GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	Mechatronics of Vehicles, PG_00038469		
Field of study	Electrical Engineering		
Date of commencement of studies	February 2026	Academic year of realisation of subject	2026/2027
Education level	second-cycle studies	Subject group	
Mode of study	Full-time studies	Mode of delivery	at the university
Year of study	1	Language of instruction	Polish
Semester of study	2	ECTS credits	3.0
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. Dariusz Karkosiński	
	Teachers	dr hab. inż. Dariusz Karkosiński	

Lesson types

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	4.0	41.0	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_K03] can interact and work in a group assuming various roles and identify priorities for the achievement of a specific task	The student works independently and cooperates in a professional group and organizes a time schedule for solving the assigned task.	[SK1] Assessment of group work skills
[K7_U05] is able to select equipment and carry out electrical measurements, design measuring systems for the determination of nonelectrical quantities, and analyse the results obtained	The student identifies automotive sensor and actuator systems. The student connects measurement systems to determine the characteristics of sensors, transducers, and actuators. The student conducts a series of tests of these devices and evaluates their correct operation.	[SU4] Assessment of ability to use methods and tools
[K7_W07] has an in-depth, theoretically grounded knowledge of electromechanical systems and their electromechanical systems and their design, electrotraction systems power supply and electrical energy storage devices	The student recognizes the sensor and actuator systems of a car.	[SW2] Assessment of knowledge contained in presentation

Subject contents

Course content – lecture
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.

Course content – laboratory
Exercise 1. - Alternator, Exercise 2. - Starter, Exercise 3. - Wipers (without report) Exercise 4. - Sensors of combustion cars, Exercise 5. - Actuators of combustion cars, Exercise 6. - Ignition systems, glow plugs, Exercise 7. Electric car driving with groups of 2-3 people Exercise 8. - Battery diagnostics

<table>
<tr><td>Prerequisites and co-requisites</td><td colspan="3">Basic knowledge of electrical engineering and electronics and the principles of operation of internal combustion engines</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>Midterm colloquium</td><td>50.0%</td><td>50.0%</td></tr>
<tr><td>Reports of laboratory exercises</td><td>50.0%</td><td>50.0%</td></tr>
</table></td></tr>
<tr><td rowspan="3">Recommended reading</td><td>Basic literature</td><td colspan="2">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.</td></tr>
<tr><td>Supplementary literature</td><td colspan="2">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.</td></tr>
<tr><td>eResources addresses</td><td colspan="2"></td></tr>
<tr><td>Example issues/ example questions/ tasks being completed</td><td colspan="3">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.</td></tr>
<tr><td>Practical activites within the subject</td><td colspan="3">Field exercises</td></tr>
</table>

Document generated electronically. Does not require a seal or signature.