GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	Fundamentals of Wind Energy Engineering, PG_00066973		
Field of study	Smart Renewable Energy Engineering		
Date of commencement of studies	October 2026	Academic year of realisation of subject	2026/2027
Education level	second-cycle studies	Subject group	Specialty subject group
Mode of study	Full-time studies	Mode of delivery	at the university
Year of study	1	Language of instruction	Polish
Semester of study	2	ECTS credits	6.0
Learning profile	general academic profile	Assessment form	exam
Conducting unit	Division of Marine Auxiliary Machinery -> Institute of Naval Architecture -> Faculty of Mechanical Engineering and Ship Technology -> Faculties of Gdańsk University of Technology		
Name and surname of lecturer (lecturers)	Subject supervisor	prof. dr hab. inż. Paweł Flaszyński	
	Teachers		

Lesson types

Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
Number of study hours	30.0	0.0	45.0	0.0	0.0	75

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	75	9.0	66.0	150

Subject objectives

The aim of the course is to familiarize students with fundamentals of wind resources, wind statistics and fundamentals of wind turbines. This is introductory course to more advanced topics on wind energy courses.

Learning outcomes

Course outcome	Subject outcome	Method of verification
[K7_U02] is capable of creating and analyzing digital models of renewable energy systems, including wind power systems, and utilizes digital tools for project analysis, evaluation, supervision, and optimization	The student demonstrates the ability to think analytically and to identify technical issues in the field of wind energy by applying appropriate engineering methods.	[SU3] Assessment of ability to use knowledge gained from the subject
[K7_W03] understands the concept of digital twin technology and its application in optimizing and monitoring energy systems using artificial intelligence methods and large-scale data analytics	Student is able to define basic requirements for wind turbine digital twin.	[SW3] Assessment of knowledge contained in written work and projects
[K7_W01] knows and understands theories related to wind energy generation and can explain the operating principles of wind turbines and the process of converting wind energy into electricity	The student knows and understands theories related to wind energy generation and can explain the operating principles of wind turbines and the process of converting wind energy into electrical energy.	[SW3] Assessment of knowledge contained in written work and projects
[K7_K02] recognizes technological innovations in the field of wind energy, is ready to adapt to and implement new technologies in energy systems	The student is able to characterize the basic concepts related to flow structure. The student is familiar with the fundamentals of boundary layer theory, airfoil aerodynamics, and support structure design.	[SK5] Assessment of ability to solve problems that arise in practice

<table>
<tr><td>Subject contents</td><td>Course content – lecture

1. Introduction of wind turbine systems
2. Wind turbine terminology
3. Turbulent flow including fundamental information on measurement techniques and numerical methods.
4. Basic atmospheric boundary layer structure and flow phenomena; micro-and meso-scale modeling and practices, including basic parameterizations and numerical aspects, wind shear.
5. Analysis and use of wind statistics (e.g. wind atlas data)
6. Fundamentals of rotor aerodynamics
7. Wind turbine control and power curve
8. General introduction to structural mechanics - structures types, forces, boundary conditions and loads
9. Experimental and numerical materials testing
10. Numerical and theoretical basics of support structures mechanics
11. Fundamentals of support structures design.
12. Digital Twin in Wind Energy</td></tr>
<tr><td>Prerequisites and co-requisites</td><td>Fundamentals of mechanics of structures and fluid</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>Laboratory</td><td>60.0%</td><td>40.0%</td></tr>
<tr><td>Lecture</td><td>60.0%</td><td>60.0%</td></tr>
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<tr><td rowspan="3">Recommended reading</td><td>Basic literature</td><td>Wind Energy Handbook, Tony Burton, David Sharpe,Nick Jenkins, Ervin Bossanyi, John Wiley & Sons, 2001</td></tr>
<tr><td>Supplementary literature</td><td>Literature will be provided during the course</td></tr>
<tr><td>eResources addresses</td><td></td></tr>
<tr><td>Example issues/ example questions/ tasks being completed</td><td></td></tr>
<tr><td>Practical activites within the subject</td><td>Not applicable</td></tr>
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