GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	Electronics, PG_00064140		
Field of study	Electronics and Telecommunications, Informatics, Automatic Control, Cybernetics and Robotics		
Date of commencement of studies	October 2024	Academic year of realisation of subject	2024/2025
Education level	second-cycle studies	Subject group	Obligatory subject group in the field of study
Mode of study	Full-time studies	Mode of delivery	at the university
Year of study	1	Language of instruction	English
Semester of study	1	ECTS credits	5.0
Learning profile	general academic profile	Assessment form	exam
Conducting unit	Department of Microelectronic Systems -> Faculty of Electronics, Telecommunications and Informatics		
Name and surname of lecturer (lecturers)	Subject supervisor	dr hab. inż. Piotr Płotka	
	Teachers	dr inż. Sylwia Babicz-Kiewlicz dr hab. inż. Piotr Płotka dr hab. inż. Grzegorz Blakiewicz dr hab. inż. Jacek Jakusz dr inż. Janusz Kozłowski dr inż. Piotr Kurgan dr hab. inż. Bogdan Pankiewicz dr hab. inż. Waldemar Jendernalik	

Lesson types and methods of instruction	Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
	Number of study hours	20.0	0.0	20.0	0.0	0.0	40
	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	40	8.0	77.0	125

Subject objectives	Review and consolidation of the fundamental knowledge and practical skills in the field of electronics that are expected to be mastered by B.S. level students.

Learning outcomes	Course outcome	Subject outcome	Method of verification
	[K7_U12] is able, to an increased extent, to analyze the operation of components and systems related to the field of study, as well as to measure their parameters and study their technical characteristics, and to plan and carry out experiments related to the field of study, including computer simulations, interpret the obtained results and draw conclusions	Can design basic electronic circuits, simulate their properties, design measurement circuits enabling evaluation of the designed circuits and can perform the measurements.	[SU4] Assessment of ability to use methods and tools
	[K7_W03] knows and understands, to an increased 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	Knows fundamental laws of circuits and signal theory. Knows basic methods for measurement of nonelectrical quantities and related meters. Knows operation mechanisms of basic semiconductor devices. Knows basic methods of design and analysis of linear and nonlinear electronic circuits. Knows basic methods of design and analysis of digital circuits.	[SW1] Assessment of factual knowledge

Subject contents	The phenomenon of the current in electrical circuits. Current and voltage (potential difference). Ohm's law and Kirchoff's laws. Resistors, voltage and current sources. Powers associated with resistors and sources. Thevenin and Norton equivalent circuits. Current, voltage and power waveforms in the time and frequency domains. Spectrum of the waveform. Band-pass and band-stop LC filters. Basic metrological terms: measurement, converter, measuring instrument and system. Measurement errors, types of errors: systematic, random, gross. Measuring instruments of basic electrical quantities: voltage, current, resistance. Digital multimeters: architecture, noise rejection, communication with computer. Analog and digital oscilloscope, block diagram, principles of operation, area of application. Oscilloscope measurements of basic electrical quantities, cursor and automatic measurements. Construction, operation principles and current-voltage characteristics of semiconductor diodes and transistors. Integration of elements. Dynamical properties and equivalent circuits of diodes and transistors – for small and large signals. Basic amplifying stages. Models and methods for DC and AC analysis. Feedback. Operational amplifier. Nonlinear circuits – rectifiers, power suppliers, detectors, switching and multiplying circuits. Computer aided simulation of electronic circuit operation with the SPICE program, for amplifier and filter circuits and a transmission line. Binary codes, theorems of Boolean algebra, canonical forms of Boolean functions, minimization of Boolean functions in Karnaugh maps, functionally complete sets. General logic circuit characteristics, logic gates, canonical realizations of Boolean functions, realizations of Boolean functions using multiplexers. Analysis of contact networks and networks of logic gates, implementation of combinational circuits, selected realizations of memoryless iterative circuits (e.g. adders, converters of binary codes) Principle of operation and triggering methods of synchronous flip flops, Moore and Mealy models of sequential synchronous circuits, minimization of state diagrams of sequential circuits, implementation of typical synchronous circuits (e.g. counters, shift registers)
Prerequisites and co-requisites	Completed B.S. level courses on: metrology of electrical and nonelectrical quantities; circuit and signal theory; semiconductor devices and analog circuits; digital circuits; - including training in laboratory skills.

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<tr><td>Assessment methods and criteria</td><td colspan="2"><table>
<tr><th>Subject passing criteria</th><th>Passing threshold</th><th>Percentage of the final grade</th></tr>
<tr><td>scores for lab reports</td><td>50.0%</td><td>40.0%</td></tr>
<tr><td>final written exam</td><td>50.0%</td><td>60.0%</td></tr>
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<tr><td rowspan="3">Recommended reading</td><td>Basic literature</td><td>U. Tietze, Ch. Schenk, E. Gamm, Electronic Circuits - Handbook for Design and Application, Springer 2008, eBook ISBN 978-3-540-78655-9</td></tr>
<tr><td>Supplementary literature</td><td>A.S. Sedra, K.C. Smith, "Microelectronic Circuits", Oxford, 2007</td></tr>
<tr><td>eResources addresses</td><td>Adresy na platformie eNauczanie:</td></tr>
<tr><td>Example issues/ example questions/ tasks being completed</td><td colspan="2">Example 1.

Assuming a medium frequency range of the input signal, for the amplifier schematically shown in the figure and data like for the exercise on bias point calculation:

- draw an equivalent small-signal model of the amplifier;

- calculate the voltage gain vO/vS;

- calculate the input and output resistances of the amplifier.

Example 2.

Consider the logical function f (a, b, c, d) presented in the table below.

a) Minimize this function in the above given Karnaugh map (introduce the result)

b) Introduce this function in the compact form (sum of products): f (a, b, c, d) = Sum(, , , , , ,)

c) Implement the minimized function canonically using NAND gates (two layers of gates)</td></tr>
<tr><td>Work placement</td><td colspan="2">Not applicable</td></tr>
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