



Subject card

Subject name and code	Advanced foundations, PG_00072508						
Field of study	Civil Engineering						
Date of commencement of studies	October 2026		Academic year of realisation of subject		2026/2027		
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		Polish		
Semester of study	1		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 hab. inż. Adam Krasieński				
	Teachers		prof. dr hab. inż. Lech Bałachowski				
			dr hab. inż. Adam Krasieński				
			dr inż. Rafał Ossowski				
			dr inż. Paweł Więclawski				
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						
	eNauczanie source address: https://enauczanie.pg.edu.pl/2025/course/view.php?id=8238						
	Moodle ID: 8238 Fundamenty specjalne-26_27 https://enauczanie.pg.edu.pl/2025/course/view.php?id=8238						
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		2.0		18.0	50
Subject objectives	Acquisition of knowledge and skills regarding the design and construction of advanced and non-standard foundations for structures and buildings, as well as complex geotechnical systems—such as pile and piled-raft foundations, deep excavation support systems, and embankments on weak subsoil. Familiarization with modern methods for designing foundations and geotechnical structures in complex ground conditions using computational tools. Development of skills in identifying key geotechnical issues. Preparation for independent professional practice as an engineer in the fields of geotechnical design and construction.						

Learning outcomes	Course outcome	Subject outcome	Method of verification
	[K7_W04] analyses in-depth complex problems on the basis of reliable data and appropriately chosen methods, reaching logical conclusions	analyzes in depth complex issues regarding the foundation of structures and the execution of geotechnical works—based on reliable data on soil conditions and structural loads, as well as appropriately selected calculation methods—to derive logical conclusions concerning geotechnical design and construction	[SW1] Assessment of factual knowledge [SW3] Assessment of knowledge contained in written work and projects
	[K7_U04] prepares and presents the results of calculations, research and analysis in a coherent and logical manner, together with an in-depth interpretation	prepares and presents, in a coherent and logical manner, the results of analytical and numerical calculations for complex and advanced foundations and geotechnical structures—as well as studies and analyses of the interaction between these structures and the subsoil—along with an in-depth interpretation thereof	[SU1] Assessment of task fulfilment [SU3] Assessment of ability to use knowledge gained from the subject [SU4] Assessment of ability to use methods and tools
	[K7_W05] demonstrates knowledge of the principles of evaluation and verification of calculations, tests, measurements and monitoring of advanced structures and civil engineering works	demonstrates knowledge of the principles for evaluating and verifying calculations regarding geotechnical issues and tasks—including numerical calculations—as well as testing, measurements, and monitoring of advanced foundations, geotechnical structures, and ground improvement systems	[SW1] Assessment of factual knowledge [SW2] Assessment of knowledge contained in presentation
Subject contents	Course content – lecture 1. Review of soil mechanics and foundation engineering. 2. Review of geotechnical documentation and design. 3. Foundations for transportation structures – bridges and viaducts. 4. Load testing and testing of instrumented piles; dynamic testing and pile integrity testing. 5. Bored piles with base grouting – grouting mechanism. 6. Screw-in displacement piles and columns. 7. Modern methods for the analysis and design of pile foundations. 8. Deep excavation retaining systems: technology, structures, and structural analysis. 9. Large-scale raft foundations: application and analysis. 10. Piled-raft foundations: application, working principle, and analysis. 11. Founding transportation embankments on weak or compressible subsoil. 12. Multi-level underground parking structures – construction methods. 13. Foundations for high-rise buildings and structures. 14. Foundations in the vicinity of existing structures.		
	Course content – project Choose one of four projects: 1. Design of a pile foundation for a bridge pier 2. Design of a deep excavation support system with two levels of bracing 3. Design of a piled-raft foundation for a storage tank 4. Embankment foundation on improved soil		
Prerequisites and co-requisites	Knowledge and skills in the following construction-related subjects and fields: - strength of materials and structural mechanics - soil mechanics - fundamentals of foundation engineering - reinforced concrete and steel structures - static analysis (including numerical methods) of complex frame and plate structures		
Assessment methods and criteria	Subject passing criteria	Passing threshold	Percentage of the final grade
	Lecture midterm	55.0%	40.0%
	Project completion	60.0%	50.0%
	22 Lecture attendance	0.0%	10.0%

Recommended reading	Basic literature	1. E. Motak: "Shallow Foundations. Formulas, Tables, Examples" [Fundamenty bezpośrednie. Wzory, tablice, przykłady]. Arkady, Warsaw, 1988. 2. M. Kosecki: Statics of Pile Systems. Principles of Calculation Using the Generalized Method and of Pile-Raft Foundations Using the Two-Parameter Subgrade Model [Statyka ustrojów palowych. Zasady obliczania metodą uogólnioną i fundamentów płytowo-palowych metodą podłoża dwuparametrowego]. PZITB Szczecin Branch, 2006. 3. K. Gwizdała: "Pile Foundations" [Fundamenty palowe], Volumes 1 and 2. PWN, Warsaw, 2011, 2013. 4. A. Krasieński: Screw-in Displacement Piles. Interaction with Cohesionless Soil [Pale przemieszczeniowe wkręcane. Współpraca z niespoistym podłożem gruntowym]. Gdańsk University of Technology Publishing House, Monograph No. 134, 2013, 250 pp. 5. A. Krasieński: Proposed Procedure for the Calculation and Design of Pile Foundations [Propozycja procedury obliczania i projektowania fundamentów palowych]. XXXVI National Structural Designer Workshop. Wisła, June 28 – July 1, 2022.
	Supplementary literature	1. Z. Wiłun: "Outline of Geotechnics" (Zarys geotechniki). WKŁ, Warsaw. 2. E. Dembicki et al.: "Foundation Engineering, Vol. I and II" (Fundamentowanie, t. I i II). Arkady, Warsaw 1988. 3. A. Jarosiniak: "Lightweight Retaining Structures" (Lekkie konstrukcje oporowe). WKŁ, Warsaw 2000. 4. A. Krasieński: Design principles for screwed-in displacement piles in non-cohesive soils. *Marine Engineering and Geotechnics* (Inżynieria Morska i Geotechnika) No. 4/2013, pp. 278–286.
	eResources addresses	
Example issues/ example questions/ tasks being completed	Types of ground conditions and geotechnical categories. Generalized Winkler model of the subsoil. Analysis of foundation slabs on an elastic subgrade. Determination of settlement characteristics for single piles and pile groups. Mechanism of base grouting for bored piles. Interaction mechanism between a piled-raft foundation and the subsoil. Principles of designing deep excavation support systems.	
Practical activities within the subject	Not applicable	

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