GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	Electronic Circuits, PG_00067328
Field of study	Automatic Control, Cybernetics and Robotics

Date of commencement of studies	October 2025	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	2	Language of instruction	Polish
Semester of study	3	ECTS credits	3.0
Learning profile	general academic profile	Assessment form	assessment

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	30.0	15.0	0.0	0.0	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	2.0	28.0	75

Subject objectives	The aim of the course is to familiarize participants with the structure, operating principles, and analysis of basic analog electronic circuits, both linear and nonlinear. As part of the course, students will learn about the structure and characteristics of real operational amplifiers and how to use them in the design of a wide range of electronic circuits. The course will also cover the use of bipolar junction transistors (BJTs) and MOSFETs in the construction of basic electronic 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	The student knows the structure and parameters of basic analog linear and nonlinear electronic circuits, as well as their applications.	[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	The student is able to calculate the parameters of basic analog electronic circuits.	[SU1] Assessment of task fulfilment

Subject contents	The lecture will cover the following topics: 1) DC characteristics of bipolar and field-effect transistors, as well as their small-signal equivalent models. 2) Power supply of bipolar transistor amplifiers. 3) Analysis and characteristics of bipolar amplifiers in basic operating configurations. 4) Power supply of MOS transistor amplifiers. 5) Analysis and characteristics of MOS amplifiers in basic operating configurations. 6) Frequency characteristics of wideband transistor amplifiers. 7) Structure and parameters of operational amplifiers. 8) Application of operational amplifiers in the design of basic electronic circuits. 9) Use of negative feedback. 10) Introduction to switched-capacitor circuits. 11) Diode amplitude detector. 12) Half-wave and full-wave rectifiers. 13) Parallel voltage regulator with a Zener diode. 14) Series voltage regulators. 15) Analysis of the nonlinear properties of bipolar and MOS amplifiers as well as differential pairs. 16) Gilbert multiplier. 17) RC harmonic oscillators. 18) Resonant amplifiers and harmonic oscillators with a resonant circuit. 19) Schmitt trigger. 20) Relaxation oscillators. 21) Phase detector. As part of the course exercises, students will solve problems corresponding to the lecture content. During each exercise session, it is expected that 2 or 3 calculation problems will be solved.
Prerequisites and co-requisites	Basic knowledge of circuit theory and the properties of electronic components.

Assessment methods and criteria	Subject passing criteria	Passing threshold	Percentage of the final grade
	Homework and attendance	50.0%	50.0%
	Midterm colloquium	50.0%	50.0%

Recommended reading	Basic literature	1) Guziński A: "Liniowe elektroniczne układy analogowe", WNT, 1994. 2) Sedra A.S., Smith K.C.: "Microelectronic circuits", Oxford University Press, New York, Oxford, 2020. 3) M. Niedźwiecki, M. Rasiukiewicz, Nieliniowe elektroniczne układy analogowe, WNT 1991. 4) Paul R. Gray, Paul J. Hurst, Stephen H. Lewis, Robert G. Meyer: "Analysis and Design of Analog Integrated Circuits", Wiley, 2024.
	Supplementary literature	No requirements
	eResources addresses	

Example issues/ example questions/ tasks being completed	1) Calculate the operating point of an amplifier with a bipolar or MOS transistor. 2) Calculate the values of the small-signal equivalent model parameters of a transistor. 3) Draw the small-signal equivalent circuit of a transistor amplifier for mid-frequency range. 4) Calculate the small-signal voltage gain, input resistance, and output resistance of a transistor amplifier. 5) Draw the small-signal equivalent circuit of the amplifier for low frequencies. 6) Draw the small-signal equivalent circuit of the amplifier for high frequencies. 7) Calculate the cutoff frequencies of a transistor amplifier. 8) Apply Miller's theorem to determine the upper cutoff frequency of a transistor amplifier. 9) Provide the parameters of ideal and real operational amplifiers. 10) Provide circuits and parameters of circuits using operational amplifiers. 11) State the properties of negative feedback. 12) State the characteristics of switched-capacitor circuits. 13) Calculate the parameters of a power supply with a parallel/series voltage regulator. 14) Describe the properties of transistor amplifiers operating with signals that cause low harmonic distortion. 15) State the properties of a bipolar differential pair. 16) Describe the Gilbert multiplier circuit. 17) Provide circuits of basic systems with operational amplifiers that implement simple nonlinear functions. 18) State the generation condition and properties of RC and LC harmonic oscillators. 19) Describe the principles of harmonic oscillator analysis. 20) Provide the circuit diagram and properties of a Schmitt trigger.
Work placement	Not applicable

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