GDAŃSK UNIVERSITY OF TECHNOLOGY

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 2025	Academic year of realisation of subject	2026/2027
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 -> Wydziały Politechniki Gdańskiej		
Name and surname of lecturer (lecturers)	Subject supervisor	dr inż. Roman Liberacki	
	Teachers		

Lesson types and methods of instruction

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_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.	[SW1] Assessment of factual knowledge [SW3] Assessment of knowledge contained in written work and projects
[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	[SK5] Assessment of ability to solve problems that arise in practice [SK4] Assessment of communication skills, including language correctness
[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_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.	[SU1] Assessment of task fulfilment [SU4] Assessment of ability to use methods and tools

Subject contents	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). 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. The principle of sustainable development. The impact of wind energy on the environment in all phases of its existence. 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.
Prerequisites and co-requisites	Knowledge of the basics of probability calculus and the construction of wind power plants.

Assessment methods and criteria

Subject passing criteria	Passing threshold	Percentage of the final grade
Written test 1	50.0%	35.0%
Written test 2	50.0%	35.0%
Project report	100.0%	30.0%

Recommended reading

Basic literature	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. 2. ELECTRONIC RELIABILITY DESIGN HANDBOOK. MIL-HDBK-338B. 1 October 1998. Department of Defence USA. 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. 4. JRC Technical Report: Offshore Risk Assessment - An overview of methods and tools, 2016.
Supplementary literature	1. Tony L Burton, Nick Jenkins, Ervin Bossanyi, John Graham, Wind Energy Handbook, 3rd Edition, John Wiley and Sons Ltd, may 2021.
eResources addresses	

Example issues/ example questions/ tasks being completed	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.
Work placement	Not applicable

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