



## Subject card

Subject name and code	Wind Power Stations, PG_00042216						
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			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	4	Language of instruction			Polish		
Semester of study	7	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 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	8.0	0.0	0.0	23
	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	23		3.0		24.0	50
Subject objectives	The objective of the subject is to supply the students with the basic theoretical knowledge and practical skills concerning technological and economic aspects of wind power, principles of operation of wind turbines and their applications in diverse climatic conditions.						
Learning outcomes	Course outcome		Subject outcome			Method of verification	
	K6_U08		The student is able to design the basic parameters of the selected technology related to energy conversion and select auxiliary devices and evaluate the project taking into account technical and economic aspects.			[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	
	K6_W10		The student knows the basic installations in the field of renewable energy sources and their impact on the environment.			[SW1] Assessment of factual knowledge	
Subject contents	<p><b>LECTURE:</b> The current state and future prospects of wind power development in Poland and the world. The possibilities of using wind power in Poland. Types of winds and their structure. Wind energy aspects: speed, direction, power, energy and variability of wind. Wind measurement. The theory of a wind turbine. Wind turbines and the history of the development. Wind turbines with vertical and horizontal rotation axis. Controlling strategies.</p> <p><b>LABORATORY:</b> 1. Flow past a sphere. Aerodynamic drag crisis. 2. Measurement of pressure distribution on a circular cylinder. Determination of the aerodynamic drag coefficient. 3. Flow around airfoil. Aerodynamic characteristics. Aerodynamic forces as a function of angle of attack.</p>						
Prerequisites and co-requisites	Fluid mechanics.  Thermodynamics.						

Assessment methods and criteria	Subject passing criteria	Passing threshold	Percentage of the final grade
	Lecture Written Test	50.0%	50.0%
	Laboratory reports	100.0%	50.0%
Recommended reading	Basic literature	1. Boczar T.: <i>Wykorzystanie energii wiatru</i> , Wydawnictwo PAK, Warszawa 2010 2. Flaga A.: <i>Inżynieria wiatrowa. Podstawy i zastosowania</i> , Wydawnictwo Arkady 2008 3. Hau E.: <i>Wind turbines</i> , Springer 2006 4. Jagodziński W.: <i>Silniki wiatrowe</i> , PWT Warszawa 1959 5. Lewandowski W.: <i>Proekologiczne odnawialne źródła energii</i> , WNT Warszawa 2012 6. Lubośny Z.: <i>Farmy wiatrowe w systemie elektroenergetycznym</i> , WNT Warszawa 2009 7. Marecki J.: <i>Podstawy przemian energetycznych</i> , WNT Warszawa 2008 8. Maroński R.: <i>Siłownie wiatrowe</i> , Oficyna Wydawnicza Politechniki Warszawskiej Warszawa 2016	
	Supplementary literature	1. International Renewable Energy Agency <a href="http://www.irena.org">www.irena.org</a> 2. GLOBAL WIND REPORT gwec.net 3. Polityka energetyczna Polski do roku 2040. <a href="http://www.gov.pl">www.gov.pl</a> 4. Przyszłość morskiej energetyki wiatrowej w Polsce. Raport PSEW. Maj 2019	
	eResources addresses	Adresy na platformie eNauczenie: Siłownie wiatrowe, W/L, Energetyka/PTE, sem.07, zima 23/24 (PG_00042216) - Moodle ID: 31944 <a href="https://enauczenie.pg.edu.pl/moodle/course/view.php?id=31944">https://enauczenie.pg.edu.pl/moodle/course/view.php?id=31944</a>	
Example issues/ example questions/ tasks being completed	1. Prospects for the development of electricity production technology in Poland based on wind energy. 2. The concept of wind, wind characteristics, wind measurement, wind variability and frequency, wind power and energy. 3. Construction of HAWT wind turbines, selected designs of HAWT wind turbines. 4. Types of wind turbines. Selected designs of VAWT wind turbines. 5. Betz's law, power factor, wind turbine efficiency curve.		
Work placement	Not applicable		