GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

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

Lesson types and methods of instruction

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.	[SU1] Assessment of task fulfilment [SU4] Assessment of ability to use methods and tools
[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.	[SW3] Assessment of knowledge contained in written work and projects [SW2] Assessment of knowledge contained in presentation [SW1] Assessment of factual knowledge
[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.	[SK5] Assessment of ability to solve problems that arise in practice [SK2] Assessment of progress of work

Subject contents

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

Jardine, R., Chow, F., Overy, R., & Standing, J. (2005). ICP design methods for driven piles in sands and clays (Vol. 112). London: Thomas Telford.

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.

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.

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.

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>Work placement</td><td colspan="2">Not applicable</td></tr>
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