



Subject card

Subject name and code	Risk Assessment, Safety and Reliability of Wind Energy Systems, PG_00066972						
Field of study	Smart Renewable Energy Engineering						
Date of commencement of studies	October 2026	Academic year of realisation of subject				2027/2028	
Education level	second-cycle studies	Subject group				Obligatory subject group in the field of study	
Mode of study	Full-time studies	Mode of delivery				at the university	
Year of study	2	Language of instruction				English	
Semester of study	4	ECTS credits				6.0	
Learning profile	general academic profile	Assessment form				assessment	
Conducting unit	Division of Marine Power Plants -> 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		dr inż. Roman Liberacki				
	Teachers						
Lesson types	Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
	Number of study hours	30.0	30.0	0.0	15.0	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	Introducing the student to the basic concepts of safety and reliability of technical systems, with particular emphasis on wind power plants, and the mathematical methods used to analyze the level of safety and reliability."						
Learning outcomes	Course outcome	Subject outcome			Method of verification		
	[K7_K05] complies with legal regulations and standards related to renewable energy, including wind power, ensuring that energy installations and projects operate in accordance with current legislation	Student knows the regulations regarding the safety and reliability requirements for wind energy systems and can apply them in practical calculations.			[SK5] Assessment of ability to solve problems that arise in practice		
	[K7_K71] is able to explain the need to apply knowledge from humanistic, social, economic or legal sciences in order to function in a social environment	Student understands and applies the principle of sustainable development. Student is able to explain the need to consider ecological, economic, and social aspects at every stage of a wind power plant's existence			[SK4] Assessment of communication skills, including language correctness [SK5] Assessment of ability to solve problems that arise in practice		
	[K7_W101] is able to make an in-depth identification of key objects and phenomena related to the field of study, as well as theories that describe them and applicable analytical and design methods	Student identifies system elements and functional connections between them. Student is able to select the appropriate mathematical model to assess the reliability of an element or system.			[SW3] Assessment of knowledge contained in written work and projects [SW1] Assessment of factual knowledge		
	[K7_U01] is able to apply analytical thinking and solve technical problems related to renewable energy systems, including wind power, using engineering methodologies	Student is able to perform a risk analysis of a wind power plant using available engineering methods and propose ways to reduce the level of risk.			[SU4] Assessment of ability to use methods and tools [SU1] Assessment of task fulfilment		

Subject contents	<p>Course content – lecture The concept of reliability, reliability indicators. Mathematical models for reliability assessment. Point and interval estimation of the mean time to failure. Hypothesis testing for the mean time to failure and the distribution of time to failure. Reliability structures for complex systems. Human factor, human (operator) reliability. Reliability of wind power plants (turbines, blades, drive train).</p> <p>Descriptive and probabilistic formulation of maintainability. Types of maintenance for energy devices. Strategies for maintaining wind power plants and minimizing their operating costs. Monitoring and diagnosing the technical condition of wind power plants. Availability of wind power plants. Mathematical models for assessing the availability of systems without and with redundancy.</p> <p>The principle of sustainable development. The impact of wind energy on the environment in all phases of its existence.</p> <p>Hazards in onshore and offshore wind energy. Definition of risk, qualitative and quantitative methods of risk assessment. Risk criteria, formal safety assessment, safety norms and standards. Minimizing hazards, crew training, safety systems, and functional safety in wind energy.</p>														
Prerequisites and co-requisites	Knowledge of the basics of probability calculus and the construction of wind power plants.														
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>Project report</td> <td>100.0%</td> <td>30.0%</td> </tr> <tr> <td>Written test 2</td> <td>50.0%</td> <td>35.0%</td> </tr> <tr> <td>Written test 1</td> <td>50.0%</td> <td>35.0%</td> </tr> </tbody> </table>			Subject passing criteria	Passing threshold	Percentage of the final grade	Project report	100.0%	30.0%	Written test 2	50.0%	35.0%	Written test 1	50.0%	35.0%
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Recommended reading	<p>Basic literature</p> <p>Supplementary literature</p> <p>eResources addresses</p>	<p>1. Modarres M., What every engineer should know about Reliability and Risk Analysis, Center for Reliability Engineering, University of Maryland, College Park, Maryland, Marcel Dekker, Inc., New York, Basel, Hong Kong, 1993.</p> <p>2. ELECTRONIC RELIABILITY DESIGN HANDBOOK. MIL-HDBK-338B. 1 October 1998. Department of Defence USA.</p> <p>3. Massimo Lazzaroni, Loredana Cristaldi, Lorenzo Peretto, Paola Rinaldi, and Marcantonio Catelani.: Reliability Engineering. Basic Concepts and Applications in ICT. 2011 Springer-Verlag Berlin Heidelberg.</p> <p>4. JRC Technical Report: Offshore Risk Assessment - An overview of methods and tools, 2016.</p> <p>1. Tony L Burton, Nick Jenkins, Ervin Bossanyi, John Graham, Wind Energy Handbook, 3rd Edition, John Wiley and Sons Ltd, may 2021.</p>													
Example issues/ example questions/ tasks being completed	<ol style="list-style-type: none"> 1. Define reliability in probabilistic terms. 2. Present examples of techniques for assessing the probability of human error. 3. Determine the reliability of a component or a complex technical system. 4. Present possible strategies for the maintenance of wind farm components. 5. Determine the stationary availability index of a component or a complex technical system. 6. Perform a qualitative or quantitative risk analysis of a selected wind power plant. 														
Practical activities within the subject	Not applicable														