GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	Transport energy, PG_00062420						
Field of study	Transport						
Date of commencement of studies	February 2027		Academic year of realisation of subject	2026/2027			
Education level	second-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	2.0			
Learning profile	general academic profile		Assessment form	assessment			
Conducting unit	Department of Electrified Transportation -> Faculty of Electrical and Control Engineering -> Faculties of Gdańsk University of Technology						
Name and surname of lecturer (lecturers)	Subject supervisor		dr hab. inż. Mikołaj Bartłomiejczyk				
	Teachers						
Lesson types	Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
	Number of study hours	15.0	15.0	0.0	0.0	0.0	30
	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	30		5.0	15.0		50
Subject objectives	Student is able to design and model traction power supply systems for urban transport and railway; calculates the energy efficiency of vehicles and transportation systems.						

Learning outcomes

Course outcome	Subject outcome	Method of verification
[K7_K03] demonstrates the ability to identify ethical dilemmas and recognize and evaluate alternative courses of action	The student understands the impact of given means of transportation and their energy consumption on the environment. Compares technical solutions from the technical point of view, but also in terms of positive and negative social and environmental effects. Is able to propose compromise solutions.	[SK5] Assessment of ability to solve problems that arise in practice
[K7_U01] creates innovative solutions to complex and unstructured problems, taking into account the variability of the environment by synthesizing information from many sources, using analytical, simulation and experimental methods	Student is able to integrate knowledge of mathematics, physics, electronics, power engineering, traffic engineering, civil engineering of transport and other fields by applying a system based approach, including nontechnology aspects (economics, psychology, sociology, environment, health and safety). Student is able to define the effect these fields have on the development of transport systems, able to use new technical and technological achievements and assess their utility for transport.	[SU2] Assessment of ability to analyse information
[K7_W02] explains the importance and interdependence of key components describing transport systems and processes and their environment, using in-depth knowledge in accordance with the main trends in the development of scientific disciplines related to the field of study	The student can identify solutions to improve energy efficiency and reduce the environmental impact of transportation systems. Is able to select the means of transport and its power supply in consideration of given operating conditions.	[SW3] Assessment of knowledge contained in written work and projects

Subject contents

Course content – lecture

LECTURE Functions and specificity of energetic of land, air and sea transport. Electric traction power supply systems in the world. Electrical and mechanical designs of traction substations. Overhead catenary line. Traction storage energy systems - electrochemical batteries, super capacitors, flywheels and hybrid systems. Hydrogen fuel cell technologies. Contactless supply to traction vehicles. Basic methods and algorithms of calculation of traction power supply system. The calculation of the supply system including road traffic congestion. Modeling supply system of electric traction. Simulations methods. Mathematical models of dynamic cooperation the current collector with the catenaries. Effect of network parameters and the traction current collector on the quality of current collection. Network Diagnostics of catenaries, current collector, and their cooperation in dynamic conditions. The impact of the traction supply station, catenaries and electric vehicles on the environment in AC and DC supply system. The specificity of the ship electrical engineering, aircraft. Power of motor transport - cars with combustion engine, electric and hybrid propulsion motor energy consumption of auxiliary equipment and devices. Electromobility. EXERCISES Calculation of traction characteristics. Calculation of the resistance of movement. Implementation of the theoretical method. Calculation of the voltage drops and of currents load in the traction power supply system. Calculation of network parameters and the traction substation. The power bilance, efficienty of the propulsion. Regenerative braking, using of the storage energy systems in vehicles.

Prerequisites and co-requisites

Basic knowledge of electrical engineering, computer science and electric traction.

Assessment methods and criteria

Subject passing criteria	Passing threshold	Percentage of the final grade
Practical exercise	60.0%	50.0%
Midterm colloquium	60.0%	50.0%

Recommended reading

Basic literature

Karwowski K. (red.): Energetyka transportu zelektryfikowanego. Poradnik inżyniera. Wyd. PG, 2020. Dąbrowski T.: Sieci i podstacje trakcyjne. Warszawa: WKŁ 1986. Szeląg A., Drążek Z., Maciołek T.: Elektroenergetyka miejskiej trakcji elektrycznej. Radom 2017.Siłka W.: Teoria ruchu samochodu. Warszawa: WNT 2002. Szeląg A.: Wpływ napięcia w sieci trakcyjnej 3 kV DC na parametry energetyczno-trakcyjne zasilanych pojazdów. Radom 2013. Głowacki K., Onderka E.: Sieci trakcyjne. Bibice: EMTRAK 2002. Kneba Z., Makowski S.: Zasilanie i sterowanie silników. WKiŁ, Warszawa 2004. Siłka W.: Energochłonność ruchu samochodu. WNT, Warszawa 1997. 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).

	Supplementary literature	1. Journals and magazines: Technika Transportu Szynowego, Elektrische Bahnen, Revue Generale des Chemins de Fer. 2. Internet: www.pkp.com.pl, www.transportszynowy.pl, www.kieppe-elektrik.com, www.pesa.pl, www.railway-technology.com, www.railroaddata.com, www.raileurope.com, www.trainweb.org
	eResources addresses	
Example issues/ example questions/ tasks being completed	1. Draw the traction effort curve of the vehicle and give its limitations.2. Give the equations of vehicle dynamics of motion.3. Discuss the principles of implementing the train run calculations.4. How to determine the energy efficiency of a vehicle?	
Practical activites within the subject	Not applicable	

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