



## Subject card

Subject name and code	Advanced foundations, PG_00042226						
Field of study	Civil Engineering						
Date of commencement of studies	October 2025		Academic year of realisation of subject		2025/2026		
Education level	second-cycle studies		Subject group		Obligatory subject group in the field of study 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	1		ECTS credits		2.0		
Learning profile			Assessment form		assessment		
Conducting unit	Department of Geotechnics, Geology and Marine Civil Engineering -> Faculty of Civil and Environmental Engineering -> Faculties of Gdańsk University of Technology						
Name and surname of lecturer (lecturers)	Subject supervisor		dr hab. inż. Marcin Cudny				
	Teachers						
Lesson types	Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
	Number of study hours	15.0	0.0	0.0	15.0	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		5.0		15.0	50
Subject objectives	Introduction to design an analysis of advanced geotechnical structures. Example engineering problem analysed in project classes is piled raft foundation. The foundation need to be designed with standard methods then it should be analysed (soil-structure interaction, deformation analysis) with finite element method (FEM). Preferred tool is FE-system ZSoil (free student version)						

Learning outcomes	Course outcome	Subject outcome	Method of verification
	[K7_W12] has deep and theoretical firm knowledge about geotechnical investigation, the rules of geotechnical design and engineering geology; knows the complicated processes in soil, techniques of foundations, draining systems, soil strengthening, geosynthetics applications, underground constructions and earthworks	Ability to determine the scope of the necessary geotechnical parameters depending on the selected methods of designing and analysis of the geotechnical structure - soil ground interaction.	[SW3] Assessment of knowledge contained in written work and projects [SW1] Assessment of factual knowledge
	[K7_W03] knows basics of Continuum Mechanics, knows rules of static analysis, stability and dynamics of complex rod, shell and volume structures, both in linear and basic nonlinear regime	Knowledge of theoretical basis of advanced design calculations and analyses of soil-structure interaction. Knowledge of basic constitutive models of soils with their parameters. Ability to build a computational model of various geotechnical structures.	[SW3] Assessment of knowledge contained in written work and projects [SW1] Assessment of factual knowledge
	[K7_W07] has expanded knowledge of theory of road and airport pavements, pavement maintenance, advanced methods of material testing and construction technologies	Knowledge of the basic methods of ground improvements under road embankments in difficult geotechnical conditions.	[SW1] Assessment of factual knowledge
	[K7_W14] knows and applies building codes and obeys the Construction Law; has knowledge on environmental impact of investment realisation	Knowledge of basic design recommendations in the Eurocode 7 standard - Geotechnical design.	[SW3] Assessment of knowledge contained in written work and projects
	[K7_U14] is able to plan and to interpret the geotechnical investigations, to analyse the foundation stability; can design direct and deep foundations in complex soil conditions for complicated static and dynamical loads	Ability to interpret in-situ and laboratory tests in order to perform advanced design calculations and numerical analyses. It applies to different types of soil, load conditions and drainage conditions.	[SU5] Assessment of ability to present the results of task [SU2] Assessment of ability to analyse information
Subject contents	<p>Course content – lecture</p> <ol style="list-style-type: none"> <li>1. Introduction basic rules, methods and standards in designing geotechnical structures.</li> <li>2. Shallow and raft foundations</li> <li>3. Piled foundations</li> <li>4. Piled raft foundations.</li> <li>5. Ground improvement methods.</li> <li>6. Basic rules on FEM in geotechnical applications.</li> <li>7. Different design methods of piled raft foundations.</li> <li>8. Modelling of piled raft foundation with FEM.</li> <li>9. Influence of material model in analyses of soil-structure interaction.</li> <li>10. Understanding and estimation of material parameters of advanced soil constitutive models.</li> </ol>		
Prerequisites and co-requisites	Basic knowledge of soil mechanics, foundation engineering and structural mechanics.		
Assessment methods and criteria	Subject passing criteria	Passing threshold	Percentage of the final grade
	activity during project classes	10.0%	10.0%
	correctness and quality of the project report	60.0%	90.0%

Recommended reading	Basic literature	1. ICE manual of geotechnical engineering, Volume 2. Geotechnical Design, Construction and Verification,  2. Eurocode 7 - Geotechnical Design,  3. Helwany S., <i>Applied Soil Mechanics with Abaqus Applications</i>
	Supplementary literature	1. Wood D.M., Geotechnical Modelling,  2. Terzaghi K., Peck R.B., Mesri G., Soil Mechanics in Engineering Practice
	eResources addresses	
Example issues/ example questions/ tasks being completed	1. Analysis of calculation parameters and their variability with depth. 2. Calculation results of a piled raft foundation using traditional methods. 3. Calculation model made in the ZSoil system. 4. Comparative analysis of the obtained results in various calculation variants. 5. Graphical presentation of the results in the project.	
Practical activities within the subject	Not applicable	

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