



Subject card

Subject name and code	Analog Electronic Circuits, PG_00067033						
Field of study	Electronics and Telecommunications						
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	4		ECTS credits		3.0		
Learning profile	general academic profile		Assessment form		exam		
Conducting unit	Department of Microelectronic Systems -> Faculty of Electronics Telecommunications and Informatics -> Wydział 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		3.0		27.0	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. The course covers topics related to the use of bipolar and MOS transistors in the construction of fundamental electronic systems. Students will also 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, such as amplifiers, nonlinear converters, and harmonic oscillators.						

Learning outcomes	Course outcome	Subject outcome	Method of verification
	[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 defines and explains performance parameters of analog I electronic circuits. The student indicates and explains applications of analog electronic circuits.	[SU4] Assessment of ability to use methods and tools
	[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_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 knows the structure and parameters of basic analog linear and nonlinear electronic circuits, as well as their applications.	[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 defines and explains performance parameters of analog I electronic circuits. The student indicates and explains applications of analog electronic circuits.	[SU4] Assessment of ability to use methods and tools
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 aligned with the lecture content. It is expected that 2 to 3 calculation-based problems will be solved during each class hour.		

Prerequisites and co-requisites			
Assessment methods and criteria	Subject passing criteria	Passing threshold	Percentage of the final grade
	Homework and attendance	50.0%	50.0%
	Written exam	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) Niedźwiecki M, Rasiukiewicz M.: "Nieliniowe elektroniczne układy analogowe", WNT 1991. 4) Tietze U., Schenk Ch.: "Electronic Circuits --- Handbook for Design and Applications", Springer 2nd edition, 2008.	
	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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