

FOUNDATION ENGINEERING

Subject code: **06.4-WILŚ- BUD- FUND- IB09**

Subject type: Obligatory

Language of instruction: English

Responsible for the subject: Person currently conducting lectures

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Providing education: Ewa Wojnicka-Janowska, Ph.D. Eng.

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Type of class	Number of classes per semester	Number of classes per week	Semester	Type of credit	ECTS points
Full time studies					4
Lecture	30	2	IV	exam	
Class	15	1		credit with a grade	
Laboratory	15	1		credit with a grade	
Project	15	1		credit with a grade	
Part time studies					
Lecture	18	2	IV	exam	
Class	9	1		credit with a grade	
Laboratory	9	1		credit with a grade	
Project	9	1		credit with a grade	

SUBJECT OBJECTIVE:

Discussion of the problems related to building foundations. Designing non-deformable foundations and pile foundations.

INITIAL REQUIREMENTS:

Strength of materials, Geology, Soil mechanics

SUBJECT SCOPE:

Lecture

Preliminary issues related to foundation: General characteristics and division of foundations; Geotechnical category of the object; Characteristics of materials (comparison of stiffness and strength of steel, concrete and soil). Substrate foundation characteristics: soil characteristics with short-term and long-term loading; Typical stress paths with drainage for foundations, excavation, active pressure and passive retaining walls; Review of field tests; Computational substrate model and a constitutive soil model.

Direct foundations: Classification of foundations; Load capacity of the substrate under direct foundations under load with drainage and without drainage.

Mechanisms of soil destruction under foundations; General, local and pile destruction; Elastic half-space: state of stress, displacement - approximate solutions; Method of triaxial and uniaxial deformation in settlement calculations; Settlement according to EC7.

Intermediate foundations: Pile division; Characteristics of individual types of piles; Selection of piling technology for ground conditions. Load capacity of vertically loaded piles; Negative friction; Problems of pile performance in loose and cohesive soils; Foundations on wells.

Excavations and retaining structures: Phenomenon of ground water filtration; Water flow grid for foundation excavation; Critical hydraulic drop; Liquefaction of land; Division of retaining structures and principles of load transfer; Sheet walls.

Foundation on expansive soil.

Reinforced soil and the use of geosynthetics.

Class

Principles of foundation footing design. Principles of designing foundation footing on piles.

Project

Project of foundation footing. Project of foundation footing on piles.

Laboratory

Field studies of subsoil and preparation of geotechnical documentation.

Educational methods:

Lecture	conventional lecture,
Laboratory	field studies in teams,
Class	conventional classes (discussion of design principles, calculations),
Project	individual and team work on a project.

EDUCATION RESULTS:

Results after completion of the course	Symbol	Verification method	Type of class
Knowledge			
The student can describe individual types of foundations and understand what impacts on the ground are generated by particular types of objects. The student knows basic methods of ground field research and can explain the advantages and disadvantages of individual methods; The student understands what factors depend on the bearing capacity of foundations and the deformability of the substrate under foundations and knows how to determine individual substrate parameters.	K_W04	exam	L
The student can characterize individual piling technologies. The student can describe types of retaining structures and the nature of impacts on these structures. The student is able to explain the risks associated with foundations on expansive soil and apply countermeasures. The student knows the functions of geosynthetics; The student can describe examples of substrate reinforcement with reinforced soil	K_W06		
Abilities			
The student can match an object with a geotechnical category	K_U08	test of abilities	C
The student can use basic equipment for field research and identify the parameters of a substrate model	K_U12,	test of abilities	Lab
The student can design typical direct foundations (foot or bench) and intermediate foundations (piles loaded axially) of the second geotechnical category	K_U09, K_U10	project	P
Social competences			
The student is aware of the responsibility for their individual work, understands the need for teamwork	K_K04	conversation during lectures initiated by the teacher;	L, C, Lab, P

and the need for cooperation of geologists, geotechnicians, designers and contractors		checking competences during the introduction to classes	
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REQUIREMENTS TO OBTAIN A CREDIT:

Lecture	a written test with points.
Laboratory	the condition for a credit is completion of reports on time and a positive grade for a written test.
Class	the condition for a credit is a positive grade for two written tests.
Project	the condition for a credit is completion on time of two previously consulted and approved individual projects.

Criteria for grades for the exam and written tests:

91-100% correct answers	grade 5.0
81-90 % correct answers	grade 4.5
71-80 % correct answers	grade 4.0
61-70 % correct answers	grade 3.5
51-60 % correct answers	grade 3.0
0-50 % correct answers	grade 2.0

STUDENT WORK:

Organized classes	30L + 15Lab + 15C + 15P =	75 h
Preparation for the exam		30 h
Laboratory – individual work		15 h
Project – individual work		25 h
Class – individual work		10 h
Total	75 + 30 + 15 + 25 + 10 =	155 h
ECTS for the subject	155 / 30 = 5,17	4 ECTS

BASIC LITERATURE:

1. Biernatowski K.: Fundamentowanie, PWN, Warsaw 1984.
2. Dembicki E. et al.: Fundamentowanie. Projektowanie i wykonawstwo, t.2, Arkady, Warsaw 1988.
3. Gwizdała K.: Fundamenty palowe. Technologie i obliczenia, Tom 1, PWN, Warsaw 2010.
4. Grabowski Z., Pisarczyk S. Obrycki M.: Fundamentowanie, Oficyna Wyd. Politechniki Warszawskiej, Warsaw 1999.
5. Jarominiak A. et al.: Pale i fundamenty palowe. Arkady, Warsaw 1976.
6. Rossiński B. et al.: Fundamenty. Projektowanie i wykonawstwo, Arkady, Warsaw 1976.

COMPLEMENTARY LITERATURE:

1. Bowles J.E.: Foundation analysis and design, McGraw-Hill, New York 1988.
2. Das B.M.: Principles of foundation engineering, PWS Eng., Boston 1984.
3. Rybak Cz., Puła O., Sarniak W.: Fundamentowanie. Projektowanie posadowień, Doln. Wyd. Edu., Wrocław 2001.
4. Wysokiński L., Kotlicki W., Godlewski T.: Projektowanie geotechniczne według Eurokodu 7. Poradnik, ITB Warsaw 2011.
5. PN-EN 1997: 2008 Eurokod 7. Projektowanie geotechniczne. PKN, Warsaw.
6. PN-81/B-03020. Grunty budowlane. Posadowienia bezpośrednie budowli. Obliczenia statyczne i projektowanie.
7. PN-83/B-02482. Fundamenty budowlane. Nośność pali i fundamentów palowych.
8. PN-83/B-03010. Ściany oporowe. Obliczenia statyczne i projektowanie

SYLLABUS PREPARED BY:

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