



Module name: Physical properties of rock and soils

Academic year: 2019/2020 Code: GIGR-2-104-ME-s ECTS credits: 2

Faculty of: Mining and Geoengineering

Field of study: Mining Engineering Specialty: Mining Engineering

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

Lecture language: English Profile of education: Academic (A) Semester: 1

Course homepage: —

Responsible teacher: dr hab. inż. Małkowski Piotr (malkgeom@agh.edu.pl)

Module summary

The student gets the basic knowledge about rock and soil physical properties. He knows the principles of rocks and soils behaviour and knows the factors which influence on them. He carries out some laboratory investigations on rocks and soils.

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	A student has the awareness of mining activity meaning and the results of mining operations for the economy and for the sustainable development	IGR2A_K01, IGR2A_K04, IGR2A_U05	
Skills: he can			
M_U001	A student can carry out the simple tests on rocks and soils	IGR2A_W06, IGR2A_W03, IGR2A_U05, IGR2A_U06	
M_U002	A student can predict the results of mining operations in different rock mass types	IGR2A_W03, IGR2A_U05, IGR2A_W05, IGR2A_U06	
Knowledge: he knows and understands			
M_W001	A student knows the basic rock and soil physical properties	IGR2A_K01, IGR2A_W03, IGR2A_W02, IGR2A_K04, IGR2A_U05, IGR2A_W05, IGR2A_U06, IGR2A_U04	Completion of laboratory classes

M_W002	A student knows the basic rock parameters used in mining engineering	IGR2A_K01, IGR2A_W04, IGR2A_W03, IGR2A_W02, IGR2A_K04, IGR2A_U01	Completion of laboratory classes
M_W003	A student knows the type of rocks and is able to predict their behaviour during mining operations	IGR2A_W03, IGR2A_W02, IGR2A_U01, IGR2A_W05, IGR2A_U06	Completion of laboratory 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
30	15	0	15	0	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	A student has the awareness of mining activity meaning and the results of mining operations for the economy and for the sustainable development	-	-	+	-	-	-	-	-	-	-	-
Skills: he can												
M_U001	A student can carry out the simple tests on rocks and soils	-	-	+	-	-	-	-	-	-	-	-
M_U002	A student can predict the results of mining operations in different rock mass types	+	-	+	-	-	-	-	-	-	-	-
Knowledge: he knows and understands												
M_W001	A student knows the basic rock and soil physical properties	-	-	+	-	-	-	-	-	-	-	-
M_W002	A student knows the basic rock parameters used in mining engineering	-	-	+	-	-	-	-	-	-	-	-
M_W003	A student knows the type of rocks and is able to predict their behaviour during mining operations	+	-	+	-	-	-	-	-	-	-	-

Student workload (ECTS credits balance)

Student activity form	Student workload
Udział w zajęciach dydaktycznych/praktyka	30 h
Preparation for classes	12 h
przygotowanie projektu, prezentacji, pracy pisemnej, sprawozdania	12 h
Realization of independently performed tasks	4 h
Examination or Final test	2 h
Summary student workload	60 h
Module ECTS credits	2 ECTS

Additional information

Module content

Lectures

The type of rocks and soils, definitions and classifications, the general physical properties

The lecture presents the rock classification and needed definitions. The rocks origin influence on their properties. The general groups of physical properties are discussed.

Structural and textural features and their description

The structural and textural features and the way of their description. Their meaning for mining activity (mining system, roadways drivage, roadways' stability, support design).

The soil, the basic physical parameters

The basic physical parameters for soils. The determinants influence on the soil state. Consistency and compactness.

The rocks - basic structural parameters. Porosity and permeability

The basic structural parameters of rocks. Porosity and permeability and their meaning for mining and underground engineering operation. The influence of the depth on rock properties.

Mechanical rock and soil properties

Mechanical rock and soil properties – rocks as the elastic materials and soils as the compact materials. The division on strength and strain properties.

The water influence on rocks

The meaning of water content in the rock mass. The meaning of aquifers for soils and rocks. The change of rock properties affected by water.

Acoustic properties of rocks. Stratified rock mass.

P-wave and S-wave. Dynamic elastic moduli. The stratified rock masses. Approach to their description.

Laboratory classes

Laboratory tests on rocks

The students do laboratory research on six stands. The investigations relate to:

1. Structural rock and soil parameters (unit density, porosity) and humidity
2. Water permeability
3. Triaxial compression
4. The Atterberg limits
5. Dynamic elastic moduli
6. Gas permeability

Solid rocks strength and deformability

The show of basic mechanical test on rocks

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.

Laboratory classes: W trakcie zajęć laboratoryjnych studenci samodzielnie rozwiązują zadany problem praktyczny, dobierając odpowiednie narzędzia. Prowadzący stymuluje grupę do refleksji nad problemem, tak by otrzymane wyniki miały wysoką wartość merytoryczną.

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

The student can pass the subject if he attends all the laboratory excersises , pass the theory related to the topics and prepare the reports.

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.

Laboratory classes:

- Attendance is mandatory: Yes

- Participation rules in classes: Studenci wykonują ćwiczenia laboratoryjne zgodnie z materiałami udostępnionymi przez prowadzącego. Student jest zobowiązany do przygotowania się w przedmiocie wykonywanego ćwiczenia, co może zostać zweryfikowane kolokwium w formie ustnej lub pisemnej. Zaliczenie zajęć odbywa się na podstawie zaprezentowania rozwiązania postawionego problemu. Zaliczenie modułu jest możliwe po zaliczeniu wszystkich zajęć laboratoryjnych.

Method of calculating the final grade

50% the mark of laboratory classes + 50% the mark from final test

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

One extra excersise is organize at the end of the semester

Prerequisites and additional requirements

Maximum 2 absences on lectures are allowed.

Recommended literature and teaching resources

Any books related to rock mechanics and soil mechanics.

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

1. Małkowski P., Ostrowski Ł., Brodny J.: Analysis of Young's modulus for Carboniferous sedimentary rocks and its relationship with uniaxial compressive strength using different methods of modulus determination. *Journal of Sustainable Mining*, vol. 17, iss. 3, 2018, pp. 145-157.
2. Małkowski P., Ostrowski Ł., Bożęcki P.: The impact of the mineral composition of Carboniferous claystones on the water-induced changes of their geomechanical properties. *Geology, Geophysics & Environment*, vol. 43 no. 1, 2017, pp. 43-55.
3. Małkowski P., Ostrowski Ł.: The methodology for the young modulus derivation for rocks and its value. *Procedia Engineering*, vol. 191, 2017, pp. 134-141.

Additional information

N/D