Name of the module/abjuilt         Code 1010101231010130901           Mechanical Structures         Profile of study (brain all codemic, practical)         Yar./Semister 2/3           Environmental Engineering First-cycle Studies         Profile of study (brain all codemic, practical)         Yar./Semister 2/3           Electrice pathspeciaty         -         Poilsh         Course (computery, elective) polish         2/3           Cycle of study:         First-cycle studies         Form of study (full-time, part-time)         No. of neurons           Lecture:         30         Classes:         15         Laboratory:         Project/seminars:         15         S           Education arreas and fields of sciences and art         (brak)         (brak)         ECTS distribution (number and %)           Education arreas and fields of science and art         ECTS distribution (number and %)         5         100%           Responsible for subject / lecturer:         Responsible for subject / lecturer:         d'in2. Tomaz / Azimierski enail: cmaze / Azimierski enain discoemice metailog / Acity of CNI and Environmenta			STUDY MODULE DE	ESCRIPTION FORM			
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Lecture:       30       Classes:       15       Laboratory:       Project/seminars:       15       5         Status of the course in the study program (Basic, major, other)       (university-wide, from another field)       (brak)         Education areas and fields of science and att       (brak)       (brak)         technical sciences       5       100%         Responsible for subject / lecturer:       Responsible for subject / lecturer:       drin2. Tomasz Kazmierski         drin2. Grzegorz Krzyzaniak       drin2. Tomasz Kazmierski       email: tomasz kazmierski         email: grzegorz Krzyzaniak       drin2. Tomasz Kazmierski       email: tomasz kazmierski         email: grzegorz Krzyzaniak       drin2. Tomasz Kazmierski       email: tomasz kazmierski         email: grzegorz Krzyzaniak       drin2. Tomasz Kazmierski       email: tomasz kazmierski         Prerequisites in terms of knowledge, skills and social competencies:       1       Knowledge       Knowledge of selected topics in mathematics, physics, engineering mechanics, materials strength and thermodynamics         2       Skills       Use the knowledge to explain processes and phenomena in mechanical and flow devices         3       Social       Awareness of the need to constantly update and supplement knowledge and skills         4. Use the students skills of resolving basic problems of mechanical strength in mechanical constructions		First-cyc	cle studies	full-time			
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Responsible for subject / lecturer:       Responsible for subject / lecturer:         dr in2. Grzegorz Krzyżaniak       dr in2. Tomasz Każmierski         email: grzegorz. Krzyżaniak @put.poznan.pl       email: tomasz.kazmierski@put.poznan.pl         tel. 616652034       email: tomasz.kazmierski@put.poznan.pl         Preculty of Civil and Environmental Engineering       Faculty of Civil and Environmental Engineering         ul. Piotrowo 5 60-965 Poznań       ul. Piotrowo 5 60-965 Poznań         Prerequisites in terms of knowledge, skills and social competencies:         1       Knowledge         3       Social competencies         4       Knowledge of selected topics in mathematics, physics, engineering mechanics, materials         3       Social competencies         6. Skills       Use the knowledge to explain processes and phenomena in mechanical and flow devices         3       Social competencies       Awareness of the need to constantly update and supplement knowledge and skills Able to share their skills with people in the group         Assumptions and objectives of the course:       .         1. Purchase by the students skills of resolving basic problems of mechanical strength in mechanical constructions         2. Getting to know with flow devices used in heating, ventilation and air conditioning.         Study outcomes and reference to the educational results for a field of study         Knowledge:       1.	Educati	on areas and fields of sci	ence and art				
dr inž. Grzegorz Krzyżaniak       dr inž. Tomasz Kaźmierski         email: grzegorz. Krzyżaniak @put.poznan.pl       tel. 616652034         Faculty of Civil and Environmental Engineering       tel. 616652079         ul. Piotrowo 5 60-965 Poznań       Faculty of Civil and Environmental Engineering         ul. Piotrowo 5 60-965 Poznań       Ul. Piotrowo 5 60-965 Poznań         Prerequisites in terms of knowledge, skills and social competencies:         1       Knowledge         2       Skills         3       Social competencies:         3       Awareness of the need to constantly update and supplement knowledge and skills         2       Skills         4       Awareness of the need to constantly update and supplement knowledge and skills         7       Awareness of the course:         1.       Purchase by the students skills of resolving basic problems of mechanical strength in mechanical constructions         2. Getting to know with flow devices used in heating, ventilation and air conditioning.         Study outcomes and reference to the educational results for a field of study         Knowledge:         1       Study outcomes and reference to the educational results for a field of study         Knowledge:         2       Types, principles and functions of valves used for cold and hot water[-] -[-]         3       Types, prin	techr	nical sciences			5 100%		
email: grzegorz.krzyźaniak@put.poznan.pl       email: tomasz.kazmierski@put.poznan.pl         tel. 616652034       tel. 616652079         Faculty of Civil and Environmental Engineering       ul. Piotrowo 5 60-965 Poznań         Prerequisites in terms of knowledge, skills and social competencies:         1       Knowledge       Knowledge of selected topics in mathematics, physics, engineering mechanics, materials         2       Skills       Use the knowledge to explain processes and phenomena in mechanical and flow devices         3       Social competencies       Awareness of the need to constantly update and supplement knowledge and skills         3.       Social competencies       Awareness of the course:         1.       Purchase by the students skills of resolving basic problems of mechanical strength in mechanical constructions         2.       Study outcomes and reference to the educational results for a field of study         Methodege         1.       Purchase by dis claulation and selection of the most commonly used machine connections[-] -[-]         2.       Types, principles and functions of valves used for cold and hot water[-] -[-]         3.       Study outcomes and reference to purper used for cold and hot water[-] -[-]         4.       Types, principles and ways to adjust the fan in the ventilation and air conditioning -[-]         5.       Study outcomes and reference to the educational r	Resp	onsible for subj	ect / lecturer:	Responsible for subject	t / lecturer:		
tel. 616652034       tel. 616652079         Faculty of Civil and Environmental Engineering       I. 616652079         Prerequisites in terms of knowledge, skills and social competencies:         1       Knowledge         2       Skills         2       Skills         3       Social competencies:         Awareness of the need to constantly update and supplement knowledge and skills         Able to share their skills with people in the group         Assumptions and objectives of the course:         1.       Faculty of civil and Environmental Engineering         2.       Skills         3       Social competencies         Awareness of the need to constantly update and supplement knowledge and skills         Able to share their skills with people in the group         Assumptions and objectives of the course:         1.       Purchase by the students skills of resolving basic problems of mechanical strength in mechanical constructions         2. Getting to know with flow devices used in heating, ventilation and air conditioning.         Study outcomes and reference to the educational results for a field of study         Knowledge:         1.       Basic rules of calculation and selection of the most commonly used machine connections [-] - [-]         2. Types, principles and functions of valves used for cold and hot water [-] - [-]	dr ir	nż. Grzegorz Krzyżani	ak	dr inż. Tomasz Kaźmierski			
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ul. Piotrowo 5 60-965 Poznań       ul. Piotrowo 5 60-965 Poznań         Prerequisites in terms of knowledge, skills and social competencies:         1       Knowledge         2       Skills         2       Skills         3       Social competencies         Competencies       Awareness of the need to constantly update and supplement knowledge and skills         Able to share their skills with people in the group         Assumptions and objectives of the course:         1. Purchase by the students skills of resolving basic problems of mechanical strength in mechanical constructions         2. Getting to know with flow devices used in heating, ventilation and air conditioning.         Study outcomes and reference to the educational results for a field of study         Knowledge:         1. Spes, principles and functions of valves used for cold and hot water [-] - [-]         2. Types, principles and ways to adjust the fan in the ventilation and air conditioning - [-]         Skills:         1. Execution of construction drawings of single parts and assembly drawing of simple devices, - [-]         2. Execution of installation drawings on rectangular projection construction layouts as well as in axonometric - [-]         Scial competencies:         1. The student understands the importance of engineering and its impact on the environment - [-]			opmontal Engineering				
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Study outcomes and reference to the educational results for a field of study         Knowledge:         1. Basic rules of calculation and selection of the most commonly used machine connections [-] - [-]         2. Types, principles and functions of valves used for cold and hot water [-] - [-]         3. Types, principles of operation, methods of selection and adjustment of pumps used for cold and hot water [-]         4. Types, principles and ways to adjust the fan in the ventilation and air conditioning - [-]         Skills:         1. Execution of construction drawings of single parts and assembly drawing of simple devices, - [-]         2. Execution of drawings of buildings in sections and rectangular projections in accordance with the applicable rules and graphical notations - [-]         3. Execution of installation drawings on rectangular projection construction layouts as well as in axonometric - [-]         Social competencies:         1. The student understands the importance of engineering and its impact on the environment - [-]         2. The student is able to think and act in an enterprising way - [-]							
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3. The student is able to prioritize appropriately in carrying out tasks - [-]							
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## Assessment methods of study outcomes

