GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	Grid Integration of Wind Energy, PG_00066985		
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	Specialty 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	2	Language of instruction	English english
Semester of study	3	ECTS credits	2.0
Learning profile	general academic profile	Assessment form	assessment
Conducting unit	Department of Electrical Power Engineering -> Faculty of Electrical and Control Engineering -> Wydziały Politechniki Gdańskiej		
Name and surname of lecturer (lecturers)	Subject supervisor	prof. dr hab. inż. Zbigniew Lubośny	
	Teachers		

Lesson types and methods of instruction

Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
Number of study hours	15.0	0.0	15.0	0.0	0.0	30

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	30	4.0	16.0	50

Subject objectives

The aim is to familiarise students with issues related to wind power and the construction of wind farms, as well as their potential use in the regulatory processes of power systems.

Learning outcomes

Course outcome	Subject outcome	Method of verification
[K7_W02] knows and understands the challenges of effectively integrating decentralized renewable energy generation into the power grid, including energy storage issues, and is particularly familiar with technologies used in wind power	Has a structured knowledge of power quality issues.	[SW1] Assessment of factual knowledge
[K7_K03] has intercultural communication competencies, essential for international energy projects, and can collaborate effectively with individuals from various cultures and backgrounds, appreciating diversity	Has extensive expertise on wind farms and their incorporation into electrical systems.	[SK5] Assessment of ability to solve problems that arise in practice
[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	Can use basic artificial intelligence tools to monitor selected points in the energy system.	[SW2] Assessment of knowledge contained in presentation
[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	Solve problems covered in the course subject by using mathematical methods.	[SU2] Assessment of ability to analyse information

Subject contents	Wind energy: development and resources. Calculating the energy resources available at a given location for a specific type of wind turbine. Designs for wind power plants. Wind farms. Methods of connection to the electricity system. Control of wind power plants and wind farms. The impact of wind turbines on the electricity system. RfG Grid Code. EON, ION, and FON procedures. Selection of wind farm components. Basic topologies of power electronic converters used in wind turbines. Control algorithms for converters in various operating modes: GFM and GFL - concept, operation, and impact on the power system.
Prerequisites and co-requisites	Knowledge of electricity systems and their structure, as well as the regulatory processes implemented.

Assessment methods and criteria

Subject passing criteria	Passing threshold	Percentage of the final grade
Laboratory	60.0%	50.0%
Lecture	60.0%	50.0%

Recommended reading

Basic literature	J. Machowski, Z. Lubosny, J. W. Bialek, J. Bumby: Power system dynamics stability and control. Third Edition, Wiley 2020. Hau E., Renouard H.: Wind Turbines Fundamentals, Technologies, Application, Economics. Springer 2006. Letcher T. M. ed.: Wind Energy Engineering: A Handbook for Onshore and Offshore Wind Turbines. Academi Press, 2017. Lubosny Z.: Wind Turbine Operation in Electric Power Systems: Advanced Modeling. Springer 2003. COMMISSION REGULATION (EU) 2016/631 of 14 April 2016 establishing a network code on requirements for grid connection of generators
Supplementary literature	S. N. Vukosavic, Grid-Side Converters Control and Design. Springer International Publishing, 2018. doi: 10.1007/978-3-319-73278-7. R. Teodorescu, M. Liserre, and P. Rodriguez, *Grid converters for photovoltaic and wind power systems: Teodorescu/grid converters for photovoltaic and wind power systems*. Hoboken, NJ: Wiley-Blackwell, 2011. J. Fang, J. Liu, H. Wu, J. Chen, and F. Blaabjerg, *Grid-forming converters: Principles, control, and applications in modern power systems*. San Diego, CA: Academic Press, 2024
eResources addresses	

Example issues/ example questions/ tasks being completed	1. Calculate the annual electricity production of a wind farm equipped with a given type of turbines, located in area characterised of given wind speed distribution. 2. Calculate reactive power compensation devices parameters that meet the RfG Grid Code requirements.
Work placement	Not applicable

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