Railway Transport         Polish         obligatory           Cycle of study:         First-cycle studies         Form of study (full-time,part-time)         full-time           No. of hours         Lecture:         2         Classes:         -         Laboratory:         1         Project/seminars:         2           Status of the course in the study program (Basic, major, other)         (university-wide, from another field)         (brak)         ECTS distribution (number and %)           Education areas and fields of science and art         (brak)         (brak)         2         100%           technical sciences         2         100%         2         100%         2         100%           Responsible for subject / lecturer:         dr in2. Damian Frackowiak (Pouthorsing Machines and Transportation ul. Piotrowo 3 60-965 Pozmar)         2         100%           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.         3         Social Understanding the need to expand their competence, willingness to work together as a team.           2         Skills         Ability to solve problems in the field of fluid mechanics and base of machines design.         1           2         Skills         Ability to solve problems in the field of fluid mechanics and base			STUDY MODULE D	ES	CRIPTION FORM			
Transport       (general academic, practical) (brak)       4 / 7         Elective path/speciality Elective path/speciality Cycle of study:       Railway Transport       Subject offered in: Polish       Course (compulsory, elective) obligatory         Cycle of study:       First-cycle studies       Form of study (full-time, particular)       No. of readits         Lecture:       2       Classes:       - Laboratory:       1       Project/seminars:       -       2         Status of the course in the study program (Basic, major, other)       (university-wide, from another field)       No. of credits         Education areas and fields of science and art       ECTS distribution (number and %)       2       100%         Education areas and fields of science and art       Image: Case of the course in the study program, nel technical sciences       2       100%         Responsible for subject / lecturer:       dri niz. Damian Frackowiak email: damian.trackowiak @put.poznan.pl tel. 48 61 2244516       Faculty of Working Machines and Transportation ul. Pictrowo 360-965 Poznad         Prerequisites in terms of knowledge, skills and social competencies:       Image: Case of the course:       1         1       Knowledge       Ability to solve problems in the field of fluid mechanics, automation and electrical engineering basics.       1         2       Skills       Ability to solve problems in the field of fluid mechanics and base of machines design.	Name of the module/subject							
Railway Transport         Polish         obligatory           Cycle of study:         First-cycle studies         Form of study (full-time,part-time)         full-time           No. of hours         Lecture:         2         Classes:         -         Laboratory:         1         Project/seminars:         2           Status of the course in the study program (Basic, major, other)         (university-wide, from another field)         (brak)         ECTS distribution (number and %)           Education areas and fields of science and art         (brak)         (brak)         2         100%           technical sciences         2         100%         2         100%         2         100%           Responsible for subject / lecturer:         dr in2. Damian Frackowiak (Pouthorsing Machines and Transportation ul. Piotrowo 3 60-965 Pozmar)         2         100%           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.         3         Social Understanding the need to expand their competence, willingness to work together as a team.           2         Skills         Ability to solve problems in the field of fluid mechanics and base of machines design.         1           2         Skills         Ability to solve problems in the field of fluid mechanics and base					(general academic, practical	)		
First-cycle studies       full-time         No. of hours       No. of credits         Lecture:       2         Status of the course in the study program (Basic, major, other)       (university-wide, from another field)         (brack)       (brack)         Education areas and fields of science and at       (brack)         technical sciences       2         1       frint_Damian Frackowiak         email: damian_frackowiak@put.poznan.pl       tel. 48 61 2244516         Faculty of Working Machines and Transportation          ul. Plotrow 3 60-965 Poznani       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.         • Understanding the structure and principles of hydraulics and pneumatics.          • Social competencies       Understanding the main branches of technical results for a field of study         Knowledge       Indumentals of computer statics, kinematics and dynamics of a particle and ringib body. (K1A_W13)         Status of the structure and principles of hydraulics and pneumatics: statics, kinematics and dynamics of a particle and ringib body. (K1A_W13)         L	Elective		Iway Transport				Course (compulsory, elective) obligatory	