#### Lectures: Written final test

Project: Execution and completion of design projects: 2 (typical mechanical constructions) + 1 (pumping station).

### Course description

Mechanical loads and stresses. Fatigue strength. Uncoupled connections - welded and rivet connections, and coupled connections ? screw connections. The function of fittings. Shutoff valves, dampers and non-return valves. Control valves and safety valves ? construction, principles of functioning, application. Thermostatic valves - construction, principles of functioning, criterion of throttling. Types of pumps ? operation parameters: capacity, pumping pressure, power, efficiency. Pumping system ? geometrical and energy quantities. Cavitations in pumping systems. Characteristics of rotary pumps and their operating point. Parallel and series operation of pumps. Control of pumps capacity. Fans and blowers ? characteristics of devices, specific measures. Types of fans. Characteristics of centrifugal fans. Axial fans ? construction, velocity and pressure pattern, supply power. Control of axial fans.

#### **Basic bibliography:**

1. Janiak M.: Urządzenia mechaniczne w inżynierii środowiska. Cz.1. Wydawnictwo Politechniki Poznańskiej 1993.

2. Janiak M., Krzyżaniak G.: Urządzenia mechaniczne w inżynierii środowiska. Cz. 2. Wydawnictwo Politechniki Poznańskiej 1995.

3. Praca zbiorowa: Mały Poradnik Mechanika tom I i II. Warszawa 1998

#### Additional bibliography:

1. Stępniewski : Pompy. PWN Warszawa

# Result of average student's workload

Activity		Time (working hours)
1. Participation in lectures		30
2. Participation in project exercises	30	
3. Participation in project exercises	30	
4. Preparation (at home) for the project exercises	9	
5. Participation in consultations related to the project exercises	20	
6. Preparation for the final test	5	
7. Final test	1	
Student's wo	rkload	
Source of workload	hours	ECTS
Total workload	125	5
Contact hours	65	3
Practical activities	60	2