transition tables and state diagrams. Basic codes (natural, BCD, etc.). Gray code, its properties and applications. Postulates and theorems of the Boolean algebra. Proving Boolean tautologies. Venn diagrams. Canonical forms of Boolean functions. Minimization of functions in Karnaugh maps. Functionally complete systems. Basic logic gates. Canonical realization of Boolean functions using NAND and NOR gates. Multiplexers and demultiplexers. Designing the digital multiplexing circuits. Synthesis of combinational circuits. Application of error correcting codes: codes with parity bits, Hamming code. Synthesis of iterative circuits: description using state transition tables and state diagrams. Synthesis of sequential synchronous circuits: Moore and Mealy models. The synchronous D, T, JK and RS flip-flops: principle of operation and triggering. Synthesis of sequential asynchronous circuits: elimination of static hazard and races. Fundamental information about microprocessor systems and assembly language programming.
Prerequisites and co-requisites	

Assessment methods and criteria

Subject passing criteria	Passing threshold	Percentage of the final grade
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%
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%
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	Barski M., Jędruch W.: Układy cyfrowe i mikroprocesory – skrypt. Wyd. PG 1985. Barski M., Jędruch W., Niedźwiecki M., Raczyński P., Sarzyński B.: Układy cyfrowe i mikroprocesory – zadania. Wyd. PG 1984. Traczyk W.: Układy cyfrowe. Podstawy teoretyczne i metody syntezy. Elektronika-Informatyka-Telekomunikacja, WNT 1982.
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	Adresy na platformie eNauczanie:

Example issues/ example questions/ tasks being completed	1. Perform an algorithmic decimal-to-binary conversion of a given number (e.g. 183.17). 2. Present Mealy graph of the iterative circuit subtracting two binary numbers. 3. Implement the synchronous D flip flop using the synchronous T flip flop and logic gates. 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. 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.
Work placement	Not applicable