

**AGH**AGH UNIVERSITY OF SCIENCE
AND TECHNOLOGY

Module name: The impact of underground construction on surface and surrounding rock mass

Academic year: 2019/2020 Code: GBUD-2-210-GE-s ECTS credits: 3

Faculty of: Mining and Geoengineering

Field of study: Civil Engineering Specialty: Geotechnical Engineering and Underground Construction

Study level: Second-cycle studies Form and type of study: Full-time studies

Lecture language: English Profile of education: Academic (A) Semester: 2

Course homepage: —

Responsible teacher: dr inż. Tajduś Krzysztof (ktajdus@agh.edu.pl)

Module summary

Workshops, lectures and projects focusing on the influence of underground construction on the surface and buildings and evaluation of its hazard.

Description of learning outcomes for module

MLO code	Student after module completion has the knowledge/ knows how to/is able to	Connections with FLO	Method of learning outcomes verification (form of completion)
Social competence: is able to			
M_K001	Is aware of the responsibility for the quality of their calculations of surface deformation and their impact on the design of buildings	BUD2A_K03	Execution of a project, Test, Activity during classes
Skills: he can			
M_U001	can describe the influence of underground construction on basic hazard to buildings	BUD2A_U01	Execution of a project, Test, Activity during classes
M_U002	can calculate the indicators of rock mass deformation	BUD2A_U01	Execution of a project, Test, Activity during classes
Knowledge: he knows and understands			
M_W001	can describe basic influence of underground construction on the surface and surrounding rock mass,	BUD2A_W05	Execution of a project, Test, Activity during classes
M_W002	knows the methods of calculation of underground construction influence on rock mass and surface	BUD2A_W01	Execution of a project, Test, Activity during classes

Number of hours for each form of classes

Suma	Form of classes										
	Lectures	Auditorium classes	Laboratory classes	Project classes	Conversation seminar	Seminar classes	Practical classes	Fieldwork classes	Workshops	Prace kontrolne i przejściowe	Lektorat
45	30	0	0	15	0	0	0	0	0	0	0

FLO matrix in relation to forms of classes

MLO code	Student after module completion has the knowledge/ knows how to/is able to	Form of classes										
		Lectures	Auditorium classes	Laboratory classes	Project classes	Conversation seminar	Seminar classes	Practical classes	Fieldwork classes	Workshops	Prace kontrolne i przejściowe	Lektorat
Social competence: is able to												
M_K001	Is aware of the responsibility for the quality of their calculations of surface deformation and their impact on the design of buildings	+	-	-	+	-	-	-	-	-	-	-
Skills: he can												
M_U001	can describe the influence of underground construction on basic hazard to buildings	+	-	-	+	-	-	-	-	-	-	-
M_U002	can calculate the indicators of rock mass deformation	+	-	-	+	-	-	-	-	-	-	-
Knowledge: he knows and understands												
M_W001	can describe basic influence of underground construction on the surface and surrounding rock mass,	+	-	-	+	-	-	-	-	-	-	-
M_W002	knows the methods of calculation of underground construction influence on rock mass and surface	+	-	-	+	-	-	-	-	-	-	-

Student workload (ECTS credits balance)

Student activity form	Student workload
Udział w zajęciach dydaktycznych/praktyka	45 h
przygotowanie projektu, prezentacji, pracy pisemnej, sprawozdania	20 h
Realization of independently performed tasks	15 h
Contact hours	1 h
Summary student workload	81 h
Module ECTS credits	3 ECTS

Additional information

Module content

Lectures

Behavior of rock mass in the area of various underground constructions, changes of rock mass/soil state of stress and strain near underground construction, surface deformation indicators, calculation of surface deformation for a various type of underground constructions, surface damage classification in the area of disturbance.

Project classes

Implementation of a project including the estimation of surface and rock mass deformation caused by underground construction.

Teaching methods and techniques:

Lectures: Treści prezentowane na wykładzie są przekazywane w formie prezentacji multimedialnej w połączeniu z klasycznym wykładem tablicowym wzbogaconymi o pokazy odnoszące się do prezentowanych zagadnień.

Project classes: Studenci wykonują zadany projekt samodzielnie, bez większej ingerencji prowadzącego. Ma to wykształcić poczucie odpowiedzialności za pracę w grupie oraz odpowiedzialności za podejmowane decyzje.

Warunki i sposób zaliczenia poszczególnych form zajęć, w tym zasady zaliczeń poprawkowych, a także warunki dopuszczenia do egzaminu:

Credit is obtained within the primary deadline and one retake. Detailed assessment rules are agreed by the lecturers at the beginning of the semester. Admission to the exam requires a positive evaluation of classes.

Zasady udziału w poszczególnych zajęciach, ze wskazaniem, czy obecność studenta na zajęciach jest obowiązkowa:

Lectures:

- Attendance is mandatory: No

- Participation rules in classes: Studenci uczestniczą w zajęciach poznając kolejne treści nauczania zgodnie z sylabusem przedmiotu. Studenci winni na bieżąco zadawać pytania i wyjaśniać wątpliwości. Rejestracja audiowizualna wykładu wymaga zgody prowadzącego.

Project classes:

- Attendance is mandatory: Yes
- Participation rules in classes: Studenci wykonują prace praktyczne mające na celu uzyskanie kompetencji zakładanych przez syllabus. Ocenie podlega sposób wykonania projektu oraz efekt końcowy.

