GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	Fundamentals of electrical engineering, PG_00058332		
Field of study	Hydrogen Technologies and Electromobility		
Date of commencement of studies	October 2026	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	1	Language of instruction	Polish
Semester of study	1	ECTS credits	3.0
Learning profile	general academic profile	Assessment form	exam
Conducting unit	Department of Electrical Engineering -> Faculty of Electrical and Control Engineering -> Faculties of Gdańsk University of Technology		
Name and surname of lecturer (lecturers)	Subject supervisor	dr inż. Joanna Wołoszyn	
	Teachers	dr inż. Joanna Wołoszyn	

Lesson types

Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
Number of study hours	30.0	30.0	0.0	0.0	0.0	60
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	60	3.0	12.0	75

Subject objectives

Knowledge and understanding of the laws describing the electrical circuits. Mastering the methods of analysis of DC and AC electrical circuits and create energy balance circuit. The ability to use symbolic method for analyzing AC electrical circuits. Understanding the phenomenon of resonance in electrical circuits. Ability to perform fazor graphs of voltage, current and power in AC electrical circuits.

Learning outcomes

Course outcome	Subject outcome	Method of verification
[K6_W02] has knowledge of physics and chemistry including electrostatics, electromagnetism, electrodynamics, wave motion, acoustics, mechanics, thermodynamics, optics, solid state physics; including knowledge necessary to understand the basic physical phenomena occurring in hydrogen devices, systems and installations as well as automation and robotics systems	Able to describe the electric circuit in a steady state with appropriate equations. T Able to apply an effective method of solving a given electrical circuit. Can evaluate the correctness of the solutions of electric circuit's.	[SW1] Assessment of factual knowledge
[K6_U04] can apply the learned methods to the analysis and design of electrical elements, devices and systems	Solve the given electrical circuit. Confirm the correctness of this solution. Able to assess the influence of variability of electric circuit elements on the values of currents, voltages and power in the electric circuit..	[SU4] Assessment of ability to use methods and tools

Subject contents	Course content – lecture **LECTURES** The basic concepts of electrical engineering. The law describing the phenomenon of electrical, physical quantities and their units. The electrical circuit elements and their characteristics. Physical quantities and their units describing electrical phenomena. Dimensional analysis. Current, potential, voltage, resistance, conductance. Elements of electrical circuits. Ohm"s law. Circuit linearity, stationarity, passivity. Kirchhoff's laws. The classification of signals. Periodic and no periodic signals. The basic concepts in electric circuits. Joule"s law, power and energy. Tellegen's theorem, the balance of power. Methods for solving DC circuits: similarities, superposition, nodal analysis, loop currents and Thevenin's. AC circuits. The average value and the effective signal. The method of complex amplitudes. Methods for solving AC circuits: similarities, superposition, nodal, loop currents and Thevenin. Phasor diagram of circuit. The capacity in AC circuits. The measurements of voltage, current, power and energy. The phenomenon of resonance. The match of the receiver to the source. Reactive power compensation. Magnetically coupled circuits. Course content – exercises **EXERCISES** Description of electrical circuits using Kirchhoff's laws. Solving DC circuits with following methods: similarity, superposition, nodal analysis, loop currents and Thevenin's. The implementation of the balance of power circuits. The calculation of average values and the effective signal. Solving AC circuits with following methods: similarity, superposition, nodal analysis, Thevenin's and loop currents. Calculation of resonance frequencies, the quality factor and amplitude and phase characteristics of the electric circuit. The selection of circuit elements for various criterias.
Prerequisites and co-requisites	Knowledge of the Foundations of Mathematics. Knowledge of the Physics at the secondary school level

Assessment methods and criteria

Subject passing criteria	Passing threshold	Percentage of the final grade
Written exam	60.0%	65.0%
Midterm colloquium	50.0%	35.0%

Recommended reading

Basic literature	1. Bolkowski S.: Teoria obwodów elektrycznych. WNT Warszawa 2009. 2. Bolkowski S. *at al.*: Zbiór zadań z elektrotechniki teoretycznej. WNT Warszawa 2009. 3. Cichocki A. *at al.* : Zbiór zadań z elektrotechniki teoretycznej. PWN Warszawa 1985. 4. Horiszny J. *at al.* : Obwody elektryczne w stanie ustalonym. Zbiór zadań. Wydawnictwo PG. Gdańsk 2005. 5. Kurdziel R.: Podstawy elektrotechniki. WNT Warszawa 1973.
Supplementary literature	1. Krakowski M.: Elektrotechnika teoretyczna. T. 1. PWN Warszawa 1999. 2. Mikołajuk K., Trzaska Z.: Elektrotechnika teoretyczna - analiza i synteza elektrycznych obwodów liniowych. PWN Warszawa 1987.
eResources addresses	

Example issues/ example questions/ tasks being completed	1. For a given circuit of DC current write equations according to Kirchhoff's laws allowing to solve the circuit. 2. Give the rules for matching the load to the real source of current. What is the efficiency of the circuit under these conditions? Write the appropriate dependencies. 3. For block diagram give an idea of Thevenin method. Provide the necessary assumptions for this method. 4. Give the definition of active power in the AC circuit. Calculate the active power of the load, which voltage and current are described by the formulas: $u(t) = U_m \sin(t + a)$ and $i(t) = I_m \sin(t + b)$. Calculate the active power of the load, in which the voltage and current are periodically changing waveforms. 5. For a given circuit of AC current create the phasor graph of currents and voltages. 6. What is a parallel resonant circuit? Calculate quality factor for the parallel RLC circuit.
Practical activites within the subject	Not applicable

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