Zał. Nr 1 do ZW 16/2020

PROGRAM OF STUDIES

FACULTY: .OF GEOENGINEERING, MINING AND GEOLOGY

MAIN FIELD OF STUDY: .MINING AND GEOLOGY

DISCIPLINE: D1 ENVIRONMENTAL, MINING AND POWER ENGINEERING

EDUCATION LEVEL second-level studies

FORM OF STUDIES: full-time studies

PROFILE: general academic

LANGUAGE OF STUDY: English/Polish

Content:

1. Assumed learning outcomes – attachment no. . ……. to the program of studies
2. Program of studies description – attachment no. …… to the program of studies

In effect since .2022/2023

Zał. Nr 2 do ZW 16/2020

ASSUMED LEARNING OUTCOMES

FACULTY: Geoengineering, Mining, and Geology

MAIN FIELD OF STUDY: Mining and Geology

EDUCATION LEVEL: second-level studies

PROFILE: general academic

Location of the main-field-of study:

Branch of science: **engineering and technical sciences**

Discipline: **environmental engineering, mining and energy**

……

Explanation of the markings:
P6U – universal first degree characteristics corresponding to education at the first-level studies - 6 PRK level *
P7U – universal first degree characteristics corresponding to education at the second-level studies - 7 PRK level *

P6S – second degree characteristics corresponding to education at the first-level studies - 6 PRK level *
P7S – second degree characteristics corresponding to education at the second-level studies - 7 PRK level *

W - category "knowledge"
U - category "skills"
K - category "social competences"
K (*faculty symbol*) _W1, K (*faculty symbol*) _W2, K (*faculty symbol*) _W3, … - main-field-of study learning outcomes related to the category "knowledge"
K (*faculty symbol*) _U1, K (*faculty symbol*) _U2, K (*faculty symbol*) _U3, … - main-field-of study learning outcomes related to the category "skills"
K (*faculty symbol*) _K1, K (*faculty symbol*) _K2, K (*faculty symbol*) _K3, … - main-field-of study learning outcomes related to the category "social competences"
… _inż. – learning outcomes related to the engineer competences

* delete as applicable

Main field of study learning outcomes	Description of learning outcomes for the main-field-of study After completion of studies, the graduate:	Reference to PRK characteristics		
		Universal first degree characteristics (U)	Second degree characteristics typical for qualifications obtained in higher education (S)	
			Characteristics for qualifications on 6 / 7* levels of PRK	Characteristics for qualifications on 6 and 7 levels of PRK, enabling acquiring engineering competences
KNOWLEDGE (W)				
K2_GIG_W01	has knowledge of effective scientific expression and presentation, knows the rules and methods for conducting scientific research and presenting their results in a scientific publication	P7U_W	P7S_WG	
K2_GIG_W02	has extended and in-depth knowledge of physics and/or chemistry, necessary to understand the phenomena and processes affecting the properties of the Earth's crust and raw materials it contains.	P7U_W	P7S_WG	
K2_GIG_W03	has basic knowledge of the role and main principles of financial management in the enterprise; has in-depth knowledge of the economic evaluation of investment projects and investment risk assessment	P7U_W	P7S_WG P7S_WK	P7S_WG_inż P7S_WK_inż
K2_GIG_W04	has systematised knowledge of the fundamentals and types of environmental management systems in Poland and EU countries; knows the tools and instruments supporting their implementation and the applicable legal regulations.		P7S_WG P7S_WK	P7S_WG_inż P7S_WK_inż
K2_GIG_W05	has basic knowledge necessary to understand the social and psychological determinants of engineering activities	P7U_W	P7S_WK	P7S_WK_inż
K2_GIG_W06	has knowledge of the basic decision models in management with the use of IT tools/applications	P7U_W	P7S_WK	P7S_WK_inż
K2_GIG_W07	has knowledge of the processes and technologies used in geoengineering, mining and processing of mineral resources		P7S_WG	P7S_WG_inż

