



## Subject card

Subject name and code	Power Engineering and Telematics in Transportation, PG_00018252						
Field of study	Electrical Engineering						
Date of commencement of studies	February 2024		Academic year of realisation of subject		2024/2025		
Education level	second-cycle studies		Subject group				
Mode of study	Full-time studies		Mode of delivery		at the university		
Year of study	2		Language of instruction		Polish		
Semester of study	3		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. Mikołaj Bartłomiejczyk				
	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		6.0		49.0	100
Subject objectives	The student has expanded knowledge about electric transport systems in the field of grid supply and autonomous supply vehicles. Student describes and develops traction power systems for for vehicles transportations and long-distance transport. Presents the process of modelling these systems. Explains the issue of cooperation with the current collector overhead contactline. Student has general basic knowledge of transport telematics systems and skillfully selected technologies used in transport telematics.						
Learning outcomes	Course outcome		Subject outcome		Method of verification		
	K7_U11		The ability to technically and economically analyze the traction energy system		[SU1] Assessment of task fulfilment		
	K7_W07		Can perform and interpret the results of the analysis		[SW3] Assessment of knowledge contained in written work and projects		
	K7_K02		Student is able to determine the energy demand of individual means of transport		[SK5] Assessment of ability to solve problems that arise in practice		
Subject contents	<b>LECTURE</b> Tasks and specificity of energy of transport by land, air and sea. Power systems of electric traction in the world. Traction substations - remote control systems. Overhead catenary systems, especially on high speed. Power of the vehicle. Applications of power electronics converters in transport. Traction energy storage - batteries, supercapacitors, flywheels and hybrid. Methods and algorithms for the calculation of traction power supply systems. Modeling of electric traction power supply system. Mathematical models of a dynamic relationship with the current collector traction. Criteria for assessing the quality of cooperation current collector. Diagnostics of overhead catenary systems, contact line - pantograph interaction. The genesis of telematics transport. Standardization of telematics. The telematics systems for rail vehicles and road. Communication network architecture in vehicle. Interface man - machine, HMI. Integrated information systems. Telematics devices. Navigation and telecommunications. Systems: measuring the flow of travelers, travel information, warning and control systems in vehicles and on the road, against-accident, e-automation of highway, vehicles and cargo identification and others. Information about the traffic and its control. Intelligent transport systems. Development trends of transport. Electric vehicle charging systems. Electric buses. Ecodriving - energy-saving techniques for driving an electric vehicle. Measurement analysis of the traction network supply system. Intelligent electric vehicle charging systems. Traction Smart Grids. Energy consumption for the vehicle's own needs. HVAC system. OPEN-AIR LABORATORY Construction of contact line system and track return system. Structure of traction substation. Remote control systems - construction and functioning. Traffic control systems. Stationary storage energy system.						
Prerequisites and co-requisites	Basic understanding of electric traction, power electronics and informatics.						
Assessment methods and criteria	Subject passing criteria		Passing threshold		Percentage of the final grade		
	Development task		60.0%		25.0%		
	Midterm colloquium		60.0%		75.0%		

Recommended reading	Basic literature	<ol style="list-style-type: none"> <li>1. Głowacki K., Onderka E.: Sieci trakcyjne. Bibice: EMTRAK 2002.</li> <li>2. Podoski J., Kacprzak J., Mysiek J.: Zasady trakcji elektrycznej. Warszawa: WKŁ 1980.</li> <li>3. Praca zbiorowa, red. Strojny J.: Trakcja elektryczna prądu stałego. Układy zasilania. Podręcznik INPE dla elektryków. Zeszyt 27.SEP-COSiW, Warszawa, 2009.</li> <li>4. Giętkowski Z., Karwowski K., Mizan M.: Diagnostyka sieci trakcyjnej. Gdańsk: Wyd. PG 2009/Biblioteka Cyfrowa Politechniki Gdańskiej.</li> <li>5. Adamski A.: Inteligentne systemy transportowe. Uczelniane Wydawnictwa Naukowo Techniczne AGH, Kraków 2003.</li> <li>6. Piecha J. (red.): Rejestracja i przetwarzanie danych w telematycznych systemach transportu. Monografia. Wyd. Politechniki Śląskiej, Gliwice 2003.</li> <li>7. Steimel A.: Electric Traction - Motion Power and Energy Supply. Oldenbourg Industrieverla 2007.</li> <li>8. Bartłomiejczyk M., Połom M.: <i>Multiaspect measurement analysis of breaking energy recovery</i>. Energy Conversion and Management, Vol. 127, (2016)</li> <li>9. Bartłomiejczyk M., Połom M.: <i>The impact of the overhead line's power supply system spatial differentiation on the energy consumption of trolleybus transport: planning and economic aspects</i>. Transport, Vol. 32, nr 1 (2017), s.1-12,</li> <li>10. Bartłomiejczyk M.: <i>Smart grid technologies in electric power supply systems of public transport</i>. Transport, Vol. 33, nr 5 (2018)</li> <li>11. Bartłomiejczyk M.: <i>Super capacitor energy bank MEDCOM UCER-01 in Gdynia trolleybus system</i>. IECON 2016 - 42nd Annual Conference of the IEEE Industrial Electronics Society, 23-26.10.2016, Florencja, Włochy</li> <li>12. Bartłomiejczyk M.: <i>Dynamic charging of electric buses</i>. Warsaw, De Gruyter Poland, 2018, 97 s. ISBN 978-3-11-064507-1, DOI: 10.2478/9783110645088</li> <li>13. Bartłomiejczyk M.: <i>Driving performance indicators of electric bus driving technique: naturalistic driving data multicriterial analysis</i>. IEEE Transactions on Intelligent Transportation Systems</li> <li>14. Sakowska M.: <i>Zintegrowany, innowacyjny system zdalnego sterowania trolejbusowymi podstacjami trakcyjnymi oraz odłącznikami sieci trakcyjnej wizytówką PKT Gdynia Sp. z o.o., Raport Tramwajowy 2/2014</i></li> </ol>
	Supplementary literature	<ol style="list-style-type: none"> <li>1. <a href="http://www.pkp.com.pl">www.pkp.com.pl</a>, <a href="http://www.transportszynowy.200.pl">www.transportszynowy.200.pl</a>, <a href="http://www.kieppe-elektrik.com">www.kieppe-elektrik.com</a>, <a href="http://www.pesa.pl">www.pesa.pl</a>, <a href="http://www.railway-technology.com">www.railway-technology.com</a>, <a href="http://www.railroaddata.com">www.railroaddata.com</a>, <a href="http://www.raileurope.com">www.raileurope.com</a>, <a href="http://www.trainweb.org">www.trainweb.org</a>.</li> <li>2. Czasopisma: Technika Transportu Szynowego, Elektrische Bahnen, Revue Generale des Chemins de Fer.</li> <li>3. Nowacki G. (red.): Telematyka transportu drogowego. Warszawa: ITS, 2008.</li> </ol>
	eResources addresses	Adresy na platformie eNauczanie:
Example issues/ example questions/ tasks being completed	<ol style="list-style-type: none"> <li>1. Power systems of electric traction in the world.</li> <li>2. Methods for the calculation of traction power supply systems.</li> <li>3. Traction energy storage.</li> <li>4. Telecommunication systems in transportation.</li> <li>5. Charging system of electrical vehicles</li> <li>6. Smart Grid systems</li> </ol>	
Work placement	Not applicable	