



## Subject card

Subject name and code	, PG_00056122						
Field of study	Mechatronics						
Date of commencement of studies	October 2023	Academic year of realisation of subject			2025/2026		
Education level	first-cycle studies	Subject group					
Mode of study	Full-time studies	Mode of delivery			at the university		
Year of study	3	Language of instruction			Polish		
Semester of study	6	ECTS credits			2.0		
Learning profile	general academic profile	Assessment form			assessment		
Conducting unit	Institute of Mechanics and Machine Design -> Faculty of Mechanical Engineering and Ship Technology						
Name and surname of lecturer (lecturers)	Subject supervisor		dr inż. Paweł Załuski				
	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		0.0		0.0	30
Subject objectives	The aim of the course is to familiarise students with the application of hydraulic and electro-hydraulic drive and control as well as programmable systems in car construction, particularly steering, braking and suspension systems.						

Learning outcomes	Course outcome	Subject outcome	Method of verification
	[K6_W10] has knowledge about development trends in the field of engineering and technology sciences and scientific disciplines: Mechanical Engineering, Automation, Electronics, Electrical Engineering and Space Technologies, adequate for Mechatronics course	The student has knowledge of hydraulic drive and control in automobile construction. The student explains the application of hydraulic assistance in steering gears with kinematic, hydraulic and electric feedback and programmable steering systems. The student is able to design and select elements of a full hydraulic steering gear. The student describes the structure of the elements and operation of a hydraulic braking system with a brake force booster and corrector. The student calculates operating parameters of hydraulic braking system. The student understands the operation of a braking system equipped with ABS valves and the operation of ESP. The student will describe the construction of the hydraulic and pneumohydraulic elements of the suspension system with height and lateral tilt corrector in automobiles.	[SW1] Assessment of factual knowledge
	[K6_U05] is able to use properly chosen tools to compare design solutions of elements and mechatronics systems according to given application and economic criteria (e.g. power demand, speed, costs)	The student is able to carry out calculations and solve design tasks related to mechatronic equipment in the field of steering, braking and suspension systems used in automobiles.	[SU3] Assessment of ability to use knowledge gained from the subject
	[K6_U06] is able to identify and formulate specification of simple, practical engineering tasks, distinctive for mechatronics	The student is able to design a full hydraulic power steering system	[SU1] Assessment of task fulfilment [SU4] Assessment of ability to use methods and tools
	[K6_W08] knows and understands design and production processes of elements and simple mechatronic devices	The student has basic knowledge of operation and design of mechatronic devices as applied to electrohydraulic steering, braking and suspension systems in automotive engineering	[SW1] Assessment of factual knowledge
Subject contents	Development of automotive hydraulics. Application of hydraulics in passenger cars. Varieties and requirements for steering servos. Hydromechanical and full-hydraulic steering servos. Electro-hydraulic steering servos. Programmable steering servos. Requirements and components of the automotive braking system. Circuits and hydraulic components of the braking system. Electrohydraulic braking systems ABS, ASR. Elements of vehicle suspension. Hydropneumatic suspension. Hydropneumatic levelling systems. Electronic stability control system ESP. Electro-hydraulic control systems in CAN-Bus system.		
Prerequisites and co-requisites	Fundamentals of general mechanics, hydraulics and electrical engineering		
Assessment methods and criteria	Subject passing criteria	Passing threshold	Percentage of the final grade
	test	56.0%	100.0%
Recommended reading	Basic literature	Szydelski Z.: Napęd i sterowanie w pojazdach i samojezdnych maszynach roboczych. WNT Warszawa 1980  Reński A.: Budowa samochodów. Układy hamulcowe i kierownicze oraz zawieszenia. Oficyna Wydawnicza Politechniki Warszawskiej. Warszawa 2004	
	Supplementary literature	Leiter R.: Hamulce samochodów osobowych i motocykli. Wydawnictwa Komunikacji i Łączności. Warszawa 198  Katalogi firm: Danfoss, Bosch-Rexroth	
	eResources addresses	Adresy na platformie eNauczanie:	
Example issues/ example questions/ tasks being completed	Full-hydraulic steering servo design.Principle of operation of ABS, ESPOperation and application of retarder		
Work placement	Not applicable		