K2_GIG_W08	has in-depth knowledge of the recognition and assessment of resources, quality, and value of the deposit, legal procedures to launch mine operations, and to conduct mining and mineral processing	P7U_W	P7S_WG P7S_WK	P7S_WG_inż P7S_WK_inż
K2_GIG_W09	has knowledge of the operation of mining or geoengineering enterprises as well as about their production management and optimization		P7S_WG P7S_WK	P7S_WG_inż P7S_WK_inż
K2_GIG_W10	has extended knowledge of the sciences describing the phenomena that are the basis of technologies used in mining and mineral engineering and the sciences explaining the phenomena and threats accompanying mining, mineral engineering, and environmental protection, in particular in the field of rock mass mechanics, soil mechanics, geophysics, hydrogeology, and ecology	P7U_W	P7S_WG P7S_WK	P7S_WG_inż P7S_WK_inż
K2_GIG_W11	knows the formal and legal conditions in the field of geology, mining, geoengineering, mineral engineering and environmental protection	P7U_W	P7S_WK	
K2_GIG_W12	has knowledge of the rational use of environmental resources, circular economy and economic activity sustainable in terms of innovation, environmental protection and safety	P7U_W	P7S_WG P7S_WK	P7S_WG_inż P7S_WK_inż
K2_GIG_W13	knows the environmental impact assessment procedures and their legal regulations, factors influencing such an assessment, its stages, and the effectiveness of the applied research methods; knows the basic concepts and frameworks of environmental risk and human health exposure assessments		P7S_WG P7S_WK	P7S_WG_inż P7S_WK_inż
K2_GIG_W14	has broadened knowledge of the threats that occur in mining and mineral engineering and knows how to counteract them		P7S_WG	P7S_WG_inż
K2_GIG_W15	has basic knowledge of computer modeling of geological structures, computer aided design, and monitoring of mining or geoengineering objects	P7U_W	P7S_WG P7S_WK	P7S_WG_inż P7S_WK_inż
K2_GIG_W16	has knowledge of changes in the rock mass under the influence of mining, with particular emphasis on its impact on the ground surface and methods of monitoring to protect the surface		P7S_WG	P7S_WG_inż

K2_GIG_W17	knows the methodology and techniques of occupational risk assessment in light of Polish and international law; knows the basics of organization and management of work safety, necessary for management and traffic supervision in mining, geoengineering and mineral engineering	P7U_W	P7S_WG P7S_WK	P7S_WG_inż P7S_WK_inż
K2_GIG_W18	knows methods and tools for designing, calculating, and optimizing systems for the extraction, processing, and processing of minerals and waste with the use of mathematical modelling and digital simulation of technological operations	P7U_W	P7S_WG P7S_WK	P7S_WG_inż P7S_WK_inż
K2_GIG_W19	has knowledge of machine systems used in raw material technologies and geoengineering, their reliability and life cycle		P7S_WG P7S_WK	P7S_WG_inż P7S_WK_inż
SKILLS (U)				
K2_GIG_U01	has linguistic resources appropriate for a specialist language and is able to use the specialist language in all linguistic activities to communicate in a professional environment in the field of studied discipline		P7S_UK	
K2_GIG_U02	has language skills in accordance with the requirements specified for the B2 + level of the European System for the Description of Languages (CEFR) in the foreign language in which learning is continued; understands and interprets professional texts in the field of mining and geology; speaks and writes using academic and engineering language.		P7S_UK	
K2_GIG_U03	concerning the second foreign language, understands quite well the content and intentions of an oral statement or written text on a topic known from everyday and professional life; can write a short text on a known topic, including a utility text (e.g. an informal letter); is able to participate in conversations on known topics and to a limited extent expresses themself about studies and professional work, using socio-cultural knowledge		P7S_UK	
K2_GIG_U04	is able to use analytical methods and IT tools, including digital simulation, to design, calculate, optimize systems for extraction, processing, processing of minerals and waste or revitalization of post-mining facilities	P7U_U	P7S_UW	P7S_UW_inż

