



Subject card

Subject name and code	Pumps and Water Turbines and small Hydropower, PG_00042134						
Field of study	Power Engineering, Power Engineering, Power Engineering, Power Engineering, Power Engineering						
Date of commencement of studies	October 2020	Academic year of realisation of subject			2022/2023		
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	6	ECTS credits			2.0		
Learning profile	general academic profile	Assessment form			assessment		
Conducting unit	Institute of Energy -> Faculty of Mechanical Engineering and Ship Technology						
Name and surname of lecturer (lecturers)	Subject supervisor	dr hab. inż. Marian Piwowarski					
	Teachers	dr hab. inż. Marian Piwowarski dr inż. Marzena Banaszek					
Lesson types and methods of instruction	Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
	Number of study hours	15.0	0.0	15.0	0.0	0.0	30
	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	30	3.0		17.0		50
Subject objectives	The aim of the course is to introduce students to issues related to water machines such as centrifugal pumps and water turbines used in the power industry, to familiarize students with the basic concepts, principles of operation and selection for installations. In the field of small power engineering, discussion of the machine equipment of a small power plant and its cooperation with the power grid.						
Learning outcomes	Course outcome	Subject outcome			Method of verification		
	K6_W09	The student has a basic knowledge of pump type energy devices, compressors, turbines, internal combustion engines, boilers, pipelines and their accessories and the methods of their selection depending on the needs.					
	K6_U08	The student is able to choose methods modeling and design devices and design typical device design mechanical or component using appropriate methods and tools with consideration given performance criteria					
Subject contents	Pumps used in the power industry, construction, characteristics, operating curves, selection to the needs of the installation, allowable suction height due to cavitation. Basic equation of centrifugal pumps. Centrifugal, helicoidal, diagonal, propeller pumps, construction, construction elements, strength, examples of construction. Characteristics, regulation and drives of centrifugal pumps. Small water power plants, machine equipment, selection of turbines according to the hydrotechnical conditions of the facility, foundation height, characteristics of various types of small water turbines.						

Prerequisites and co-requisites	Fluid mechanics Centrifugal pumps Water turbines		
Assessment methods and criteria	Subject passing criteria	Passing threshold	Percentage of the final grade
	exercise report laboratory	50.0%	50.0%
	passing test	50.0%	50.0%
Recommended reading	Basic literature	<ol style="list-style-type: none"> 1. Krzyżanowski W.: Turbiny wodne. Konstrukcja i zasady regulacji. WNT. Warszawa, 1971; 2. Hoffmann M.: Małe elektrownie wodne. Nabba, Warszawa, 1991; 3. Troskoleński A. T., Łazarkiewicz S. Pompy wirowe, Wydawnictwa Naukowo-Techniczne, Warszawa, 1973; 4. Jędrał W. Pompy wirowe odśrodkowe, Oficyna Wydawnicza Politechniki Warszawskiej, Warszawa, 1996; 	
	Supplementary literature	<ol style="list-style-type: none"> 1. Szczegolew G., Garkawi J.: Turbiny wodne oraz ich regulacja. PWN, Warszawa 1959; 2. Łaski A.: Elektrownie wodne. Wyd. Naukowo-Techniczne, Warszawa, 1975; 3. Michałowski S., Plutecki J.: Energetyka wodna. Wydawnictwo Naukowo-Techniczne, Warszawa, 1975; 	
	eResources addresses	Adresy na platformie eNauczenie: Pompy, turbiny wodne i mała energetyka - Moodle ID: 29713 https://enauczenie.pg.edu.pl/moodle/course/view.php?id=29713	
Example issues/ example questions/ tasks being completed	<ol style="list-style-type: none"> 1. List the quantities characterizing the operation of a water turbine. 2. Present the design solutions of water turbines used in small hydropower. 3. Rules for selecting pumps for the pumping installation. 4. Determine the pump foundation height with known anti-cavitation surplus. 		
Work placement	Not applicable		