

SYLLABUS

Name: Advanced Geotechnical Problems (BudAB>SM1ADGEPR19)

Name in Polish:

Name in English: Advanced Geotechnical Problems

Information on course:

Course offered by department: Faculty of Civil Engineering
Course for department: Silesian University of Technology
Term: Winter semester 2025/2026
Cordinator of course edition: Giuseppe Modoni
Dr hab. inż. Marian Łupieżowiec

Default type of course examination report:

EGZ

Language:

English

Course homepage:

<https://platforma.polsl.pl/rb/course/view.php?id=144>

Short description:

The purpose of this lecture is to give a basic introduction to the problems related with the advanced geotechnical engineering. Students will gain a knowledge on the: soil improvement techniques; deep excavations; tunnelling methods; geotechnical earthquake engineering; methods for the analysis of soil-structure interaction problems; constitutive models and their calibration; FEM analyses applied to the geotechnical engineering.

Description:

LECTURES: 25 h

In the lectures following topics will be covered:

- Presentation of the several case studies related with the geotechnical failures. Analysis of the subsoil conditions, types of foundations, soil improvement techniques (e.g. grouting, dynamic replacement, soil reinforcement), designing methods, controlling procedures for the executions of improvement works.

- Characteristic of the deep excavations, structural components, construction methods and induced effects during construction.

Introduction to the tunnelling giving basic characteristics of the cut and cover, conventional and mechanized methods. Description of the slurry shield and earth pressure balanced shield used for the excavation carried out in soft soils.

- Introduction to earthquake engineering: basic terminology, phenomena, types of seismic waves, response spectrum, site effects and soil liquefaction.

- Description of the constitutive models for the coarse and fine grained soils. Selecting the appropriate soil testing procedure to obtain necessary parameters necessary to describe the mechanical behaviour. Calibration of the constitutive models.

- Application of the Finite Element Method for the geotechnical engineering. Review of different FEM packages for the soil-structure analysis: Plaxis, Z_Soil, Midas GTS NX, Abaqus, Flac, Code_aster etc. Examples of the FEM analysis applied to geotechnical engineering, e.g. deep excavation, mechanized and conventional tunnelling processes.

LABORATORY: 5h

5 hours of laboratory including introduction to exercise and consultations hours are carried out during semester according to schedule released at the beginning of it. Student's attendance in laboratories classes is obligatory.

Students will perform research exercise related to the chosen soil-structure interaction problem analyzed with use of the FEM code.

Bibliography:

Terzaghi K.: Theoretical Soil Mechanics. John Wiley and Sons, 1943

Pisarczyk S.: Metody wzmacniania gruntów. Oficyna Wydawnicza Politechniki Warszawskiej, 2005

Gryczmański M.: Wprowadzenie do opisu sprężysto-plastycznych modeli gruntów. PAN, Komitet Inżynierii Lądowej i Wodnej, Warszawa, 1995.

Zienkiewicz O. C.: Metoda elementów skończonych. Arkady, Warszawa, 2001

Gorbunov-Posadov M.: Obliczanie konstrukcji na podłożu sprężystym. Wydawnictwo Budownictwo i Architektura, 1956

Wood D. M.: Geotechnical modeling. CRC Press, 2004

Siemińska-Lewandowska A.: Głębokie wykopy. Projektowanie i wykonawstwo. Wydawnictwa Komunikacji i Łączności, 2011

Kramer S. L.: Geotechnical Earthquake Engineering. Prentice Hall, 1996

Lancelotta R.: Geotechnical Engineering. Taylor & Francis, 2009

Learning outcomes:

Knowledge:

1. Knows advanced methods of analyzing the soil-structure interaction problems. [K2A_W09]

2. Knows issues related to the FEM analysis applied to the geotechnical engineering. Knows theory of the basic constitutive laws used to describe mechanical behaviour of fine and coarse soils. [K2A_W09]

3. Knows construction methods of foundations for the advanced/complex structures. Knows modern techniques of soil improvement. [K2A_W13]

Skills:

1. Is able to perform numerical simulation of the foundation and analyze results. [K2A_U05]

2. Is able to choose appropriate soil improvement technique in accordance to subsoil conditions and type of structure. Can assess bearing capacity of the complex subsoil. [K2A_U05]

Assessment methods and assessment criteria:

Lack of initial requirements for this subject.

The condition for passing the subject is passing the lecture part (weight 70%) and laboratory part (weight 70%).

In order to have partial grades transferred, the student should contact the instructor within the first two weeks of the semester.

Information on course edition:**Default type of course examination report:**

EGZ

Bibliography:*missing bibliography in English***Notes:**

The syllabus is valid from the winter semester of the 2025/2026 academic year, and its content is not subject to change during the semester.

Details of classes and study groups

lecture (25 hours)

Study groups details

Group number 1

Class instructors:

Giuseppe Modoni

laboratory classes (5 hours)

Study groups details

Group number 1

Class instructors:

Dr hab. inż. Marian Łupieżowiec

Element of course groups in various terms:

Course group description	First term	Last term
<i>missing group description in English</i> (BudAB-S2-2019-sem1)	2020/2021-Z	

Course credits in various terms:**<without a specific program>**

Type of credits	Number	First term	Last term
European Credit Transfer System (ECTS)	3	2020/2021-Z	