GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	Circuits and Signals, PG_00047549		
Field of study	Electronics and Telecommunications		
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
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	exam
Conducting unit	Department of Marine Electronic Systems -> Faculty of Electronics, Telecommunications and Informatics		
Name and surname of lecturer (lecturers)	Subject supervisor	dr inż. Piotr Grall	
	Teachers	dr inż. Piotr Grall dr inż. Kamil Stawiarski dr hab. inż. Iwona Kochańska	

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	4.0	51.0	100

Subject objectives	Equipping a student with knowledge and skills acquired in studying the basics of analogue circuits and signals. The knowledge is sought to be useful in further professional studies and practice.

Learning outcomes	Course outcome	Subject outcome	Method of verification
	[K6_W01] knows and understands, to an advanced extent, mathematics necessary to formulate and solve simple issues related to the field of study	Knowledge of the method of analysis of linear analog systems and elementary non-linear systems.	[SW1] Assessment of factual knowledge
	[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	Knowledge of the analytical approach in the time domain and in the field of s-frequency, phasor approach and spectral analysis using the Fourier series, as well as the simulation approach in circuit analysis.	[SW1] Assessment of factual knowledge
	[K6_U01] can apply mathematical knowledge to formulate and solve complex and non-typical problems related to the field of study and perform tasks, in an innovative way, in not entirely predictable conditions, by:n- appropriate selection of sources and information obtained from them, assessment, critical analysis and synthesis of this information,n- selection and application of appropriate methods and toolsn	Ability to apply the analytical approach in the time domain, in the field of s-frequency, use of the phasor approach and spectral analysis of periodic signals using the Fourier series, as well as the use of the simulation approach in practical cases of circuit analysis.	[SU1] Assessment of task fulfilment [SU4] Assessment of ability to use methods and tools
	[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	Ability to use methods of analysis of linear analog systems and elementary non-linear systems in practical situations.	[SU4] Assessment of ability to use methods and tools [SU1] Assessment of task fulfilment

Subject contents

1. Basic electric circuit variables and their units.
2. Models of basic electric circuit elements.
3. Static and dynamic parameters of basic electric circuit elements.
4. Linearity and time invariance of electric circuits.
5. Quasistationarity versus a long delay-line.
6. Operational amplifier and its typical applications.
7. Analysis of circuits containing operational amplifiers.
8. Independent voltage and current sources, ideal and real. Controlled sources.
9. Kirchhoff"s current and voltage laws.
10. One-port, two-port and multi-port - examples.
11. Analysis of linear circuits: connection of elements, equivalent resistance, transformation "triangle-to star", current and voltage divisors.
12. The principle of superposition.
13. Thevenin and Norton equivalent circuits.
14. The loop-current and the node-voltage methods.
15. Standard continuous-time signals. Causality.
16. The Laplace transformation.
17. Transfer function. Examples.
18. Transients in basic linear circuits.
19. Steady -state response of basic linear circuits.
20. Phasor circuits.
21. Maximum power transfer - load match.
22. Time-domain circuit characteristics.
23. Frequency responses of linear circuits.
24. Stability.
25. Resonant circuits.
26. Examples of analysis of resonant circuits.
27. Nonlinear circuits - responses for constant and sinusoidal excitations.
28. The Fourier series.
29. The spectrum of a periodic function. Circuit response for a periodic function.
30. Circuit analysis computer programs.

Prerequisites and co-requisites

Assessment methods and criteria

Subject passing criteria	Passing threshold	Percentage of the final grade
Written exam	51.0%	70.0%
Midterm colloquium	51.0%	30.0%

Recommended reading	Basic literature	J. Osiowski and J. Szabatin: Fundamentals of circuit theory, volumes I, II and III. WNT Warszawa 1993 (volume I and volume II) and 1995 (volume III) and subsequent editions.A. Leśnicki: Analog signal technique, volumes 1 and 2, Gdansk University of Technology Publishing House, Gdańsk 2014.C. Stefanski: Circuit and signal primer (available at https://enauczanie.pg.edu.pl/moodle/course/view.php?id=9722)(all in Polish)
	Supplementary literature	No requirements
	eResources addresses	Adresy na platformie eNauczanie:
Example issues/ example questions/ tasks being completed	1. Refer what we mean by 'equivalent circuits'. In a linear network given, determine in steps the equivalent Thevenin parameters and discuss the possible methods of solution. 2. Give a definition of a causal signal. Calculate, in a given first-order circuit the step and/or the impulse response. 3. List the known properties of the Laplace transformation. Based solely on that knowledge (without direct referring to Laplace formula, if possible) perform how to calculate the transform of an exemplary piece-wise linear/constant causal signal. 4. Discuss the application of the method of phasors and give an example of an RLC circuit in which you have to determine analitically the output waveform. How does the solution modify in case we change the excitation from cosinus to sinus or vice versa? 5. Consider we have a periodic signal. Give a definition of it's spectra in Fourier terms. Calculate and/or sketch the spectra of a square wave.	
Work placement	Not applicable	