GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

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| Subject name and code | Digital Circuits, PG_00047653 | | |
| Field of study | Informatics | | |
| Date of commencement of studies | October 2024 | Academic year of realisation of subject | 2024/2025 |
| Education level | first-cycle studies | Subject group | Obligatory subject group in the field of study<br>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. Janusz Kozłowski | |

| 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 |

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| Subject objectives | Assimilation of theorems of Boolean algebra.<br><br>Expanding knowledge on canonical realizations of logic functions.<br><br>Learning methods of implementation of logic 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 | Student got familiar with useful binary codes and their important applications.<br>Student got knowledge on practical application of the Boolean algebra for description of digital 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.<br>Student got familiar with methods used for testing of digital circuits. | [SU1] Assessment of task fulfilment |
| | [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.<br>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.<br>Student got familiar with methods used for testing of software. | [SU1] Assessment of task fulfilment |

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| 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.<br><br>Postulates and theorems of the Boolean algebra. Proving Boolean tautologies. Venn diagrams.<br><br>Canonical forms of Boolean functions. Minimization of functions in Karnaugh maps.<br><br>Functionally complete systems. Basic logic gates. Canonical realization of Boolean functions using NAND and NOR gates.<br><br>Multiplexers and demultiplexers. Designing the digital multiplexing circuits.<br><br>Synthesis of combinational circuits. Application of error correcting codes: codes with parity bits, Hamming code.<br><br>Synthesis of iterative circuits: description using state transition tables and state diagrams.<br><br>Synthesis of sequential synchronous circuits: Moore and Mealy models.<br><br>The synchronous D, T, JK and RS flip-flops: principle of operation and triggering.<br><br>Synthesis of sequential asynchronous circuits: elimination of static hazard and races.<br><br>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 |
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| 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% |
| 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% |

Recommended reading

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| Basic literature | Barski M., Jędruch W.: Układy cyfrowe i mikroprocesory – skrypt. Wyd. PG 1985.<br><br>Barski M., Jędruch W., Niedźwiecki M., Raczyński P., Sarzyński B.: Układy cyfrowe i mikroprocesory – zadania. Wyd. PG 1984.<br><br>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: |

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| Example issues/ example questions/ tasks being completed | 1. Perform an algorithmic decimal-to-binary conversion of a given number (e.g. 183.17).<br><br>2. Present Mealy graph of the iterative circuit subtracting two binary numbers.<br><br>3. Implement the synchronous D flip flop using the synchronous T flip flop and logic gates.<br><br>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.<br><br>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 |

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