GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	Pumps, turbines and small hydropower, PG_00053657						
Field of study	Mechanical Engineering						
Date of commencement of studies	October 2022		Academic year of realisation of subject	2024/2025			
Education level	first-cycle studies		Subject group				
Mode of study	Full-time studies		Mode of delivery	at the university			
Year of study	3		Language of instruction	English			
Semester of study	5		ECTS credits	2.0			
Learning profile	general academic profile		Assessment form	assessment			
Conducting unit	Department of Energy and Industrial Apparatus -> Faculty of Mechanical Engineering and Ship Technology						
Name and surname of lecturer (lecturers)	Subject supervisor		dr inż. Marzena Banaszek				
	Teachers						
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		0.0	0.0	30	
Subject objectives	The aim of the course is to provide students with knowledge of basic information about hydrotechnical structures used for damming water used for small hydropower, discussing the machine equipment of a small power plant and its cooperation with the power grid, providing basic concepts and principles of operation of water turbines and pumps and their selection, and the environmental impact of the energetic use of the river.						

Learning outcomes

Course outcome	Subject outcome	Method of verification
K6_U06	The student is able to use mathematical and physical models to analyze the processes and phenomena occurring in mechanical devices in the field of material strength, thermodynamics and fluid mechanics.	[SU4] Assessment of ability to use methods and tools [SU3] Assessment of ability to use knowledge gained from the subject [SU2] Assessment of ability to analyse information
K6_U01	The student is able to obtain information from professional literature, databases and other resources necessary to solve engineering tasks; is able to integrate the obtained information and interpret it, as well as draw conclusions and present reasoned opinions.	[SU4] Assessment of ability to use methods and tools [SU3] Assessment of ability to use knowledge gained from the subject [SU2] Assessment of ability to analyse information
K6_W09	The student has basic knowledge in the field of thermodynamics and fluid mechanics, construction and operation of thermal energy devices, process apparatus, including renewable energy sources as well as refrigeration and air conditioning.	[SW1] Assessment of factual knowledge
K6_W12	The student has basic knowledge necessary to understand non-technical determinants of engineering activity, has basic knowledge in the field of management, including quality management and running a business, in the field of intellectual property protection and patent law; knows the general principles of creating and developing forms of individual entrepreneurship and the basic principles of occupational health and safety applicable in the machinery industry.	[SW1] Assessment of factual knowledge

Subject contents

LECTURES: Hydropower, Potential of hydropower, Environmental, climate and social issues and impact on hydropower development, Assessment and characterisation of hydropower energy resources, River hydrology & flow alteration, Hydrometry: water level measurement and discharge techniques, Hydraulic structures, Hydropower plants, Hydraulic turbines basic theory, Conventional and non-conventional hydraulic turbines, Centrifugal and rotary pumps

LABORATORIES: HYDROMETRY: Determination of the flow rate, Characteristics of a sharp-crested weir, Determination of the flow rate using a current meter, HYDRAULIC TURBINES: Determination of the characteristics of a Kaplan turbine, PUMPS: Determination of the characteristics of a centrifugal pump

Prerequisites and co-requisites

not applicable

Assessment methods and criteria

Subject passing criteria	Passing threshold	Percentage of the final grade
written test	50.0%	100.0%

Recommended reading	Basic literature	1. Davis S.: Microhydro: Clean Power from Water, Mother Earth News Wiser Living Series, 2004 2. Thake J.: The Micro-Hydro Pelton Turbine Manual: Design, Manufacture and Installation for Small-Scale Hydro-Power, 2001 3. 21st Century Ultimate Hydropower Toolkit: Microhydropower, Hydroelectric Power, Dams, Turbine, Environmental Impact, Fish, Impoundment, Pumped Storage, Diversion, Run-of-River 4. Harvey A.: Micro-Hydro Design Manual: A Guide to Small-Scale Water Power Schemes, 1993 5. Layman's handbook on how to develop a small hydro site, 1998 6. Farias C.F.: Fish-friendly Water Turbines: design and evaluation, LAP LAMBERT Academic Publishing, 2017 7. Peng W.: Fundamentals of turbomachinery, John Wiley & Sons 2008 8. Leyland B.: Small Hydroelectric Engineering Practice, Taylor & Francis Ltd 2014 9. Karassik I.J. (et al.): Pump Handbook, McGraw-Hill Education 2008 10. Gülich J.F.: Centrifugal and rotary pumps, Springer - Verlag Berlin, Heidelberg, 2008 11. Lobanoff V.S., Ross R. R.: Centrifugal Pumps Design & Application, Butterworth - Heinemann, 1992 12. Nelik L.: Centrifugal and rotary pumps fundamentals with applications, CRC Press LLC, 2000
	Supplementary literature	1. ESHA: Guide on How to Develop a Small Hydropower Plant https://energiatalgud.ee/img_auth.php/a/ab/Guide_on_How_to_Develop_a_Small_Hydropower_Plant.pdf 2. IRENA: Hydropower, Data and Statistics https://www.irena.org 3. Full report – BP Statistical Review of World Energy 2020 https://www.bp.com/content/dam/bp/business-sites/en/global/corporate/pdfs/energy-economics/statistical-review/bp-stats-review-2020-full-report.pdf 4. IHA: 2020 Hydropower Status Report https://www.hydropower.org/statusreport
	eResources addresses	Adresy na platformie eNauczanie:
Example issues/ example questions/ tasks being completed	**SELECTED PROBLEMS OF PUMPS, TURBINES AND SMALL HYDROPOWER** 1. The status and future prospects for small hydropower in the selected country. 2. Hydrograph, flow duration curve, rating curve as methods of assessment and characterisation of hydropower resources. 3. Selected structures of hydraulic structures for small hydropower applications in the selected country. 4. Description of the selected hydropower plant in the selected country. 5. Hydraulic turbine installed in the selected hydropower plant.	
Work placement	Not applicable	