GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	Electrical Engineering, PG_00055389						
Field of study	Mechatronics						
Date of commencement of studies	October 2025		Academic year of realisation of subject	2025/2026			
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	assessment			
Conducting unit	Department of Control Systems Engineering -> Faculty Of Electrical And Control Engineering -> Wydziały Politechniki Gdańskiej						
Name and surname of lecturer (lecturers)	Subject supervisor		prof. dr hab. inż. Dionizy Czekaj				
	Teachers						
Lesson types and methods of instruction	Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
	Number of study hours	15.0	15.0	15.0	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		6.0	49.0		100
Subject objectives	The aim is to explain the fundamental laws of the electrical phenomena and to acquaint students with the basic principle of operation of electrical equipment. Teaching the methods of the analysis of simple electrical circuits.						

Learning outcomes

Course outcome	Subject outcome	Method of verification
[K6_W10] has knowledge about development trends in the field of engineering and technology sciences and scientific disciplines: Mechanical Engineering, Automation, Electronics, Electrical Engineering and Space Technologies, adequate for Mechatronics curse	The student knows new technical solutions used in electric drive systems and control and supervision systems of electrical devices. Recognizes the importance of self-expanding knowledge and skills in the field of study and related areas. Combines knowledge from various fields to understand the principles of operation of modern mechatronic devices and systems.	[SW1] Assessment of factual knowledge
[K6_W05] has knowledge in the field of electrical engineering, electronics and construction materials applied in mechatronics	The student understands the principles of construction and operation of basic electrical machines and devices. Knows the rules of safe operation of electrical devices.	[SW1] Assessment of factual knowledge
[K6_U04] is able to utilise known methods and mathematical models as well as analogue and digital measurement methods for analysing and assessment of stationary continuous and discrete mechatronics systems and processes	The student calculates the value of the currents, voltages and power in the electrical circuit elements. Uses basic electrical equipment used in industry. Performs basic measurements of electrical quantities. Operates a modern electric drive systems.	[SU1] Assessment of task fulfilment [SU5] Assessment of ability to present the results of task [SU2] Assessment of ability to analyse information [SU4] Assessment of ability to use methods and tools
[K6_W02] has a knowledge in term of physics that includes mechanics, thermodynamics, optics, electricity, magnetism, atomic physics, nuclear physic, solid state physics, including the knowledge necessary to understand basic phenomena occurring in mechatronic elements and systems and its surroundings	The student defines the basic physical quantities in electrical engineering. Explains the principles describing the relationship between physical quantities in electric circuits.	[SW1] Assessment of factual knowledge

Subject contents

Lecture: The basic physical quantities in electrical engineering. Electrical circuit elements and their characteristics. Kirchhoff"s laws. Analysis of linear DC circuits - basic calculation methods. Nonlinear circuits - basic properties. Single-phase AC linear circuits, the current-voltage relations for the resistor, induction coil and capacitor. Method of complex amplitudes for calculation of currents and voltages in AC circuits. Powers in AC circuits. The phenomenon of resonance in electrical circuit. Three-phase AC circuit - the basic formulas, power measurement. Electric and magnetic field, forces in the electromagnetic field. The Faraday"s law of electromagnetic induction. Transformer - the physical phenomena and principles of operation, the basic equations. Rotating electrical machines - motor and generator. Electric DC motors - principles of operation, velocity control. Three-phase AC motors: induction-, synchronous-, permanent magnet motor and their control. The structure of the drive system. Semiconductor electronics components: diode, transistor, thyristor. Power electronic converters in the drive system: rectifier, chopper, inverter. Systems of protection against electric shock. Tutorials: Electrical circuit elements and their characteristics. Kirchhoff"s laws. Basic methods of analysis of linear DC circuits. Nonlinear circuits: Determination of bias point of non-linear element. Single-phase linear AC circiuts - the complex amplitudes method for analysis of the AC circuits. Calculation of power in the sinusoidal alternating current circuits. Determination of resonant frequencies in the electrical circuit. Symmetrical three-phase AC circuits - examples of the calculation. Analysis of circuits with the transformer. Determination of parameters in a simple drive system based on the electric motor, the selection of circuit elements. Laboratory: Linear and nonlinear DC circuits - the supply and load elements, measurements of electrical quantities, voltage-current characteristics of the elements. AC circuits - basic elements, measurements of power, current and voltage, setting the parameters. Transients in electrical circuits. The drive system of DC motor - methods of speed and torque control / electric drive of the vehicle. The drive system with asynchron motor - start-up, speed control. Servodrive with permanent magnet synchronous motor - position, velocity and torque control.

Prerequisites and co-requisites

Basic knowledge in mathematics and physics at secondary level.

Assessment methods and criteria

Subject passing criteria	Passing threshold	Percentage of the final grade
Practical exercise (laboratory)	50.0%	40.0%
Written midterm colloquiums (tutorials)	50.0%	40.0%
Test on the content of lectures	50.0%	20.0%

Recommended reading

Basic literature	1. Pr. zb. : Elektrotechnika i elektronika dla nieelektryków. Podręcznik akademicki Mechanika. WNT, Warszawa 2004; 2. Kurdziel R.: Podstawy Elektrotechniki. WNT, Warszawa 1972; 3. Zawalich E., Zawalich J.: Elektrotechnika dla mechaników zadania. Wyd. PG, Gdańsk 2003; 4. Horiszny J., Aftyka W., Tiliouine H., Mizan M.: Obwody elektryczne w stanach ustalonych. Zbiór zadań. Wyd. PG, Gdańsk 2004; 5. Instrukcje laboratoryjne.
Supplementary literature	1. Pr. zb.: Poradnik Inżyniera Elektryka. T.1-3. WNT, Warszawa 1996; 2. Matulewicz W.: Maszyny elektryczne podstawy. Wyd. PG, Gdańsk 2005.
eResources addresses	Adresy na platformie eNauczanie:

Example issues/ example questions/ tasks being completed	The calculation of the currents in the DC circuit. Calculation of currents in the AC circuit. Calculation of the power of circuit components. The adjustment of the circuit parameters to achieve a specific desired value of the given output parameter of the circuit. The calculation of currents and voltages in a circuit with the loads of the given nominal values. The calculation of currents and voltages in a circuit with a transformer. Calculate the current in the symmetrical 3-phase circuit.
Work placement	Not applicable

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