No. of hours       No. of credits         Lecture:       2       Classes:       - Laboratory:       1       Project/seminars:       -       2         Status of the course in the study program (Basic, major, other)       (university-wide, from another field)       (brak)       2         Education areas and fields of science and at       (brak)       (brak)       2       100%         Education areas and fields of science and at       ECTS distribution (number and %)       2       100%         technical sciences       2       100%       2       100%         Responsible for subject / lecturer:         dr in2:       Damian Frackowiak       ECTS distribution (number and %)         Prerequisites in terms of knowledge, skills and social competencies:       2       100%         Prerequisites in terms of knowledge, skills and social competencies:         1       Knowledge       Ability to solve problems in the field of 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.         Geneting to know the basics of design for hydraulica and pneumatic systems.	Cycle of	study:		For	m of study (full-time,part-time)			
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Staus of the course in the study program (Back, major, other) (brak)       (university-wide, from another field)         Education areas and fields of science and art       ECTS distribution (number and %)         Education areas and fields of science and art       ECTS distribution (number and %)         technical sciences       2         Responsible for subject / lecturer: dr in2. Damian Frackowiak email: damian.frackowiak@putpoznan.pl tel. 48 61 2244516       ECTS distribution (number and %)         Prerequisites in terms of knowledge, skills and social competencies:         1       Knowledge         2       Skills         3       Social competencies         2       Skills         3       Social competencies         4       Understanding the need to expand their competence, willingness to work together as a team.         5       Study outcomes and reference to the educational results for a field of study Knowledge         1       Inderstanding the structure and principles of hydraulics and pneumatics. - Familiarizing yourself with the basics or design for hydraulic and pneumatics. - Familiarizing yourself with the basics of the course: - Understanding the structure and reference to the educational results for a field of study Knowledge         1       Has a structured knowledge in the main branches of technical mechanics: statics, kinematics and dynamics of a particle and rigid body [K1A_W04]         2. Has a structured knowledge of the fundamentals of computer science	No. of h	ours					_	
(brak)         (brak)           Education areas and fields of science and art         ECTS distribution (number and %)           technical sciences         2           dr in2. Damian Frackowiak @put.poznan.pl tel. 48 61 2244516         Fraculty of Working Machines and Transportation ul. Piotrowo 3 60-965 Poznań           Prereusistes in terms of knowledge, skills and social competencies:         Knowledge           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.           • 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         In the main branches of technical mechanics: statics, kinematics and dynamics of a particle and rigid body [K1A_W04]           1. Has a entementary knowledge in the fundamentals of computer science, i.e. computer archinech, binary, decimal, and hexadecimal counting system, the representation of numbers and graphic signs in the computer mechanics, statics, kinematics and dynamics of a particle and rigid body [K1A_W04]	Lectur	e: <b>2</b> Classes	s: - Laboratory: 1		Project/seminars:	-	2	
and %       2       100%         Responsible for subject / lecturer:       dr in2. Damian Frackowiak email: damian.frackowiak@put.poznan.pl       2       100%         Responsible for subject / lecturer:       dr in2. Damian Frackowiak@put.poznan.pl       2       244516       Faculty of Working Machines and Transportation       ul. Plotrow 3 60-965 Poznań         Prerequisites in terms of knowledge, skills and social competencies:       1       Knowledge       Knowledge, skills and social competencies:         2       Skills       Ability to solve problems in the field of 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.         • 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       I. Has a structured knowledge in the main branches of technical mechanics: statics, kinematics and dynamics of a particle and rigid body [K1A_W04]       I. Has an elementary knowledge of the fundamentals of computer science, i.e. computer architec., binary, decimal, and hexadecimal counting system, the representation of numbers	Status o	-		(	•			
Responsible for subject / lecturer:         dr in2. Damian Frackowiak 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.         Study outcorres of the course:         - Understanding the structure and principles of hydraulics and pneumatics.         Study outcorres and reference to the educational results for a field of study         - Understanding the main branches of technical mechanics: statics, kinematics and dynamics of a particle and rigid body [K1A_W04]         Study outcorres and reference to the educational results for a field of study         Nowledge:         1. Has a structured knowledge in the main branches of technical mechanics: statics, kinematics and dynamics of a particle and rigid body [K1A_W04]         Skills:         1. Has a netementary knowledge of the fundamentals of computer science, i.e. computer architec., binary, decimal, and hexadecimal counting system, the representation of numbe	Educatio	on areas and fields of sci	ence and art			-		
