

STUDY MODULE DESCRIPTION FORM		
Name of the module/subject Hydraulic and Pneumatic Drives		Code 1010624161010642493
Field of study Mechanical Engineering	Profile of study (general academic, practical) (brak)	Year /Semester 3 / 6
Elective path/specialty Internal Combustion Engines	Subject offered in: Polish	Course (compulsory, elective) obligatory
Cycle of study: First-cycle studies	Form of study (full-time, part-time) part-time	
No. of hours Lecture: 10 Classes: 8 Laboratory: 10 Project/seminars: -		No. of credits 2
Status of the course in the study program (Basic, major, other) (brak)		(university-wide, from another field) (brak)
Education areas and fields of science and art technical sciences		ECTS distribution (number and %) 2 100%
Responsible for subject / lecturer: dr inż. Damian Frąckowiak email: damian.frackowiak@put.poznan.pl tel. 48 61 2244516 Faculty of Working Machines and Transportation ul. Piotrowo 3 60-965 Poznań		
Prerequisites in terms of knowledge, skills and social competencies:		
1	Knowledge	Knowledge of the basics of machine design, fluid mechanics, automation and electrical engineering basics.
2	Skills	Ability to solve problems in the field of fluid mechanics and base of machines design.
3	Social competencies	Understanding the need to expand their competence, willingness to work together as a team.
Assumptions and objectives of the course: - Understanding the structure and principles of hydraulics and pneumatics. - Familiarizing yourself with the basic propulsion systems and controls. - Getting to know the basics of design for hydraulic and pneumatic systems.		
Study outcomes and reference to the educational results for a field of study		
Knowledge:		
1. Has a basic knowledge of the basics of machine design and the theory of machines and mechanisms, including mechanical vibration. - [K1A_W05]		
2. Has a basic knowledge of the standardized principles of engineering drawing and engineering graphics. - [K1A_W06]		
3. Has a basic knowledge of technical fluid mechanics (ideal gases and ideal fluids), Newtonian and non-Newtonian viscous fluids, heat and fluid flow machinery. - [K1A_W07]		
4. Is up-to-date with the latest trends in mechanical engineering, i.e. automation, mechatronization, machine design and construction processes automation, increase in safety and ease of operation, use of modern construction materials. - [K1A_W18]		
Skills:		
1. Is able to use acquired mathematical theories to create and analyze simple mathematical models of machines, their components and simple technical systems. - [K1A_U07]		
2. Is able to create a diagram of a system, select its items and perform basic calculations using ready-made computational packages for mechanical, hydrostatic and electric or hybrid propulsion of a machine. - [K1A_U09]		
3. Is able to hand draw a simple schematic or a machine component in accordance with the principles of technical drawing. - [K1A_U14]		
4. Is able to perform rudimentary technical calculations in fluid mechanics and thermodynamics, such as heat and mass balance, pressure loss in pipes, selected parameters of blowers and fans in ventilation and transportation systems, calculate the thermodynamic flows in thermal machines. - [K1A_U17]		

Social competencies:
1. Understands the need and knows the possibilities of lifelong learning. - [K1A_K01]
2. Is aware of and understands the importance and impact of non-technical aspects of mechanical engineering activities and its impact on the environment and responsibility for own decisions. - [K1A_K02]
3. Is aware of the importance of behavior in a professional manner, compliance with the rules of professional ethics and respect for cultural diversity. - [K1A_K03]
4. Has a sense of responsibility for one's own work and is willing to comply with the principles of teamwork and taking responsibility for collaborative tasks. - [K1A_K04]

Assessment methods of study outcomes
- Written exam of the course.
- Assessment of laboratory exercises based on assessments of the reports and short entrance tests.

Course description
The principle of operation and ownership of hydraulic drives. Application of hydrostatic and hydrodynamic drives. Hydraulic fluids. Hydraulic components: pumps, valves, motors, actuators, accumulators, hydraulic power units. Hydrostatic systems. Systems with multiple receivers. Hydrostatic transmissions, hydraulic servo drives. The structure of the pneumatic drive and control. Pneumatics applications. Systems of preparation of compressed air. Elements of pneumatic systems. General principles for design of hydraulic and pneumatic drives and controls. Programs for computer-aided design of hydraulic and pneumatic systems.

Basic bibliography:
1. Osiecki A.: ?Hydrostatyczny napęd maszyn?. WNT, Warszawa , 2004.
2. Stryczek St.: ?Napęd hydrostatyczny ? elementy. WNT, Warszawa, 2003.
3. Stryczek St.: ?Napęd hydrostatyczny ? układy? . WNT, Warszawa, 2003.
4. Szenajch W.: ?Napęd i sterowanie pneumatyczne?. WNT, Warszawa, 2003

Additional bibliography:
1. Pizoń A.: ?Elektrohydrauliczne analogowe i cyfrowe układy automatyki?, WNT, W-wa 1995.
2. Szydelski Z.: Pojazdy samochodowe ? napęd i sterowanie hydrauliczne. WKŁ, W-wa,1999.

Result of average student's workload

Activity	Time (working hours)
1. Participation in lectures	30
2. The consolidation of the lecture	15
3. Consultation on the material given in lectures	2
4. Exam Preparation	10
5. Participation in the exam	2
6. Preparation for laboratory	8
7. Participation in laboratory exercises	15
8. Consultation on the material submitted to the laboratory exercises	2
9. Participation in the completion of the course	1

Student's workload		
Source of workload	hours	ECTS
Total workload	85	2
Contact hours	52	2
Practical activities	26	1