GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	Electric Vehicles, PG_00053420		
Field of study	Automation, Robotics and Control Systems		
Date of commencement of studies	October 2020	Academic year of realisation of subject	2023/2024
Education level	first-cycle studies	Subject group	
Mode of study	Full-time studies	Mode of delivery	at the university
Year of study	4	Language of instruction	Polish
Semester of study	7	ECTS credits	3.0
Learning profile	general academic profile	Assessment form	assessment
Conducting unit	Faculty of Electrical and Control Engineering		
Name and surname of lecturer (lecturers)	Subject supervisor	prof. dr hab. inż. Jarosław Guziński	
	Teachers		

Lesson types and methods of instruction

Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
Number of study hours	15.0	0.0	15.0	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	40.0	75

Subject objectives

The aim of the course is to acquire knowledge and skills in the field of electric autonomous vehicles. The aim of the course is to get knowledge and skills in the field of electromobility, in particular electric drives, electric motors, power-electronic converters and charging systems used in electric vehicles as well as issues related to self-driving cars.

Learning outcomes

Course outcome	Subject outcome	Method of verification
[K6_U03] can prepare and present a presentation on the problems and results of an engineering task	The student is able to prepare and present a study on the conversion of an internal combustion vehicle into an electric vehicle, including the computational selection of individual system elements and a preliminary analysis of the vehicle's performance.	[SU5] Assessment of ability to present the results of task [SU1] Assessment of task fulfilment
[K6_W10] has basic knowledge related to mechatronics and robotics systems	The student has knowledge about the construction of various types of electric vehicles and the structure and principles of operation of the basic components of the vehicle. The student has knowledge of drive motor control algorithms of electric vehicle.	[SW1] Assessment of factual knowledge
[K6_U01] can obtain information from literature, databases and other sources; integrate the information obtained, interpret it and draw conclusions, formulate and justify opinions	The student is able to analyze literature, databases and technical documentation regarding electric vehicle drive systems.	[SU2] Assessment of ability to analyse information

Subject contents

Lecture. Introductory news. Energy demand, battery capacity assessment, vehicle energy consumption meters, driving range estimation. Energy storage and converters for cooperation with energy sources: batteries, flywheel, fuel cells, supercapacitors. Automatic systems of converter drive of vehicles with electric motors. Vehicle drives with permanent magnet motors. Electric drives in hybrid vehicles: diesel-electric. Methods of controlling electric motors in vehicles. Sensorless control. Powerelectronic converters in electric vehicles. Battery charging systems. Superior vehicle control. Self-driving cars. Hydrogen technologies in electric vehicles. Design of an electric vehicle with battery supply.

Lab. Simulation part: Steer-By-Wire (SBW) in cars, electric vehicle drive system with PMSM motor and FOC sensorless control method, two-wheeled vehicle control. Experimental part: torque and speed control of the induction motor for building speed-torque characteristics of the electric vehicle, control of the electric drive with an PMSM motor for electric vehicle

<table>
<tr><td>Prerequisites and co-requisites</td><td colspan="3">Knowledge of the basics of electrical engineering and automation</td></tr>
<tr><td>Assessment methods and criteria</td><td colspan="3"><table>
<tr><th>Subject passing criteria</th><th>Passing threshold</th><th>Percentage of the final grade</th></tr>
<tr><td>Lab</td><td>60.0%</td><td>50.0%</td></tr>
<tr><td>Project</td><td>60.0%</td><td>50.0%</td></tr>
</table></td></tr>
<tr><td rowspan="3">Recommended reading</td><td>Basic literature</td><td colspan="2">1. Chau K.T.: Electric Vehicle Machines and Drives: Design, Analysis and Application. Wiley - IEEE, 2015.
2. Dembowski A,.: Elektryczny napęd trakcyjny. WNT. Warszawa 2019.
3. Karwowski K. (red.): Energetyka transportu zelektryfikowanego. Wyd. PG, Gdańsk 2018.
4. Szumanowski A.: Hybrid Electric Vehicle Drives Design. Wyd. NRI. Warszawa-Radom 2006.
5. Choromański W., Grabarek I., Kozłowski M., Czerepicki A., Marczuk K.: Pojazdy autonomiczne i systemy transportu autonomicznego. PWN. Warszawa 2020.</td></tr>
<tr><td>Supplementary literature</td><td colspan="2">1. Ali Emadi (Ed.): Advanced Electric Drive Vehicles. CRC Press, Taylor & Francis. 2015.
2. Ehsani, Y. Gao, S. Longo, K. Ebrahimi: Modern Electric, Hybrid Electric, and Fuel Cell Vehicles Fundamentals, Theory, and Design. M. CRC Press, 3rd Edition, 2018.
3. Merkisz. J., Pielecha I.: Alternatywne napędy pojazdów. Wyd. PP. Poznań 2006.
4. Dębicki M.: Teoria samochodu, teoria napędu. WNT. Warszawa 1969.
5. Gomółka J., Kowalczak F., Franke A.: Współczesne chemiczne źródła pradu. Wyd. MON. Warszawa 1977.
6. Węgrzyn B.: Samochody z napędem elektrycznym. WNT. Warszawa 1970.</td></tr>
<tr><td>eResources addresses</td><td colspan="2">Adresy na platformie eNauczanie:</td></tr>
<tr><td>Example issues/ example questions/ tasks being completed</td><td colspan="3">1. Design an electric drive system to replace internal combustion engine in selected car.
2. Run and investigate drive system of EV with an induction motor.
3. Run and investigate drive system of EVwith an PMSM motor.</td></tr>
<tr><td>Work placement</td><td colspan="3">Not applicable</td></tr>
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