GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	Electrical Engineering in Transport, PG_00038443		
Field of study	Electrical Engineering		
Date of commencement of studies	October 2023	Academic year of realisation of subject	2024/2025
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	4.0
Learning profile	general academic profile	Assessment form	assessment
Conducting unit	Department of Electrical Engineering of Transport -> Faculty of Electrical and Control Engineering		
Name and surname of lecturer (lecturers)	Subject supervisor	dr hab. inż. Leszek Jarzębowicz	
	Teachers		

Lesson types and methods of instruction

Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
Number of study hours	30.0	0.0	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	3.0	52.0	100

Subject objectives

Recognition the problems of electric traction and electrified transport systems. The acquisition of the ability to solve simple problems related to electric traction with the technical infrastructure and vehicles.

Learning outcomes

Course outcome	Subject outcome	Method of verification
K6_W10	Student can select the types and parameters of vehicles and power supply systems for various electrified transport systems.	[SW1] Assessment of factual knowledge
K6_U04	Student can use simulation methods and programs to design electric traction systems.	[SU3] Assessment of ability to use knowledge gained from the subject [SU4] Assessment of ability to use methods and tools

Subject contents

LECTURE Historical development of electric traction. The principles of traction. Direct Current (DC) and Alternating Current (AC) traction supply systems. DC and AC traction substations - power supply, structure, connections diagram. Overhead catenary systems. Construction of contact line systems and track return systems. Electric vehicles. Traction motors. Power transmission systems. Equation of motion of traction vehicle. General description of railway electric vehicles (HST, locomotives, EMUs, metro cars, LRV). Unconventional systems (Maglev). Road electric vehicles (trolleybuses, electric cars). Auxiliary equipment. Protection systems. Electric equipment: current collectors, circuits breakers, contactors, resistors. Main circuits - power electronic equipment. Control systems. DC and AC motor for traction - electrical and mechanical characteristics. Resistance control of DC motors. Application of power electronic in traction - choppers and inverters. Braking systems. On-board electronic systems. Route performance calculation. Energy-optimized traction control for electric vehicle. Energy storage devices - types and their locations. Electric signaling and train control. Automatic train control. Environmental and EMC conditions of electric vehicles operation. Operation and maintenance principles. Traffic control. Transport safety. Trends of electrical and mechanical construction development. LABORATORY Electric traction drives classic and modern: the principles of motor control, shaping of torque-speed curves, analysis of drive efficiency. Electric vehicle with direct drive - analysis of the performance of traction control algorithms. Traction substation - determining of basic characteristics and measurement of output voltage ripples, analysis of the impact of filters. Vehicle dynamics - practical approach of analysis, assessment of the impact of various factors on the dynamics. Light-weighed electric vehicles small cargo trolley and electric bicycles: structure, analysis of control methods, verification of performance.

Prerequisites and co-requisites

Basic knowledge on physics and electrical circuits.

Assessment methods and criteria	Subject passing criteria	Passing threshold	Percentage of the final grade
	Midterm colloquium	60.0%	70.0%
	Report from laboratory exercises	60.0%	30.0%
Recommended reading	Basic literature	Szeląg A. Electric Traction - Basic. Oficyna Wyd. PW, 2019. Karwowski K. (red.) Energetyka transportu zelektryfikowanego. Poradnik inżyniera. Wyd. PG, 2020. Szeląg A., Drążek Z., Maciołek T.: Elektroenergetyka miejskiej trakcji elektrycznej. Radom 2017. Steimel A.: Electric Traction and Motive Power and Energy Supply. Basic and Practical Experience. München: Oldenbourg Industrieverlag 2007. Westbrook M. H.: The electric car. Development and future of battery, hybrid and fuel-cell cars (IEE power series; no. 38). Karwowski K. (red.): Energetyka transportu zelektryfikowanego. Zbiór zadań. Wyd. KIET, 2021.	
	Supplementary literature	Giętkowski Z., Karwowski K., Mizan M.: Diagnostyka sieci trakcyjnej. Wyd. P. Gdańskiej 2009. Chrabąszcz I., Prusak J., Drapik S.: Trakcja elektryczna prądu stałego. Podręcznik INPE dla elektryków. Zeszyt 27. Bełchatów: Wyd. COSiW SEP, 2009. Madej J.: Teoria ruchu pojazdów szynowych. Warszawa: Wyd. P. Warszawskiej 2004. Podoski J., Kacprzak J., Mysłek J.: Zasady Trakcji Elektrycznej. Warszawa: WKŁ 1980.	
	eResources addresses	Adresy na platformie eNauczanie:	
Example issues/ example questions/ tasks being completed	1. Draw a simplified schema of DC traction power supply of the single-stage transformation. Why new solutions of the traction substations is preferable to application? 2. Draw a typical driving cycle rail vehicle - select waveforms: the distance traveled, speed, acceleration, jerk, power, tractive effort and traction resistance. What are the mathematical relationships between these waveforms? 3. Discuss the problem of determining power supply systems.		
Work placement	Not applicable		