GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

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| Subject name and code | Engineering of Integrated Circuits, PG_00067039 | | | | | | |
| Field of study | Electronics and Telecommunications | | | | | | |
| Date of commencement of studies | October 2025 | | Academic year of realisation of subject | 2027/2028 | | | |
| Education level | first-cycle studies | | Subject group | Optional subject group<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 | 3 | | Language of instruction | Polish | | | |
| Semester of study | 5 | | ECTS credits | 3.0 | | | |
| Learning profile | general academic profile | | Assessment form | exam | | | |
| Conducting unit | Department of Microelectronic Systems -> Faculty of Electronics Telecommunications and Informatics -> Wydziały Politechniki Gdańskiej | | | | | | |
| Name and surname of lecturer (lecturers) | Subject supervisor | | dr hab. inż. Bogdan Pankiewicz | | | | |
| | Teachers | | dr hab. inż. Bogdan Pankiewicz | | | | |
| 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 | | 3.0 | 27.0 | 75 | |
| Subject objectives | Main aim of the subject is introduction to design of integrated circuits. | | | | | | |

**Learning outcomes**

| Course outcome | Subject outcome | Method of verification |
|---|---|---|
| [K6_W10] knows and understands, to an advanced extent, the parameters, functions, and methods of analysis, design, and optimization of electronic circuits and systems, the definitions of error and measurement uncertainty, measurement methods, including time, frequency, and phase measurements, the properties of converters, and methods of digital signal processing, as well as the basic processes occurring in the life cycle of technical devices, objects, and systems, and methods of supporting processes and functions, specific to the field of study | The student is able to identify the structure, properties, and parameters of typical building blocks of CMOS integrated circuits. | [SW1] Assessment of factual knowledge |
| [K6_U12] can analyze the operation of components, circuits and systems related to the field of study, as well as measure their parameters and examine technical specifications, and plan and conduct experiments related to the field of study, including computer simulations and measurements, and interpret obtained results and draw conclusions | The student is able to design the circuit schematic and layout of a simple CMOS integrated circuit. | [SU1] Assessment of task fulfilment |
| [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 | The student knows the syntax of PSPICE files, types of possible simulations, ways of describing analog and digital circuits, and methods of simulating electronic circuits. | [SW1] Assessment of factual knowledge |

**Subject contents**

1) IC technologies, technological processing steps, process scenario.
2) Design rules.
3) Passive and active components in integrated circuits.
4) IC cost of design, prototyping and volume production.
5) IC defects and process yield.
6) Technology window of the process.
7) Relative and absolute device mismatches.
8) Methods of matching devices in IC technology.
9) Parasitic phenomenon.
10) Analog I/O circuits.
11) Digital I/O circuits.
12) Noise coupling, noise margin.
13) Power dissipation and temperature considerations.
14) Circuit extraction.
15) PSPICE circuits simulations.

**Prerequisites and co-requisites**

**Assessment methods and criteria**

| Subject passing criteria | Passing threshold | Percentage of the final grade |
|---|---|---|
| project | 50.0% | 25.0% |
| labs | 50.0% | 25.0% |
| lecture | 50.0% | 50.0% |

**Recommended reading**

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| Basic literature | 1) Paul R. Gray, Paul J. Hurst, Stephen H. Lewis, Robert G. Meyer: "Analysis and Design of Analog Integrated Circuits", Wiley, 2024.<br>2) M. Pelgrom, A. Duinmaijer, A. Welbres: "Matching properties of MOS transistors", IEEE Journal of Solid-State Circuits, vol.. 24, no. 5, October 1989.<br>3) J. Izydorczyk, PSpice komputerowa symulacja układów elektronicznych, Helion, 1993.<br>4) R. L. Geiger, P. E. Allen, N. R. Strader: "VLSI design techniques for analog and digital circuits", McGraw-Hill, 1990. |
| Supplementary literature | No requirements |
| eResources addresses | |

**Example issues/ example questions/ tasks being completed**

1. Simulation of a simple operational amplifier.
2. Layout design of a simple operational amplifier.
3. Layout extraction and final circuit simulations.
4. Power consumption analysis of a CMOS digital circuit.
5. Determination of the optimal configuration of output buffers in a CMOS digital circuit.

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| Work placement | Not applicable |

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