K2_GIG_ U05	is able to select and apply appropriate methods and IT tools for systemic management of environmental components under the given geological and mining conditions	P7U_U	P7S_UW	P7S_UW_inż
K2_GIG_U06	is able to build a simple financial model of an investment, examine its profitability and conduct a risk analysis on the ground of historical data and financial forecasts		P7S_UW	P7S_UW_inż
K2_GIG_U07	is able to design processes and technological systems used in geoengineering, mining or processing of mineral resources, is able to program basic models/algorithms of technological operations when applied to analyze the effectiveness of a complex industrial system	P7U_U	P7S_UW	P7S_UW_inż
K2_GIG_U08	understands the need for lifelong learning and is able to organize the learning of other people	P7U_U	P7S_UU	
K2_GIG_U09	is able to work in a group and lead a team to fully use its potential to solve assigned tasks	P7U_U	P7S_UO	
K2_GIG_U10	can use the knowledge of the sciences describing the phenomena that are the basis of technologies used in mining and mineral engineering and the sciences explaining the phenomena and threats accompanying mining, mineral engineering, and environmental protection for calculations, analyzes, and design of facilities, processes and technologies	P7U_U	P7S_UW P7S_UU	P7S_UW_inż
K2_GIG_U11	is able to carry out an occupational risk assessment for selected factors of the working environment with the use of computer tools; is able to independently develop elements of work safety documents required by law	P7U_U	P7S_UW P7S_UO P7S_UK	P7S_UW_inż
K2_GIG_U12	is able to carry out an assessment of the impact of industrial activities on the environment for a simple case study; is able to interpret the documentation regarding the risk assessment of the negative impact of mining activities on the health of the population and independently perform simple risk calculations		P7S_UW P7S_UO	P7S_UW_inż
K2_GIG_U13	is able to critically assess and draw conclusions from various sources and to prepare written documentation or oral presentations on the area of mineral resource engineering		P7S_UW P7S_UK	P7S_UW_inż

K2_GIG_U14	is able to apply and interpret basic decision models with the use of IT tools/applications	P7U_U	P7S_UW P7S_UO P7S_UU	P7S_UW_inż
K2_GIG_U15	is able to make a critical analysis of technical and organizational solutions used in mining, geoengineering and mineral engineering		P7S_UW P7S_UK	P7S_UW_inż
SOCIAL COMPETENCES (K)				
K2_GIG_K01	can think and act creatively and enterprisingly		P7S_KK P7S_KR	
K2_GIG_K02	understands the need to formulate and communicate to society, including through the mass media, information and opinions on the achievements of the mining industry, geoengineering and mineral engineering and other aspects of the engineer's activity; makes efforts to convey such information and opinions in a commonly understandable manner, presenting different points of view; is aware of the value and need of shaping a safety culture work and responsibility for the health and life of other employees	P7U_K	P7S_KK P7S_KO P7S_KR	
K2_GIG_K03	is aware of the importance of nontechnical effects of engineering activities, including their impact on the environment and the related responsibility for decisions made	P7U_K	P7S_KO P7S_KR	

FACULTY: **of Geoengineering, Mining and Geoology**

MAIN FIELD OF STUDY: **Mining and Geology**

LANGUAGE OF STUDY: English

SPECIALIZATION: **Mining Engineering**

DESCRIPTION OF THE PROGRAM OF STUDIES

Main field of study MINING AND GEOLOGY
Level of studies second level studies

Profile general academic
Form of studies full-time studies

1. General description

1.1 Number of semesters: **3**	*1.2 Total number of ECTS points necessary to complete studies at a given level:* **90**
1.3 Total number of hours: **960**	*1.4 Prerequisites (particularly for second-level studies):* professional title of an engineer, interview
1.5 Upon completion of studies graduate obtains professional degree of: Master of Science (magister inżynier)	*1.6 Graduate profile, employability:* The graduate will have the skills to use advanced knowledge in the field of basic, and specialized subjects. He/she will have the skills to lead teams, make high-risk decisions, and be fluent in using legal and economic knowledge. The graduate will be prepared to design technological processes, as well as to solve scientific and research problems and to undertake creative initiatives. He/she will be prepared to work in enterprises, technical supervision institutions, public state and local administration, in research and development organisations, in Poland and abroad, where advanced knowledge in the field of mining, geology and geomechanics is required. The graduate will be able to use English freely and will be prepared to work in an

	international environment and intercultural groups during his/her professional career.
1.7 Eligibility to apply for admission to a doctoral school, non-degree postgraduate programmes	*1.8 Indicate connection with University's mission and its development strategy:* The second level study program in the field of study Mining and Geology is in line with the mission and responds to the following strategic goals of Wroclaw University of Science and Technology: 1. Increasing the level of correlation of University activities with the needs of the market, 2. Raising the level of education quality through didactic interdisciplinarity *3.* Raising the level of entrepreneurship and commitment in the research processes of students and doctoral students

