GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	Mechatronics of Vehicles, PG_00038378						
Field of study	Electrical Engineering						
Date of commencement of studies	October 2022		Academic year of realisation of subject	2023/2024			
Education level	second-cycle studies		Subject group	Optional subject group Subject group related to scientific research in the field of study			
Mode of study	Part-time studies		Mode of delivery	at the university			
Year of study	2		Language of instruction	Polish			
Semester of study	3		ECTS credits	3.0			
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. Dariusz Karkosiński				
	Teachers		dr hab. inż. Dariusz Karkosiński				
Lesson types and methods of instruction	Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
	Number of study hours	10.0	0.0	10.0	0.0	0.0	20
	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	20		10.0		45.0	75
Subject objectives	Understanding the components of automotive mechatronic equipment, basic construction and diagnostics of the ignition and injection systems, the principles of operation of the vehicle traction control.						

Learning outcomes

Course outcome	Subject outcome	Method of verification
K7_W07	The student lists the elements of the mechatronic equipment of motor vehicles and defines the conditions of their work and the related requirements. Describes electrical energy storage devices. Classifies and explains the construction of electric machines in cars with internal combustion and hybrid drives. Describes the construction and diagnostics of ignition and injection systems, sensors and actuators. The student explains the ecological aspects of automotive development. Defines the purpose and principles of operation of vehicle traction control systems. The student studies the electrical and magnetic properties of alternators and starters. It diagnoses the supply and ignition systems as well as the cooling system of the spark-ignition and compression-ignition engine.	[SW3] Assessment of knowledge contained in written work and projects
K7_K03	The student carries out laboratory tasks in the group regarding the compilation, commissioning and testing of mechatronics systems and devices of motor vehicles	[SK5] Assessment of ability to solve problems that arise in practice [SK1] Assessment of group work skills
K7_U05	The student combines measurement systems to determine the characteristics of sensors, transducers and actuators. The student conducts a series of tests of the above-mentioned devices and assess their correct operation.	[SU1] Assessment of task fulfilment [SU4] Assessment of ability to use methods and tools

Subject contents

LECTURE Electro-mechatronic equipments of vehicle: working conditions and the associated requirements. Device to energy storing. Classification and construction of electrical machines in the internal combustion engine and hybrid powered cars: alternators, starters, integrated starters-alternators, electric auxiliary drives. Selection rules for selection of alternators. Construction and diagnostics plugs and fuel injection systems: sensors, actuators, controllers and fuel supply systems of the spark ignition and diesel engines. Ecological aspects of automotive development. Solution and equipment leading to a reduction of toxic emissions. On-board diagnostic systems. Communication networks. Vehicle traction control systems. LABORATORY Determination of electrical and magnetic properties of alternators, sensors, actuators and plug systems.

Prerequisites and co-requisites

Basic knowledge of electrical engineering and electronics.

Assessment methods and criteria

Subject passing criteria	Passing threshold	Percentage of the final grade
Reports of laboratory exercises	50.0%	50.0%
Midterm colloquium	50.0%	50.0%

Recommended reading

Basic literature	J.Ocioszyński, Zespoły elektryczne i elektroniczne w samochodach. WNT 1999. Z.Kneba, S.Makowski, Zasilanie i sterowanie silników. WKiŁ 2004. U.Rokosch, Układy oczyszczania spalin i pokładowe systemy diagnostyczne samochodów OBD. WKiŁ 2007. D.Karkosiński, Badanie alternatora, Instrukcja ćwiczenia laboratoryjnego, Politechnika Gdańska, Gdańsk 2001.
Supplementary literature	J.Merkisz, S.Mazurek, pokładowe systemy diagnostyczne pojazdów samochodowych OBD. WKiŁ 2007. Mikroeletronika w pojazdach samochodowych, z cyklu Informatory techniczne Bosch, Praca zbiorowa. WKiŁ 2007. Sterowanie silników o zapłonie iskrowym. Układy Motronic z cyklu Informatory techniczne Bosch, Praca zbiorowa. WKiŁ 2007. Sterowanie silników o zapłonie samoczynnym, z cyklu Informatory techniczne Bosch, Praca zbiorowa. WKiŁ 2007. Saber, 1.4KW, 3-Phase, 12-Pole 14.45V DC Dynamic Thermal Alternator with Charging System Loads and Battery, Appendix: Alternator Laboratory Measurement Tests and Methods, Mast Template Library 2006.
eResources addresses	Adresy na platformie eNauczanie: MECHATRONIKA POJAZDÓW [Niestacjonarne][2023/24] - Moodle ID: 32281 https://enauczanie.pg.edu.pl/moodle/course/view.php?id=32281

Example issues/ example questions/ tasks being completed	Discuss the environmental conditions reducing life electrical and electronic equipment in the car. Present the dependence on the capacity of the battery temperature. Provide dependence on the battery capacity charging current. Provide a diagram of the new generation of compact alternator. Provide a current-velocity characteristics of the alternator 14V, 50-90A. Discuss and sketch the construction of the alternator claw rotor. Draw the current waveform of the excitation alternator voltage regulator for two different angular velocities. Present patterns of starter solenoid switch for the two types of excitation. Describe the electric machine features an integrated hybrid IMA? Provide mechanical characteristics of the drive. What ways to change the angular velocity are used to drive fans and blowers? What ways to change the angular velocity are used to drive the wiper? What part of the wiper drive is responsible for accurate them stop at the bottom of the wind glass? How do it apply the brake for wiper drives? Provide dependence engine cylinder pressure as a function of angle for optimum ignition, and too early and too late. Provide design classic ignition system. Illustrate the phases of the spark plug ignition. Describe the voltage at the electrodes in the spark plug ignition. Draw a diagram of the ignition system with static high-voltage distribution. Determine the construction of four sensors cooperating with microprocessor ignition system. Present the types of injection. Discuss and illustrate the adaptive fuel delivery control loop negative feedback regulation. Describe the construction and operation of narrow-band oxygen sensor. Discuss the third-generation power engines with compression ignition (CI). Present the 3 variants of ABS systems for the brake system type II, and two variants for the type X. Discuss the effects of the ABS system. Present sensors and discuss the effects of the anti-slip ASR system. Replace sensors and discuss the operation of the ESP system. What is an OBD (On Board Diagnostic)? Present the components and systems of the highest risk issue monitored by the OBD system. Present the 3 types of diagnostic tests performed by the OBD system. Give the classification of OBD diagnostic monitors. Discuss ways to monitor the implementation of the combustion process (identification misfire). Present the communication networks used in motor vehicles.
Work placement	Not applicable