



## 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 2023		Academic year of realisation of subject		2023/2024		
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	Katedra Elektrotechniki i Inżynierii Wysokich Napięć -> Faculty of Electrical and Control Engineering						
Name and surname of lecturer (lecturers)	Subject supervisor		dr inż. Joanna Wołoszyn				
	Teachers		dr inż. Joanna Wołoszyn				
Lesson types and methods of instruction	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_W03] knows the methods of analysis of DC and AC circuits, the laws of electrical engineering and the properties of elements of electrical circuits		Student is able to describe the electric circuit in a steady state with appropriate equations. The student is able to apply an effective method of solving a given electrical circuit. The student 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		The student can solve the given electrical circuit and confirm the correctness of this solution. Student is 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	<b>LECTURES</b> 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.  <b>EXERCISES</b> 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. <i>at al.</i> : Zbiór zadań z elektrotechniki teoretycznej. WNT Warszawa 2009. 3. Cichocki A. <i>at al.</i> : Zbiór zadań z elektrotechniki teoretycznej. PWN Warszawa 1985. 4. Horiszny J. <i>at al.</i> : 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	Adresy na platformie eNauczanie:	
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.		
Work placement	Not applicable		