GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	Advanced Soil Mechanics and Soil Dynamics, PG_00042251						
Field of study	Civil Engineering						
Date of commencement of studies	February 2025		Academic year of realisation of subject	2025/2026			
Education level	second-cycle studies		Subject group	Optional 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	Polish			
Semester of study	2		ECTS credits	3.0			
Learning profile	general academic profile		Assessment form	exam			
Conducting unit	Department of Geotechnics, Geology and Marine Civil Engineering -> Faculty of Civil and Environmental Engineering						
Name and surname of lecturer (lecturers)	Subject supervisor		dr hab. inż. Marcin Cudny				
	Teachers						
Lesson types and methods of instruction	Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
	Number of study hours	30.0	0.0	15.0	0.0	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		5.0		25.0	75
Subject objectives	Extending the knowledge of soil mechanics and dynamics in relation to the basic engineering course for the geotechnical specialty. This knowledge is to enable conscious use of the latest design tools and the results of laboratory and field tests.						

Learning outcomes

Course outcome	Subject outcome	Method of verification
[K7_U15] has advanced skills in civil engineering within offered specialization/profile	Abillity to correctly apply the Mohr-Coulomb model in various soil and water conditions in FEM calculations.	[SU4] Assessment of ability to use methods and tools [SU3] Assessment of ability to use knowledge gained from the subject [SU2] Assessment of ability to analyse information
[K7_W12] has deep and theoreticaly firm knowledge about geotechnical investigation, the rules of geotechnical design and engineering geology; knows the complcated processes in soil, techniques of foundations, draining systems, soil strengthening, geosynthetics applications, underground constructions and earthworks	Knowledge of the basic parameters of strength and stiffness of soil ground and their determination to apply in design analyses taking into account drained and undrained conditions.	[SW1] Assessment of factual knowledge [SW2] Assessment of knowledge contained in presentation
[K7_W02] knows principles of analysis, design and dimensioning of complex constructions and its elements	Knowledge on the proper choice of calculation methods in specific design tasks. Ability to simplify complex construction issues in the final computational model, taking into account safety rules.	[SW2] Assessment of knowledge contained in presentation [SW1] Assessment of factual knowledge
[K7_W15] has deep and adequate knowlege of civil engineering, within offered specialization and profile	Knowledge of the correct selection of information and compliance with current engineering standards in the light of advanced calculation methods.	[SW1] Assessment of factual knowledge [SW2] Assessment of knowledge contained in presentation
[K7_U14] is able to plan and to interpret the geotechnical investigatons, to analyse the foundation stability; can design direct and deep foundations in complex soil conditions for complcated statical and dynamical loads	Ability of creating programs for field and laboratory soil research in specific geotechnical situations and structures. Ability to interpret these tests and use the obtained results in geotechnical design and analyses.	[SU2] Assessment of ability to analyse information [SU3] Assessment of ability to use knowledge gained from the subject

Subject contents

1. Stability of slopes and slopes.

2. Shear strength of soils - general rules for applications of the Mohr-Coulomb model (drained & undrained conditions, dilatancy and contractancy).

3. Soil stiffness: logarithmic and power law of compressibility.

4. Stiffness of soils at small and intermediate strains: dependence of stiffness on stress and strain.

5. Primary (seepage) and secondary (creep and relaxation) consolidation.

6. Critical State Theory and the Cam Clay Model

7. Advanced soil models used in practice (Soft Soil, Hardening Soil, Soft Soil Creep) and their parameters.

8. Elements of soil dynamics, basic equations and modelling principles.

9. Application of seismic methods in field and laboratory testing of soil stiffness within small strain region.

Prerequisites and co-requisites

Basic knowledge of soil mechanics and foundation engineering.

Assessment methods and criteria

Subject passing criteria	Passing threshold	Percentage of the final grade
exam	50.0%	50.0%
exercises	50.0%	50.0%

Recommended reading	Basic literature	1. Geotechnical Engineering Handbook, Editor: Urlich Smotczyk. 2. Helwany S., Applied Soil Mechanics with Abaqus Applications. 3. Duncan J.M., Wright S.G., Soil Strength and Slope Stability. 4. Material Models Manual Plaxis FEM code - current version. 5. Derski W., Izbicki R., Kisiel I., Mróz Z., Mechanika Skał i Gruntów. 6. Terzaghi K., Peck R.B., Mesri G., Soil Mechanics in Engineering Practice. 7. Muir Wood D., Geotechnical Modelling.
	Supplementary literature	Journals: Inżynieria Morska i Geotechnika Géotechnique ASCE Geotechnical and Environmental Engineering Computers and Geotechnics Numerical and Analytical Methods in Geomechanics Canadian Geotechnical Journal Geotechnical Testing Journal Soils and Foundations Geotechnik (German)
	eResources addresses	Adresy na platformie eNauczanie:
Example issues/ example questions/ tasks being completed	1. Stiffness moduli in Hardening Soil model - meaning and methods of determination. 2. Basic differences between the methods of determinig slope stability presented in the lectures. 3. Skempton parameters A and B - meaning and application 4. Effective and total strength parameters in Mohr-Coulomb model - examples of application (methods A, B and C in undrained conditions). 5. Differences in definitions of known compressibility indexes of normally consolidated and slightly overconsolidated soils. 7. Creep and relaxation, soil types in which these phenomena occur, geotechnical parameters. 8. Types of seismic waves in soil ground and directions of their propagation and polarization. Examples of tests where the velocity of these waves is measured. Application of the results of these measurements. 9. Critical state in soils and Cam Clay Model - Ability to sketch a stress path and compression curve in a triaxial test under any drainage and overconsolidation conditions.	
Work placement	Not applicable	