GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	Pumps, turbines and small hydropower (WM), PG_00042108		
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	2023/2024
Education level	first-cycle studies	Subject group	
Mode of study	Full-time studies	Mode of delivery	at the university
Year of study	4	Language of instruction	English
Semester of study	7	ECTS credits	4.0
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	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	5.0	65.0	100

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_W06	The student knows: classic and developmental energy technologies, rules for the selection and operation of heat and energy devices and installations, basic principles of energy systems operation, basic issues regarding the reliability of energy devices and diagnostics, environmental effects of energy technologies used, methods of using renewable energy sources.	[SW1] Assessment of factual knowledge
K6_U01	The student is able to obtain information from literature and other sources, organize, interpret it and draw and formulate conclusions; has the ability to self-study, the results of engineering tasks, speaks English at the B2 level, is able to design simple energy systems and their systems.	[SU2] Assessment of ability to analyse information [SU3] Assessment of ability to use knowledge gained from the subject [SU5] Assessment of ability to present the results of task
K6_U05	The student is able to formulate and solve simple energy balances in energy devices and systems and perform an energy audit of a simple building object, is able to perform a preliminary profitability analysis of the planned energy investment.	[SU2] Assessment of ability to analyse information [SU4] Assessment of ability to use methods and tools

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, Francis, pelton turbines, PUMPS: Determination of the characteristics of a centrifugal pump
Prerequisites and co-requisites	

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, SpringerVerlag 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: Pumps, Turbines and Small Hydropower, LEC/LAB, ET, sem.7 winter 2023/24 (PG_00042108) - Moodle ID: 32446 https://enauczanie.pg.edu.pl/moodle/course/view.php?id=32446

Example issues/ example questions/ tasks being completed	**SELECTED PROBLEMS OF PUMPS, TURBINES AND SMALL HYDROPOWER** 1. Current state and development prospects for small hydropower in the selected country. 2. Hydrogram, consumption curve, sum curve as methods of evaluation and characterization of hydropower resources. 3. Selected hydrotechnical structures used in small hydropower in a selected country. 4. Description of the selected hydropower plant in the selected country. 5. Turbine - water installed in a selected hydroelectric plant. 6. Basic equation of a water turbine in any form. 7. Basic equation of a centrifugal pump in any form. 8. Characteristics of head, efficiency and power as a function of efficiency for a centrifugal pump. 9. Parallel and series cooperation of two identical centrifugal pumps (characteristics). 10. Selected methods of regulation of a centrifugal pump.
Work placement	Not applicable