GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

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| Subject name and code | Measurements in marine power systems, PG_00065621 | | |
| Field of study | Naval Architecture and Offshore Structures | | |
| Date of commencement of studies | February 2025 | Academic year of realisation of subject | 2025/2026 |
| Education level | second-cycle studies | Subject group | Specialty subject group<br>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 | English |
| Semester of study | 2 | ECTS credits | 3.0 |
| Learning profile | general academic profile | Assessment form | exam |
| 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 | prof. dr hab. inż. Zbigniew Korczewski | |
| | Teachers | dr inż. Mateusz Kędzierski<br>dr inż. Patrycja Puzdrowska<br>prof. dr hab. inż. Zbigniew Korczewski | |

| Lesson types and methods of instruction | Lesson type | Lecture | Tutorial | Laboratory | Project | Seminar | SUM |
|---|---|---|---|---|---|---|---|
| | Number of study hours | 15.0 | 0.0 | 15.0 | 15.0 | 0.0 | 45 |
| | 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 | 45 | 8.0 | 22.0 | 75 |

**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_U13] evaluates the feasibility and potential for utilizing new technical and technological achievements in accomplishing tasks characteristic for the field of study | Is able to balance energy processes: basic and accompanying, implemented in the main components of the power transmission system of an offshore wind turbine based on the measurement of control parameters. | [SU1] Assessment of task fulfilment |
| [K7_W11] interprets social, economic, legal (including industrial and intellectual property laws), and other non-technical aspects of engineering activities, and includes them into engineering practice | Has basic knowledge of legal acts, standards and industry regulations which determine the operation of offshore wind farms, in terms of monitoring their operation. | [SW3] Assessment of knowledge contained in written work and projects |
| [K7_W04] demonstrates knowledge encompassing selected issues in the field of advanced knowledge, particularly in the scope of methods, techniques, tools, and algorithms specific to Naval Architecture and Ocean Engineering | Has basic knowledge of measurement systems used in offshore wind turbine drive systems and their usage for controlling and operational diagnostics. | [SW3] Assessment of knowledge contained in written work and projects |

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| Subject contents | **Lecture - 15 hours**<br><br>Uncertainties and errors in technological measurements<br><br>Wind speed measurement technologies.<br><br>Energy balance of the offshore wind turbine drive train system - basic and accompanying processes<br><br>Basic and control parameters of an offshore wind turbine<br><br>Destructive impact of the marine environment on a wind turbine<br><br>States of operational failure of the main components of an offshore wind turbine<br><br>**Laboratory exercises - 15 hours**<br><br>Measurement of velocity and kinetic energy of the air stream from the wind generator<br><br>Measurement of torque and rotational speed in a simple mechanical system<br><br>Measurement of electrical parameters of a wind turbine power systems generator<br><br>Vibration measurement in a rotating mechanical system<br><br>Identification of drive shaft fatigue by thermal imaging method<br><br>**Project - 15 hours**<br><br>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 |
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| Test | 51.0% | 50.0% |
| | 100.0% | 25.0% |
| | 100.0% | 25.0% |

Recommended reading

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| Basic literature | 1. Letcher T. M. Wind Energy Engineering. A Handbook for Onshore and Offshore Wind Turbines. Academic Press. Elsevier Inc. 2017.<br>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.<br>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.<br><br>Korczewski, Z., & Rudnicki, J. (2024). Active Diagnostic Experimentation on Wind Turbine Blades with Vibration Measurements and Analysis. *Polish Maritime Research*, 126-134. https://doi.org/10.2478/pomr-2024-0042 |
| eResources addresses | |

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| Example issues/ example questions/ tasks being completed | *1. Explain the notion of standard uncertainty type A and B.*<br><br>*2. Characterize remote sensing methods of measuring wind speed (SODAR and LIDAR).*<br><br>*3. Betz limit - simplifying assumptions.*<br><br>*4. Determine the energy balance of a wind turbine - Sankey diagram.*<br><br>*5. Perform the external characteristics of a wind turbine.* |
| Work placement | Not applicable |

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