Method of calculating the final grade

Grade for the exam (weight 0.6) + evaluation of the project (weight 0.4).

Sposób i tryb wyrównywania zaległości powstałych wskutek nieobecności studenta na zajęciach:

Excused absence from classes can be made up for with another group, with the consent of both lecturers, and provided that the class covers the same topic.

Prerequisites and additional requirements

Attendance at lectures is mandatory. Admission to the exam is given after getting credit for design classes.

Recommended literature and teaching resources

- 1.Lunardi P. Design and construction of tunnels. Springer 2012
- 2.Bell F., Cripps J.C., Culshaw M. G. & Lovell M. A. A review of ground movements due to civil and mining engineering operations
- 3.Attwell P. B. & Taylor, R. K. (eds) Ground Movements and Their Effects on Structures. Surrey University Press, London, 216-42.
- 4.Peng S.S., Chaing H.S., Longwall Mining, John Wiley & Sons, Inc., New York 1984
- 5.Rodriguez-Roa F., Ground subsidence due to a shallow tunnel in dense sandy gravel. J. Geotech. Geoenviron. Eng., ASCE, 128(5): pp. 426-34, 2002
- 6.Sagaseta C., Analysis of undrained soil deformation due to ground loss, Geotechnique 37 (3), 301-20, 1987
- 7.Mair R.J., Taylor R.N., Burland J.B., Subsurface settlement profile above tunnels in clays, Geotechnique, 43(2), pp.315-20, 1993
- 8.Geertsma J. 1973. A basic theory of subsidence due to reservoir compaction: the homogeneous case. Nederland Geologie Mijnbouw, 28, 43-62.
- 9.Whittacker B.N., Reddish D.J. Subsidence - Occurrence, Prediction and Control. Elsevier, 1989
- 10.Ryncarz T. Ruchy górotworu wywołane wyrobiskami podziemnymi. Wydawnictwo AGH, Kraków, 1992
- 11.Peng S.S. Surface subsidence engineering. New York: SME, 1992
- 12.ISRM (International Society for Rock Mechanics). In.Brown ET, editor. ISRM suggested methods: rock characterization, testing and monitoring. London: Pergamon Press, 1981

Scientific publications of module course instructors related to the topic of the module

- 1.Tajduś K. Numerical modeling and geometric numerical integration in calculation mining-induced surface displacement vectors. International Mining Conference 2014-Theory and Technique of Coal Mining and Disaster Prevention in Deep Mines. Proceedings of IMC, pp. 248-254, Chiny 2014
- 2.Tajduś K., Tajduś A. Some considerations on horizontal displacement and horizontal displacement coefficient B. Studia Geotechnica et Mechanica, Vol. 37, no. 4, pp. 75-82, 2015
- 3.Sroka A., Tajduś K. Obliczanie osiadania powierzchni terenu przy eksploatacji złóż ropy i gazu. Nafta-Gaz, AGH Uczelniane Wydawnictwo Naukowo-Techniczne, Tom. 26, nr. 1-2, str.327-334, 2009
- 4.Tajduś A., Cała M., Tajduś K. Geomechanika w budownictwie podziemnym. Projektowanie i budowa tuneli. Wydawnictwo AGH Kraków, 2012
- 5.Tajduś K. Determination of the value of the strain parameters for strata rock mass in the region of underground mining influence. VGE Verlag GmbH, Essen, Issue 2, 2009
- 6.Tajduś K., Sroka A. Analytic and numerical methods of sinkhole prognosis. 7.Altbergbau Kolloquium Verlag Glückauf GmbH, Freiberg, ISBN 978-3-86797-006-8, pp. 152-165, 2007
- 7.Tajduś K. Analysis of horizontal displacements measured over the mining operations in longwall No. 537 at the Girondelle 5 seam of the BW Friedrich Heinrich-Rheinland coal mine. Archives of Mining Sciences, ISSN 0860-7001, Vol. 61 (2016), No. 1, pp. 157-168.
- 8.Sroka A., Knothe S., Tajduś K., Misa R. Underground exploitations inside safety pillar shafts when

considering the effective use of a coal deposit. Mineral Resources Management, Vol. 31 (2015), Issue. 3, pp. 93-110.

9. Tajduś K. Analysis of horizontal displacement distribution caused by single advancing longwall panel excavation. Journal of Rock Mechanics and Geotechnical Engineering, Elsevier No. 7 (2015), pp. 395-403.

10. Sroka A., Knothe S., Tajduś K., Misa R. Point movement trace vs. the range of mining exploitation effects in the rock mass. Archives of Mining Sciences, Vol. 60 (2015), No. 4, pp. 921-929.

11. Tajduś K. Mining-induced surface horizontal displacement: The case of BW Prosper Haniel mine. Archives of Mining Sciences, Vol. 58 (2013), No. 4, pp. 1037-1055.

12. Tajduś K. The determination of the approximate value of a GSI index for Hoek's rock mass classification for the rocks in the area of Polish coal mines. Archives of Mining Sciences, Vol. 55 (2010), No. 4, pp. 879-890.

13. Tajduś K. New method for determining the elastic parameters of rock mass layers in the region of underground mining influence. International Journal of Rock Mechanics & Mining Science, Elsevier, Vol. 46 (2009), No. 8, pp. 1296-1305.

Additional information

Attendance at lectures is mandatory.

Attendance in design classes is mandatory. Knowledge of the lectures provided.