GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	Pneumatics and Hydraulics in Automatic Control and Robotics, PG_00068269		
Field of study	Automatic Control, Cybernetics and Robotics		
Date of commencement of studies	October 2025	Academic year of realisation of subject	2027/2028
Education level	first-cycle studies	Subject group	Optional subject group 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	3	Language of instruction	Polish
Semester of study	5	ECTS credits	3.0
Learning profile	general academic profile	Assessment form	assessment
Conducting unit	Division of Machine Design and Medical Engineering -> Institute of Mechanics and Machine Design -> Faculty of Mechanical Engineering and Ship Technology -> Faculties of Gdańsk University of Technology		
Name and surname of lecturer (lecturers)	Subject supervisor	dr hab. inż. Ryszard Jasiński	
	Teachers	dr hab. inż. Ryszard Jasiński	

Lesson types	Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
	Number of study hours	15.0	0.0	30.0	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	Student describes construction and principle of operation of components and drive systems, hydraulic, electrohydraulic, pneumatic, electropneumatic control used in automation and robotics. Student selects basic components to hydraulic, electrohydraulic, pneumatic, electropneumatic drive and control systems. Student builds basic hydraulic, pneumatic systems. Student takes measurements. Student analyzes results of measurements.

Learning outcomes

Course outcome	Subject outcome	Method of verification
[K6_W03] knows and understands, to an advanced extent, the construction and operating principles of components and systems related to the field of study, including theories, methods and complex relationships between them and selected specific issues - appropriate for the curriculum	Student describes the structure and operating principles of hydraulic, electrohydraulic, pneumatic, and electropneumatic drive and control components and systems used in automation and robotics.	[SW2] Assessment of knowledge contained in presentation
[K6_U12] can analyze the operation of components, circuits and systems related to the field of study, as well as measure their parameters and examine technical specifications, and plan and conduct experiments related to the field of study, including computer simulations and measurements, and interpret obtained results and draw conclusions	Student selects basic components for hydraulic, electrohydraulic, pneumatic, and electropneumatic drive and control systems. Student builds basic hydraulic and pneumatic systems. Student performs measurements. Student analyzes measurement results.	[SU1] Assessment of task fulfilment [SU3] Assessment of ability to use knowledge gained from the subject
[K6_W02] knows and understands, to an advanced extent, selected laws of physics and physical phenomena as well as methods and theories explaining the complex relationships between them, constituting the basic general knowledge in the field of technical sciences related to the field of study	Student knows and understands at an advanced level selected physical laws and phenomena as well as methods and theories explaining the operation of hydraulic, electrohydraulic, pneumatic and electropneumatic elements and systems of drive and control systems used in automation and robotics.	[SW1] Assessment of factual knowledge

Subject contents

Course content – lecture

Lecture: General information about pneumatic and hydraulic drives. Hydrostatics. Fluid dynamics. Flow equations. Development and applications of pneumatic systems in modern technology. Development and applications of hydraulic systems in modern technology. Basic elements and units of hydraulic drive and control. Applications of electrohydraulics and electronics in hydraulic drive and control systems. Generation of compressed air. Modern control systems of compressors. Basic pneumatic elements and basic pneumatic drive and control systems. Units of compressed air preparation. Elements and units converting energy of compressed air into mechanical energy. Elements controlling air flow and pressure. Comparison of pneumatic switching devices with electric and electronic devices. 6. Basic systems of pneumatic drive and control. Automation of pneumatic systems cycle. Measurements and control in laboratory of hydraulics and pneumatics. Automation of technologic and transport systems by applying pneumatics and hydraulics. Positioning of pneumatic and hydraulic driving systems. Pneumatic cylinders and motors. Control of pneumatic systems of sequence operation. Hydraulic control, speed stabilization. Control systems with hydraulic proportional and hydraulic servo valves. Characteristics of servo valves. Examples of applications of proportional and servo.

Course content – laboratory

1. Sequential control in pneumatic systems
2. Systems with timer relays - pneumatic control
3. Electropneumatic control - basics
4. Electropneumatic control - systems with timer relays
5. Electropneumatic control - systems with counters
6. Analysis of the pneumatic system of the MAS 200 mechatronic system
7. Design and selection of a pneumatic actuator
8. Computer-aided design of fluid systems
9. Pressure loss in hydraulic machine systems
10. Throttle valves and flow regulators
11. Sequential control in hydraulic systems
12. Directional control valves and check valves. differential connection of an actuator
13. Testing a proportional directional control valve. Design of a hydraulic system with a proportional directional control valve

Prerequisites and co-requisites

Assessment methods and criteria

Subject passing criteria	Passing threshold	Percentage of the final grade
Midterm colloquium	56.0%	50.0%
Practical exercise	56.0%	50.0%

Recommended reading

Basic literature	A. Morecki. Podstawy robotyki. M. Olszewski: Manipulatory i roboty przemysłowe A. Osiecki: Hydrostatyczny napęd maszyn A. Pizoń: Elementy i układy hydrauliczne w automatyce A. Pizoń: Elektrohydrauliczne analogowe i cyfrowe układy automatyki W. Szenajch: Napędy i sterownie pneumatyczne W. Szenajch. Przyrządy, uchwyty i sterowanie pneumatyczne Czasopisma: Hydraulika i Pneumatyka, Pneumatyka J.Lipski, E.Zwolak, W.Balas: Hydrauliczne urządzenia środków transportu
Supplementary literature	No requirements

	eResources addresses	
Example issues/ example questions/ tasks being completed	1. Advantages of hydrostatic systems 2. Disadvantages of hydrostatic systems 3. Energy conversion in a hydraulic device 4. Hydrodynamics 5. Law of conservation of energy 6. Energy losses in hydraulic systems 7. Laminar and turbulent flow 8. Construction and principle of operation of pneumatic directional control valves 9. Construction and principle of operation of proportional directional control valves 10. construction and principle of operation of servo valves	
Practical activites within the subject	Not applicable	

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