



Subject card

Subject name and code	, PG_00037314						
Field of study	Technical Physics						
Date of commencement of studies	October 2021	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	3	Language of instruction			Polish		
Semester of study	6	ECTS credits			1.0		
Learning profile	general academic profile	Assessment form			assessment		
Conducting unit	Zakład Maszyn Przepływowych -> 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	0.0	0.0	0.0	15
	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	15		2.0		8.0	25
Subject objectives	The aim of the course is to familiarize students with the technological and economic aspects of the use of wind energy, the principles of operation of wind turbines and their applications in various working conditions.						
Learning outcomes	Course outcome		Subject outcome		Method of verification		
	K6_W01		The student understands the civilizational importance of physics and its applications.		[SW1] Assessment of factual knowledge		
	K6_W02		The student has systematic knowledge of the basics of physics, including mechanics, thermodynamics, electricity and magnetism, optics, atomic and molecular physics, solid state physics, atomic nucleus and elementary particle physics.		[SW1] Assessment of factual knowledge		
	K6_U01		The student is able to learn independently, obtain information from literature, databases and other properly selected sources.		[SU1] Assessment of task fulfilment		

Subject contents	<p>WIND ENERGY IN POLAND AND IN THE WORLD: Current status and forecasts for the development of wind energy. Economic aspects of the use of wind energy. Advantages and disadvantages of wind energy.</p> <p>TYPES OF WINDS AND THEIR STRUCTURE: Wind formation mechanism. Wind features: wind speed and direction.</p> <p>WIND PARAMETERS: Wind speed profile. Wind variability. Wind energy and power.</p> <p>WIND ENERGY RESOURCES: Analysis of wind energy resources. Wind energy resources in a given location.</p> <p>PRINCIPLES OF WIND ENERGY CONVERSION: Betz theory. Power factor cp. Wind turbine efficiency curve.</p> <p>HISTORY OF WIND ENERGY DEVELOPMENT: Development of wind energy from ancient times to modern times.</p> <p>HAWT TYPE WIND TURBINE CONSTRUCTION: Working principle of wind turbine. Foundation, tower, nacelle.</p> <p>HAWT-TYPE WIND TURBINES SELECTED STRUCTURES: Types of horizontal axis turbines (HAWT). Selected HAWT-type turbine designs - propeller turbines, with a diffuser, multi-blade, multi-rotor, with counter-rotating rotors, using the Magnus effect, Archimedes.</p> <p>VAWT WIND TURBINES SELECTED STRUCTURES: VAWT type turbines. characteristics. applications. Savonius turbines. Darrieus turbines.</p> <p>SMALL WIND TURBINES: Small wind turbines - technical aspect & economic aspect.</p> <p>THE FUTURE OF WIND ENERGY: Micro wind turbines. Ecological buildings. Innovations in wind energy.</p> <p>CONTROL AND REGULATION OF WIND TURBINES: Purpose of controlling and regulating a wind turbines. Wind turbines control methods. Power control methods.</p> <p>SELECTED OPERATIONAL PROBLEMS OF WIND POWER PLANTS: Causes and effects of damage to wind farms. Impact of air pollution, atmospheric factors, biological life, fires on the operation of wind farms. Diagnostics of damage to wind turbines.</p>											
Prerequisites and co-requisites												
Assessment methods and criteria	<table border="1"> <thead> <tr> <th>Subject passing criteria</th> <th>Passing threshold</th> <th>Percentage of the final grade</th> </tr> </thead> <tbody> <tr> <td>test</td> <td>50.0%</td> <td>100.0%</td> </tr> </tbody> </table>			Subject passing criteria	Passing threshold	Percentage of the final grade	test	50.0%	100.0%			
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Example issues/ example questions/ tasks being completed	<ol style="list-style-type: none"> 1. Prospects for the development of electricity production technologies in Poland based on wind energy. 2. Properties of wind, wind characteristics, wind measurement, wind variability and frequency, wind power and energy. 3. Construction of HAWT wind turbines, selected HAWT turbines. 4. Selected VAWT turbines. 5. Betz's law, Betz limit of power, wind turbine efficiency curve. 											
Work placement	Not applicable											