GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	Hydropower and wind power plants, PG_00064054		
Field of study	Technical Physics		
Date of commencement of studies	October 2026	Academic year of realisation of subject	2028/2029
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	5	ECTS credits	2.0
Learning profile	general academic profile	Assessment form	assessment
Conducting unit	Institute of Physics and Applied Computer Science -> Faculty of Applied Physics and Mathematics -> Faculties of Gdańsk University of Technology		
Name and surname of lecturer (lecturers)	Subject supervisor	dr inż. Piotr Grygiel	
	Teachers		

Lesson types

Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
Number of study hours	30.0	0.0	0.0	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	15.0	50

Subject objectives

Learning about the structure and operating principles of hydroelectric and wind power plants, as well as their impact on the environment. Learning about the principles of estimating water and wind energy resources.

Learning outcomes

Course outcome	Subject outcome	Method of verification
[K6_W01] demonstrates an understanding of the civilisational significance of physics and its applications.	Understands the civilisational significance of various fields of physics and technology applicable in hydro and wind energy.	[SW1] Assessment of factual knowledge
[K6_U01] demonstrates the ability for lifelong independent learning, including acquiring information from literature, databases and other appropriate sources.	They are able to independently acquire knowledge on various aspects of hydro and wind energy, independently obtaining information from literature, databases and industry sources.	[SU2] Assessment of ability to analyse information [SU3] Assessment of ability to use knowledge gained from the subject [SU4] Assessment of ability to use methods and tools

<table>
<tr><td>Subject contents</td><td>Course content – lecture
1. History of hydroelectric power plants.
2. Types of hydroelectric power plants.
3. Functions of hydroelectric power plants in the power system.
4. Hydroelectric power plants in Poland and worldwide and their share in energy production.
5. Construction of hydroelectric power plants.
6. Types of turbines used in hydroelectric power plants.
7. Energy conversion in a hydroelectric power plant: water flow energy, energy transferred to the turbine, mechanical energy converted into electrical energy.
8. Operational problems of hydroelectric power plants: cooperation of generators with the power grid, distributed generation and energy storage.
9. Available electrical quantities and their measurement.
10. The impact of hydroelectric power plants on the environment.
11. History of wind power plants.
12. Characteristics and construction of wind power plants.
13. Wind power plants in Poland and worldwide.
14. Wind as a source of energy: wind characteristics, wind speed profiles, changes in wind speed over
15. time and their statistical representation, wind energy and power.
16. Wind energy resources in a given location, forecasting the power of a wind farm.
17. One-dimensional model of wind turbines.
18. Types of wind turbines.
19. Example of wind turbine construction.
20. Power characteristics of wind turbines.
21. Wind turbine power control, airflow separation, rotor blade angle adjustment.
22. Cooperation between wind power plants and the energy system.
23. Wind farms and their impact on the energy system, its stability and energy quality.
24. Economic aspects of wind power plant operation.
25. Impact of wind power plants on the environment.</td></tr>
<tr><td>Prerequisites and co-requisites</td><td>Basic, academic physics course in mechanics, thermodynamics, electricity and magnetism.</td></tr>
<tr><td>Assessment methods and criteria</td><td><table><tr><th>Subject passing criteria</th><th>Passing threshold</th><th>Percentage of the final grade</th></tr><tr><td>Oral assessment of a term paper on a topic chosen independently and agreed in advance with the course lecturer.</td><td>51.0%</td><td>100.0%</td></tr></table></td></tr>
<tr><td>Recommended reading</td><td><table><tr><td>Basic literature</td><td>1. H.J. Wagner and J. Mathur, Introduction to Hydro Energy Systems, Springer-Verlag GmbH, 2011</td></tr><tr><td>Supplementary literature</td><td>1. J. Raabe J, Hydro Power, VDI-Verlag GmbH, Duesseldorf, 1985.
2. J. F. Manwell, J. G Mc Gowan, A. L. Rogers, Wind Energy Explained. Theory, Design and Application. John Wiley & Sons, Ltd, 2009</td></tr><tr><td>eResources addresses</td><td></td></tr></table></td></tr>
<tr><td>Example issues/ example questions/ tasks being completed</td><td>1. Describe the stages of energy conversion in a hydropower plant.
2. Describe the types of turbines used in hydropower plants.
3. Describe the problems of cooperation of the electric generator with the power grid.
4. Characterize wind as an energy source.
5. Present a one-dimensional model of wind turbines.
6. Discuss the cooperation of a wind farm with the energy system.</td></tr>
<tr><td>Practical activites within the subject</td><td>Not applicable</td></tr>
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