GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

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|---|---|---|---|
| Subject name and code | Soil - Structure Interaction in the Design of Support Structures, PG_00066974 | | |
| Field of study | Smart Renewable Energy Engineering | | |
| Date of commencement of studies | October 2026 | Academic year of realisation of subject | 2026/2027 |
| 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 | 2.0 |
| Learning profile | general academic profile | Assessment form | assessment |
| Conducting unit | Department of Geotechnical and Hydraulic Engineering -> Faculty of Civil and Environmental Engineering -> Faculties of Gdańsk University of Technology | | |
| Name and surname of lecturer (lecturers) | Subject supervisor | dr inż. Jakub Konkol | |
| | Teachers | | |

**Lesson types**

| Lesson type | Lecture | Tutorial | Laboratory | Project | Seminar | SUM |
|---|---|---|---|---|---|---|
| Number of study hours | 10.0 | 20.0 | 0.0 | 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**

Learning basic design methods and soil-structure interactions for offshore wind foundations.

**Learning outcomes**

| Course outcome | Subject outcome | Method of verification |
|---|---|---|
| [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 | Basic knowledge in optimization techniques and big data in geotechnical site investigation and offshore pile design. | [SU4] Assessment of ability to use methods and tools<br>[SU1] Assessment of task fulfilment |
| [K7_K02] recognizes technological innovations in the field of wind energy, is ready to adapt to and implement new technologies in energy systems | Basic knowledge in analytical and numerical methods in foundation design. Application of machine learning in support of foundation design and soil parameters estimation. | [SK2] Assessment of progress of work<br>[SK5] Assessment of ability to solve problems that arise in practice |
| [K7_W04] knows the specifics of designing, constructing, and operating onshore/offshore wind farms, as well as the technical and logistical challenges involved in their implementation, including measurement and diagnostic technologies | Design standards and methods, soil parameters and calculation methods used in soil-structure interaction and bearing capacity of foundations. | [SW1] Assessment of factual knowledge<br>[SW2] Assessment of knowledge contained in presentation<br>[SW3] Assessment of knowledge contained in written work and projects |

**Subject contents**

Course content – lecture

1. *Basic physical and mechanical properties of soil.*
2. *Soil drillings and samplings for lab testing in offshore and nearshore projects.*
3. *Site investigation for offshore wind development. Examples of soil characterization reports for offshore projects.*
4. *Types of foundations used in offshore wind farms (OWF).*
5. *Design methods used in OWF: p-y curves and PISA model.*
6. *Soil constitutive behavior overview*
7. *Example of monopole foundation design using p-y curves: calculation of bearing capacity and displacements.*

**Prerequisites and co-requisites**

Basic knowledge and skills related to soil mechanics, concrete structures, steel structures, applied mechanics and structural mechanics.

<table>
<tr><td>Assessment methods and criteria</td><td colspan="2"><table>
<tr><th>Subject passing criteria</th><th>Passing threshold</th><th>Percentage of the final grade</th></tr>
<tr><td>exercises - short technical problems</td><td>50.0%</td><td>100.0%</td></tr>
</table></td></tr>
<tr><td rowspan="3">Recommended reading</td><td>Basic literature</td><td>Randolph, M., Gourvenec, S., White, D., & Cassidy, M. (2017) Offshore Geotechnical Engineering<br><br>Jardine, R., Chow, F., Overy, R., & Standing, J. (2005). ICP design methods for driven piles in sands and clays (Vol. 112). London: Thomas Telford.<br><br>Arany, L., Bhattacharya, S., Macdonald, J., & Hogan, S. J. (2017). Design of monopiles for offshore wind turbines in 10 steps. Soil Dynamics and Earthquake Engineering, 92, 126-152.<br><br>DNV-OS-J101-Design of offshore wind turbine structures. Copenhagen, Denmark: DNV</td></tr>
<tr><td>Supplementary literature</td><td>Reese, L. C., Cox, W. R., and Koop, F. D. (1974). Analysis of Laterally Loaded Piles in Sand. Proceedings of the 6th Annual Offshore Technology Conference, OTC 2080.<br><br>Cai, Y., Wu, T., Guo, L., & Wang, J. (2018). Stiffness degradation and plastic strain accumulation of clay under cyclic load with principal stress rotation and deviatoric stress variation. Journal of Geotechnical and Geoenvironmental Engineering, 144(5), 04018021.<br><br>Byrne, B. W., Burd, H. J., Zdravković, L., McAdam, R. A., Taborda, D. M., Houlsby, G. T., ... & Gavin, K. G. (2019). PISA: new design methods for offshore wind turbine monopiles. Revue Française de Géotechnique, (158), 3.</td></tr>
<tr><td>eResources addresses</td><td></td></tr>
<tr><td>Example issues/ example questions/ tasks being completed</td><td colspan="2"></td></tr>
<tr><td>Practical activites within the subject</td><td colspan="2">Not applicable</td></tr>
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