



Subject card

Subject name and code	, PG_00056120						
Field of study	Mechatronics						
Date of commencement of studies	October 2022	Academic year of realisation of subject			2024/2025		
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	dr inż. Paweł Załuski					
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 construction and operation of mechatronic elements and systems with electro-hydraulic and electro-pneumatic control, including programmable systems.						
Learning outcomes	Course outcome	Subject outcome			Method of verification		
	[K6_W08] knows and understands design and production processes of elements and simple mechatronic devices	The student knows and understands the processes and issues related to the construction and operation of mechatronic elements and systems with electrohydraulic and electropneumatic control, including programmable ones.			[SW1] Assessment of factual knowledge		
	[K6_U06] is able to identify and formulate specification of simple, practical engineering tasks, distinctive for mechatronics	The student is able to identify and formulate functions and methods of implementation for simple mechatronic engineering tasks in the field of electrohydraulic and electropneumatic drive and control.			[SU4] Assessment of ability to use methods and tools [SU3] Assessment of ability to use knowledge gained from the subject [SU1] Assessment of task fulfilment		
	[K6_W10] has a basic knowledge about development trends in terms of engineering and technical sciences and scientific disciplines: Mechanical Engineering, Automation, Electronics and Electrical Engineering, adequate for Mechatronics course	The student has basic knowledge of development trends in the field of technical sciences and scientific disciplines: hydrotronics and pneumotronics			[SW2] Assessment of knowledge contained in presentation [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 criterions (e.g. power demand, speed, costs)	Students will be able to compare design solutions of hydrotronic and pneumotronic components and systems due to given application criteria, e.g. speed of operation, effect of load on speed, energy consumption, power.			[SU3] Assessment of ability to use knowledge gained from the subject [SU2] Assessment of ability to analyse information		

Subject contents	<p><b>Hydrotronics.</b> Examples of application of hydraulic systems with electric and electronic control. Types of electrohydraulic control. Transducers. Switching control. Electromagnetically operated directional control valves. Systems with electromagnetically operated directional control valves. Proportional control. Proportional solenoids. Proportional directional valves. Servo-steering. Servo-valves with barometric, mechanical and electrical feedback. Static and dynamic characteristics of proportional valves and servo valves. Proportional control and servo control systems. Hydraulic amplifiers with electric stepper motors. Computer control systems for electrohydraulic servo drives. Hydraulic control systems for manipulators and robots. <b>Pneumotronics.</b> Application of pneumatic drives with electrical and programmable control. Types and control of compressors. Electropneumatic control. Types of electropneumatic control. Sensors used in pneumatics. Switchable electropneumatic valves. Relay technology. Electrical components used in electropneumatic control systems. Switching control systems. Digital electropneumatic control. Electropneumatic positioning systems. Pneumatic servo valves and servo drives. Programmable controls. Pneumatic systems with PLCs.</p>		
Prerequisites and co-requisites	Knowledge of general mechanics, hydrostatics, hydraulics and pneumatics		
Assessment methods and criteria	Subject passing criteria	Passing threshold	Percentage of the final grade
	tests	56.0%	100.0%
Recommended reading	Basic literature	<p>Pizoń A.: Hydrauliczne i elektrohydrauliczne układy sterowania i regulacji. WNT Warszawa 1987</p> <p>Pizoń A.: Elektrohydrauliczne i analogowe i cyfrowe układy automatyki. WNT Warszawa 1995</p> <p>Schmid D. i inni: Mechatronika. For the polish edition REA. Warszawa 2002</p>	
	Supplementary literature	<p>Katalogi firm: Bosch-Reroth, Moog, EATON, FESTO, SMC</p> <p>Vademecum Hydrauliki. Tom 2. Technika hydraulicznego sterowania zaworami proporcjonalnymi i serwozaworami. Mannesman Rexroth</p> <p>Deppert W., Stoll K.: Pneumatische Steuerungen. Vogel Buchverlag. Würzburg 1994.</p> <p>Backe W., Goedecke W.-D.: Steuerungs- und Schaltungstechnik I. Institut für hydraulische und pneumatische Antriebe und Steuerungen RWTH Aachen.</p> <p>Backe W.: Steuerungs- und Schaltungstechnik II. Institut für hydraulische und pneumatische Antriebe und Steuerungen RWTH Aachen.</p> <p>Holejko D. i inni: Pneumatyczne urządzenia automatyki. Wydawnictwa PW. Warszawa 1986.</p>	
	eResources addresses	<p>Adresy na platformie eNauczanie:</p> <p>Hydrotronika i Pneumotronika, W/L, MTR, sem. 6, letni, 2024/25 - Moodle ID: 44229  <a href="https://enauczanie.pg.edu.pl/moodle/course/view.php?id=44229">https://enauczanie.pg.edu.pl/moodle/course/view.php?id=44229</a></p>	
Example issues/ example questions/ tasks being completed	<p>principle of operation of proportional solenoid effect of load on the movement of actuators in systems with proportional valves Load sensing systems principle of operation of hydraulic servo-valves stepping units in pneumatic systems</p>		
Work placement	Not applicable		

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