GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	, PG_00057176		
Field of study	Ocean Engineering		
Date of commencement of studies	February 2023	Academic year of realisation of subject	2023/2024
Education level	second-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	1	Language of instruction	Polish
Semester of study	2	ECTS credits	5.0
Learning profile	general academic profile	Assessment form	exam
Conducting unit	Zakład Siłowni Okrętowych -> Institute of Ocean Engineering and Ship Technology -> Faculty of Mechanical Engineering and Ship Technology		
Name and surname of lecturer (lecturers)	Subject supervisor	prof. dr hab. inż. Zbigniew Korczewski	
	Teachers	mgr inż. Dominik Kreft dr inż. Patrycja Puzdrowska prof. dr hab. inż. Zbigniew Korczewski	

Lesson types and methods of instruction	Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
	Number of study hours	30.0	15.0	15.0	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	15.0	35.0	125

Subject objectives	To teach the theoretical foundations of metrology within the selected aspect of offshore wind farms, with particular emphasis on the technology of measuring the control parameters of the offshore wind turbine drive train unit for diagnostic purposes.

Learning outcomes

Course outcome	Subject outcome	Method of verification
[K7_U04] can apply mathematical methods and models and computer simulations to analyse, design, and assess the functioning of ocean technology objects and systems and their elements	Student is able to elaborate the energy balance of the offshore wind turbine power train system.	[SU3] Assessment of ability to use knowledge gained from the subject
[K7_U03] can conduct a detailed analysis of the obtained results and present them in the form of a technical report or presentation, also in English	Student is able to balance the basic and accompanying energy processes worked out in the main components of the offshore wind turbine power train system.	[SU1] Assessment of task fulfilment
[K7_U02] can plan and conduct research experiments on selected problems in ocean technology using various research methods	Student can plan and implement a diagnostic test of a wind turbine power train system on a small scale physical model.	[SU1] Assessment of task fulfilment
K7_W04	Student has got a basic knowledge of measurement systems used in offshore wind turbine propulsion systems and their application for operational diagnostics.	[SW3] Assessment of knowledge contained in written work and projects

Subject contents	Lecture - 30 hours Uncertainties and errors in technological measurements Sea wind physics and its kinetic energy Wind turbine capacity - Betz Limit Design forms of offshore wind turbine drive train systems Energy balance of the offshore wind turbine drive train system - basic and accompanying processes Methods of recovering and storing excess wind energy - energy cogeneration systems (electrolysers, fuel cells, gravity and compressed air systems) Basic and control parameters of an offshore wind turbine Destructive impact of the marine environment on a wind turbine States of operational failure of the main components of an offshore wind turbine Methods for diagnosing the mechanical system of a wind turbine - vibration, acoustic emission, detection and measurement of shock pulses (SPM), thermal imaging Auditorium exercises - 15 hours Estimating the uncertainty of simple technological measurements Calculations of the speed ratio and power factor of a wind turbine for different angles of the rotor blades Calculation of the mechanical and electromagnetic moment of a wind turbine Calculations of mechanical losses of the wind turbine drive train system Calculations of general efficiency of wind turbine drive train in direct and indirect configuration Calculations of the dissipated energy useful for forcing transverse vibrations of the wind turbine drive shaft Laboratory exercises - 15 hours Measurement of velocity and kinetic energy of the air stream from the wind generator Measurement of torque and rotational speed in a simple mechanical system Measurement of electrical parameters of a wind turbine power systems generator Vibration measurement in a rotating mechanical system Measurement of shock pulses of the bearing node Measurement of the acoustic emission of the bearing node

	Identification of drive shaft fatigue by thermal imaging method Project - 15 hours Work out the energy balance of the offshore wind turbine drive system for the given design form and the range of variability of the kinetic energy of the wind.
Prerequisites and co-requisites	Knowledge of machine building and electrical engineering

Assessment methods and criteria

Subject passing criteria	Passing threshold	Percentage of the final grade
Test	51.0%	50.0%
	100.0%	10.0%
	100.0%	20.0%
	51.0%	20.0%

Recommended reading

Basic literature	1. Letcher T. M. Wind Energy Engineering. A Handbook for Onshore and Offshore Wind Turbines. Academic Press. Elsevier Inc. 2017. 2. Passon P.,Branner K., Larsen S.E., Hvenekær R.J.: Offshore Wind Turbine Foundation Design. Technical University of Denmark, Department of Wind Energy 2015. 3. Wu B., Youngqiang L., Navid Z., Samir K.: Power Conversion and Control of Wind Energy, John Wiley & Sons, INC., Publication, 2011.
Supplementary literature	Ajid Bastankhah, Fernando Porté-Age: A New Miniature Wind Turbine for Wind Tunnel Experiments. Part I: Design and Performance. Energies 10(7), March 2018.
eResources addresses	Adresy na platformie eNauczanie: Pomiary w energetyce morskiej, C, PiBMSE, sem.2, st.2, zima 23/24 (PG_00057176) - Moodle ID: 32396 https://enauczanie.pg.edu.pl/moodle/course/view.php?id=32396 Pomiary w energetyce morskiej, C, PiBMSE, sem.2, st.2, zima 23/24 (PG_00057176) - Moodle ID: 32396 https://enauczanie.pg.edu.pl/moodle/course/view.php?id=32396

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