



Subject card

Subject name and code	Hydraulics and Pneumatics, PG_00055441						
Field of study	Mechatronics						
Date of commencement of studies	October 2024	Academic year of realisation of subject			2025/2026		
Education level	first-cycle studies	Subject group			Obligatory subject group in the field of study Subject group related to scientific research in the field of study		
Mode of study	Full-time studies	Mode of delivery			at the university		
Year of study	2	Language of instruction			Polish		
Semester of study	4	ECTS credits			3.0		
Learning profile	general academic profile	Assessment form			assessment		
Conducting unit	Department of Mechanics and Mechatronics -> 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	15.0	15.0	0.0	0.0	45
	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	45		2.0		28.0	75
Subject objectives	The aim of the course is to introduce issues and problems related to hydrostatic and pneumatic drives. The aim is to get to know the physical basis of the systems' operation, learn about the elements' construction and develop the ability to read hydraulic and pneumatic diagrams. Upon completion of the course, the student should be able to design a simple hydraulic or pneumatic system.						
Learning outcomes	Course outcome		Subject outcome		Method of verification		
	[K6_U06] is able to identify and formulate specification of simple, practical engineering tasks, distinctive for mechatronics		The student is able to design a hydraulic system meeting the given requirements.		[SU3] Assessment of ability to use knowledge gained from the subject [SU1] Assessment of task fulfilment		
	[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)		Students will understand hydraulic and pneumatic diagrams and be able to compare the operation of different systems.		[SU2] Assessment of ability to analyse information [SU1] Assessment of task fulfilment		
	[K6_W04] has organized and theoretically supported, advanced knowledge in the field of general mechanics, strength of materials, theory of mechanisms and machine dynamics, fluid dynamics, hydraulics and pneumatics, machine construction and engineering graphics		The student is able to make calculations of a simple hydraulic system. They will be able to determine flow resistance and select elements for a given system.		[SW1] Assessment of factual knowledge		

Subject contents	<p>Hydraulics</p> <ul style="list-style-type: none"> <li>• Fundamentals of hydraulic propulsion. Conservation of mass, energy. Linear and local resistance to flow. Flow through gaps, constrictions.</li> <li>• Hydraulic fluid. Types. Mineral oils. Dynamic and kinematic viscosity. Fluid requirements.</li> <li>• Hydraulic elements. Hydraulic pumps. Constructional variants. Performance, power, efficiency. Construction of hydraulic cylinders. Seals.</li> <li>• Manifolds, control. Throttle valves and pressure valves.</li> <li>• Hydraulic accumulators.</li> <li>• Graphic symbols. Principles of creation. Reading a hydraulic diagram</li> <li>• Basic hydraulic systems. Throttle and displacement systems</li> </ul> <p>Pneumatics</p> <ul style="list-style-type: none"> <li>• Properties of pneumatics. Properties of compressed air. Compressors. Filtration and drying of compressed air. Purity classes.</li> <li>• Basic pneumatic components and systems.</li> </ul>														
Prerequisites and co-requisites	Basic knowledge of materials engineering, mechanics, strength of materials, fundamentals of machine construction and the ability to read technical drawings. Basic knowledge of physics describing the flow of liquids and gases														
Assessment methods and criteria	<table border="1"> <thead> <tr> <th>Subject passing criteria</th> <th>Passing threshold</th> <th>Percentage of the final grade</th> </tr> </thead> <tbody> <tr> <td>lecture test</td> <td>56.0%</td> <td>70.0%</td> </tr> <tr> <td>lab test</td> <td>56.0%</td> <td>15.0%</td> </tr> <tr> <td>exercise test</td> <td>56.0%</td> <td>15.0%</td> </tr> </tbody> </table>			Subject passing criteria	Passing threshold	Percentage of the final grade	lecture test	56.0%	70.0%	lab test	56.0%	15.0%	exercise test	56.0%	15.0%
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lecture test	56.0%	70.0%													
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exercise test	56.0%	15.0%													
Recommended reading	Basic literature	<ul style="list-style-type: none"> <li>• Osiecki A.: Hydrostatyczny napęd maszyn. WNT Warszawa 1998</li> <li>• Stryczek S.: Napęd hydrostatyczny. Tom I Elementy. Tom II Układy. WNT Warszawa 1990</li> </ul>													
	Supplementary literature	<ul style="list-style-type: none"> <li>• Szenajch W.: Napęd i sterowanie pneumatyczne. WNT Warszawa 1997</li> <li>• Niegoda J., Pomierski W.: Sterowanie pneumatyczne. Skrypt PG. Gdańsk 1998.</li> <li>• Huścio T., Kulesza Z., Kuźmierowski T: Napędy i sterowanie pneumatyczne. Oficyna Wydawnicza Politechniki Białostockiej. Białystok 2013</li> <li>• Sobczyk P.,Hydraulika siłowa. Zbiór zadań z rozwiązaniami Rexroth Vademecum hydrauliki</li> </ul>													
	eResources addresses	Adresy na platformie eNauczanie:													
Example issues/ example questions/ tasks being completed	<p>1. Determine the maximum cylinder force for position B of the distributor (based on the drawing)2. Hydraulic oil with a viscosity of <math>\nu=40</math> cSt flows through a circular pipe of internal diameter <math>\varnothing 10</math> mm at a rate of 10 l/min. What is the velocity of the flow?3. Describe the flow through a plane gap (formula)4. Basic functions and requirements for working fluids in power hydraulics5. Draw a diagram of a series throttle system with throttling at the outlet of a double acting cylinder. On what does the extension velocity of the actuator depend?6. Draw a pneumatic system with two actuators A and B, where actuator A is a single acting actuator and B is a double acting actuator. Both actuators start moving simultaneously when the START button is pressed and both return simultaneously when they both occupy the extreme extended position. Translated with <a href="http://www.DeepL.com/Translator">www.DeepL.com/Translator</a> (free version)</p>														
Work placement	Not applicable														

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