dr inz. 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         Anouledge       Knowledge of the basics of machine design, fluid mechanics, automation and electrical engineering basics.         2       Skills         3       Social competencies         Understanding the need to expand their competence, willingness to work together as a team.         Competencies       Understanding the need to expand their competence, willingness to work together as a team.         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.         - Haarding 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.       As a structured knowledge of the fundamentals of computer science, i.e. computer architec., binary, decimal, and hyadeadecimal counting system, the representation	techn	ical sciences					2 100%	
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2       Skills         3       Social competencies         4       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 structured knowledge in the main branches of technical mechanics: statics, kinematics and dynamics of a particle and rigid body [K1A_W04]         2. Has an elementary knowledge of the fundamentals of computer science, i.e. computer architec., binary, decimal, and hexadecimal counting system, the representation of numbers and graphic signs in the computer memory, types of variables, general knowledge of the low, medium and high level programming languages, operating systems, databases, RAD environment and typical engin. applic [K1A_W13]         Skills:         1. Is able to use acquired mathematical theories to create and analyze simple mathematical models of machines, their	1	Knowledge						
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<ul> <li>Familiarizing yourself with the basic propulsion systems and controls.</li> <li>Getting to know the basics of design for hydraulic and pneumatic systems.</li> <li>Study outcomes and reference to the educational results for a field of study</li> <li>Knowledge: <ol> <li>Has a structured knowledge in the main branches of technical mechanics: statics, kinematics and dynamics of a particle and rigid body [K1A_W04]</li> <li>Has an elementary knowledge of the fundamentals of computer science, i.e. computer architec., binary, decimal, and hexadecimal counting system, the representation of numbers and graphic signs in the computer memory, types of variables, general knowledge of the low, medium and high level programming languages, operating systems, databases, RAD environment and typical engin. applic [K1A_W13]</li> </ol> </li> <li>Skills: <ol> <li>Is able to use acquired mathematical theories to create and analyze simple mathematical models of machines, their</li> </ol> </li> </ul>	Assu	mptions and obj	ectives of the course:					
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<ul> <li>2. Has an elementary knowledge of the fundamentals of computer science, i.e. computer architec., binary, decimal, and hexadecimal counting system, the representation of numbers and graphic signs in the computer memory, types of variables, general knowledge of the low, medium and high level programming languages, operating systems, databases, RAD environment and typical engin. applic [K1A_W13]</li> <li>Skills:</li> <li>1. Is able to use acquired mathematical theories to create and analyze simple mathematical models of machines, their</li> </ul>	1. Has	a structured knowledg	ge in the main branches of technic	cal m	echanics: statics, kinemat	ics a	ind dynamics of a particle	
general knowledge of the low, medium and high level programming languages, operating systems, databases, RAD environment and typical engin. applic [K1A_W13] <b>Skills:</b> 1. Is able to use acquired mathematical theories to create and analyze simple mathematical models of machines, their	2. Has	an elementary knowle						
1. Is able to use acquired mathematical theories to create and analyze simple mathematical models of machines, their	genera	I knowledge of the low	, medium and high level program					
	Skills							
components and simple technical systems [K1A_U07]				anal	yze simple mathematical r	mode	els of machines, their	
2. Is able to use popular packages for technical drawings edition and 3D modeling in sufficient detail to enable the creation or documentation in accordance with the applicable standards and models of virtual machines in three-dimensional space [K1A_U12]	docum	entation in accordance						
3. Is able to hand draw a simple schematic or a machine component in accordance with the principles of technical drawing			ple schematic or a machine comp	one	nt in accordance with the p	orinc	iples of technical drawing	
Social competencies:	Socia	I 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]

## 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.

## **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 stud	lent's workload	
Activity	Time (working hours)	
1. Participation in lectures	30	
2. Consultation on the material given in lectures	1	
3. Exam Preparation	8	
4. Participation in the exam	2	
5. Participation in laboratory exercises	15	
6. Reports of laboratory exercises	3	
7. Consultation on the material submitted to the laboratory exercises	2	
8. Participation in the completion of the course	1	
Student's wo	rkload	
Source of workload	hours	ECTS
Total workload	62	2
Contact hours	51	2
Practical activities	20	1