[1]BU – number of ECTS points assigned to hours of classes requiring direct participation of academic teachers and other persons conducting classes
[2]Traditional – enter T, remote – enter Z
[3]Exam – enter E, crediting – enter Z. For the group of courses – after the letter E or Z - enter in brackets the final course form (lec, cl, lab, pr, sem)
[4]University-wide course /group of courses – enter O
[5]DN - number of ECTS points assigned to the classes related to the University's academic activity in the discipline/disciplines to which the main field of study is assigned
[6]Practical course / group of courses – enter P. For the group of courses – in brackets enter the number of ECTS points assigned to practical courses
[7]KO – general education courses, PD – basic sciences courses, K – main field of study courses, S – specialization courses

2. **Detailed description**
   2.1 Total number of learning outcomes in the program of study: W (knowledge) = 19, U (skills) = 15, K (competences) = 3, W + U + K = 37
   ~~**2.2 For the main field of study assigned to more than one discipline - the number of learning outcomes assigned to the discipline:**~~
   ~~**D1 (major) .... (this number must be greater than half the total number of learning outcomes)**~~
   ~~**D2 ....**~~
   ~~**D3 ....**~~
   ~~**D4 ....**~~
   ~~**2.3 For the main field of study assigned to more than one discipline - percentage share of the number of ECTS points for each discipline:**~~
   ~~**D1 ....% ECTS points**~~
   ~~**D2 ....% ECTS points**~~
   ~~**D3 ....% ECTS points**~~
   ~~**D4 ....% ECTS points**~~

   2.4a. For the general academic profile of the main field of study – the number of ECTS points assigned to the classes related to the University's academic activity in the discipline or disciplines to which the main field of study is assigned – DN (must be greater than 50% of the total number of ECTS points from 1.2) 78 ECTS

   2.4b. ~~**For the practical profile of the main field of study - the number of ECTS points assigned to the classes shaping practical skills (must be greater than 50% of the total number of ECTS points from 1.2)**~~

[1]BU – number of ECTS points assigned to hours of classes requiring direct participation of academic teachers and other persons conducting classes
[2]Traditional – enter T, remote – enter Z
[3]Exam – enter E, crediting – enter Z. For the group of courses – after the letter E or Z - enter in brackets the final course form (lec, cl, lab, pr, sem)
[4]University-wide course /group of courses – enter O
[5]DN - number of ECTS points assigned to the classes related to the University's academic activity in the discipline/disciplines to which the main field of study is assigned
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2.5 Concise analysis of compliance of the assumed learning outcomes with the needs of the labor market

The economic development of the country is closely dependent on natural resources, the ability to use them and having appropriate engineering workforce. The assumed learning outcomes correspond to the needs of practice in the field of the generally understood management of mineral resources - technologies and techniques for their identification, valuation, extraction, processing, revitalization of industrial areas, and the practice of managing an enterprise (especially mining) in the sense of managing information, environment and people, using the latest IT and marketing techniques and methods. This integration of economic needs and assumed educational effects favorably shape the labor market for the graduates of the Faculty. Additionally, a good command of English and experience of working in an international group will open up the possibility of working in foreign branches of Polish enterprises and in foreign companies.

2.6. The total number of ECTS points that a student must obtain in classes requiring direct participation of academic teachers or other persons conducting classes and students (enter the sum of ECTS points for courses / groups of courses marked with the BU[1] code) **62 ECTS**

2.7. Total number of ECTS points, which student has to obtain from basic sciences classes

Number of ECTS points for obligatory subjects	4
Number of ECTS points for optional subjects	0
Total number of ECTS points	4

2.8. Total number of ECTS points, which student has to obtain from practical classes, including project and laboratory classes (enter total number of ECTS points for courses/group of courses denoted with code P)

Number of ECTS points for obligatory subjects	18
Number of ECTS points for optional subjects	39
Total number of ECTS points	57

[1]BU – number of ECTS points assigned to hours of classes requiring direct participation of academic teachers and other persons conducting classes
[2]Traditional – enter T, remote – enter Z
[3]Exam – enter E, crediting – enter Z. For the group of courses – after the letter E or Z - enter in brackets the final course form (lec, cl, lab, pr, sem)
[4]University-wide course /group of courses – enter O
[5]DN - number of ECTS points assigned to the classes related to the University's academic activity in the discipline/disciplines to which the main field of study is assigned
[6]Practical course / group of courses – enter P. For the group of courses – in brackets enter the number of ECTS points assigned to practical courses
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2.9. Minimum number of ECTS points, which student has to obtain doing education blocks offered as part of University-wide classes or other main field of study (enter number of ECTS points for courses/groups of courses denoted with code O)

3 ECTS points

2.10. Total number of ECTS points, which student may obtain doing optional blocks (min. 30% of total number of ECTS points)

55 ECTS points

3. Description of the process leading to learning outcomes acquisition:

1. Upon starting classes in each subject, the student has an appropriate level of knowledge and skills which constitute the prerequisites for a given course (it is verified by the teacher or the dean's office).
2. The student participates in classes organized at the university.
3. The student carries out the assigned work in class and at home (projects, computational tasks, analyzes, prepares presentations) and studies the literature and materials recommended by the teacher.
4. The student uses the appointed hours of the tutor's consultation, explaining his uncertainties and verifying the correct understanding of the course content.
5. The student participates in periodic tests of knowledge and skills, completes the tests available on the e-portal and is familair with the correct answers, grades and comments from the teacher.
6. In some subjects, the student participates in group tasks, taking part in the organization of the group's work, assessment of the activities of individual participants and takes responsibility for the result of the group's work.
7. The student is encouraged to become involved in the work of research clubs, student organizations, discussion clubs, sports groups, participation in social life through work in public welfare organizations, voluntary work, thus gaining valuable interpersonal skills and social competences.
8. The student participates in meetings with companies from the industry, technical excursions, job fairs, tries to gain knowledge about the labor market and additional advantages when applying for a job
9. The student is encouraged to participate in an international student exchange, and through contact with foreigners at the faculty, he or she acquires additional interpersonal, cultural and language qualifications

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[2]Traditional – enter T, remote – enter Z
[3]Exam – enter E, crediting – enter Z. For the group of courses – after the letter E or Z - enter in brackets the final course form (lec, cl, lab, pr, sem)
[4]University-wide course /group of courses – enter O
[5]DN - number of ECTS points assigned to the classes related to the University's academic activity in the discipline/disciplines to which the main field of study is assigned
[6]Practical course / group of courses – enter P. For the group of courses – in brackets enter the number of ECTS points assigned to practical courses
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4. List of education blocks:
4.1. List of obligatory blocks:
4.1.1 List of general education blocks
4.1.1.1 *Liberal-managerial subjects* block *(7 ECTS points):*

No.	Course/ group of courses code	Name of course/group of courses (denote group of courses with symbol **GK**)	Weekly number of hours					Learning effect symbol	Number of hours		Number of ECTS points			Form[2] of course/group of courses	Way[3] of crediting	Course/group of courses			
			lec	cl	lab	pr	sem		ZZU	CNPS	Total	DN[5] classes	BU[1] classes			University -wide[4]	Concerning scientific activities[5]	Practical[6]	Type[7]
1	W06GIG-SM0039G	Project Management, Appraisal and Risk Evaluation (GK)	1		2	1		K2_GIG_W08,W10, W11 K2_GIG_U04,U08,U10,U15 K2_GIG_K01	60	120	4	4	3	T/Z(w)	E(w), Z(l,p)		DN	P (3)	KO
2	W06GIG-SM0079	Operations Research	1		1			K2_GIG_W06 K2_GIG_U10,U14 K2_GIG_K01	30	90	3	3	2	T/Z(w)	Z(w,l)		DN	P (2)	KO
		Total	**2**	**0**	**3**	**1**	**0**		**90**	**210**	**7**	**7**	**5**					**5**	

Altogether for general education blocks

Total number of hours					Total number of ZZU hours	Total number of CNPS hours	Total number of ECTS points	Total number of ECTS points for DN classes[5]	Number of ECTS points for BU classes[1]
lec	cl	lab	pr	sem					
2	**0**	**3**	**1**	**0**	**90**	**210**	**7**	**7**	**5**

[1]BU – number of ECTS points assigned to hours of classes requiring direct participation of academic teachers and other persons conducting classes
[2]Traditional – enter T, remote – enter Z
[3]Exam – enter E, crediting – enter Z. For the group of courses – after the letter E or Z - enter in brackets the final course form (lec, cl, lab, pr, sem)
[4]University-wide course /group of courses – enter O
[5]DN - number of ECTS points assigned to the classes related to the University's academic activity in the discipline/disciplines to which the main field of study is assigned
[6]Practical course / group of courses – enter P. For the group of courses – in brackets enter the number of ECTS points assigned to practical courses
[7]KO – general education courses, PD – basic sciences courses, K – main field of study courses, S – specialization courses

4.1.2 List of basic sciences blocks

4.1.2.1 *Mathematics* block

No.	Course/ group of courses code	Name of course/group of courses (denote group of courses with symbol **GK**)	Weekly number of hours					Learning effect symbol	Number of hours		Number of ECTS points			Form[2] of course/group of courses	Way[3] of crediting	Course/group of courses			
			lec	cl	lab	pr	sem		ZZU	CNPS	Total	DN[5] classes	BU[1] classes			University -wide[4]	Concerning scientific activities[5]	Practical[6]	Type[7]
1	W06GIG-SM0038	Computer Aided Geological Modelling & Geostatistics (część: Geostatistics)	1		1			K2_GIG_W06,W08,W15 K2_GIG_U04,U08,U14	30	60	2		2	T	Z(w,l)			P (1)	PD
		Total	**1**	**0**	**1**	**0**	**0**		**30**	**60**	**2**		**2**					**1**	

4.1.2.3 *Chemistry* block

No.	Course/ group of courses code	Name of course/group of courses (denote group of courses with symbol **GK**)	Weekly number of hours					Learning effect symbol	Number of hours		Number of ECTS points			Form[2] of course/group of courses	Way[3] of crediting	Course/group of courses			
			lec	cl	lab	pr	sem		ZZU	CNPS	Total	DN[5] classes	BU[1] classes			University -wide[4]	Concerning scientific activities[5]	Practical[6]	Type[7]
1	W06GIG-SM0076	Geochemistry	2					K2_GIG_W02,W10K2 _GIG_K03	30	60	2	2	2	T /Z(w)	Z		DN		PD
		Total	**2**	**0**	**0**	**0**	**0**		**30**	**60**	**2**	**2**	**2**						

Altogether for basic sciences blocks:

Total number of hours					Total number of ZZU hours	Total number of CNPS hours	Total number of ECTS points	Total number of ECTS points for DN classes[5]	Number of ECTS points for BU classes[1]
lec	cl	lab	pr	sem					
3	**0**	**1**	**0**	**0**	**60**	**120**	**4**	**2**	**4**

[1]BU – number of ECTS points assigned to hours of classes requiring direct participation of academic teachers and other persons conducting classes
[2]Traditional – enter T, remote – enter Z
[3]Exam – enter E, crediting – enter Z. For the group of courses – after the letter E or Z - enter in brackets the final course form (lec, cl, lab, pr, sem)
[4]University-wide course /group of courses – enter O
[5]DN - number of ECTS points assigned to the classes related to the University's academic activity in the discipline/disciplines to which the main field of study is assigned
[6]Practical course / group of courses – enter P. For the group of courses – in brackets enter the number of ECTS points assigned to practical courses
[7]KO – general education courses, PD – basic sciences courses, K – main field of study courses, S – specialization courses

4.1.3 List of the main field of study blocks

4.1.3.1 *Obligatory main field of study* blocks

No.	Course/ group of courses code	Name of course/group of courses (denote group of courses with symbol **GK**)	Weekly number of hours					Learning effect symbol	Number of hours		Number of ECTS points			Form[2] of course/group of courses	Way[3] of crediting	Course/group of courses			
			lec	cl	lab	pr	sem		ZZU	CNPS	Total	DN[5] classes	BU[1] classes			University-wide[4]	Concerning scientific activities[5]	Practical[6]	Type[7]
1	W06GIG-SM0038	Computer Aided Geological Modelling & Geostatistics (Część: Computer Aided Geological Modelling)			2			K2_GIG_W06,W08,W15 K2_GIG_U04,U08,U14	30	90	3	3	2	T	Z		DN	P(3)	K
2	W06GIG-SM0068	Excavation Design in Open Pit Mining	2			1		K2_GIG_W07,W09,W10, W14,W18,W19 K2_GIG_U07,U10,U15 K2_GIG_K02	45	150	5	5	4	T /Z(w)	E, Z		DN	P (2)	K
3	W06GIG-SM0043 G	Theory and Practice in Geomechanics (GK)	4	1				K2_GIG_W10,W14 K2_GIG_U04,U08,U10,U15	75	180	6	6	5	T /Z(w)	E,Z		DN	P(2)	K
4	W06GIG-SM0042	Occupational Health and Safety	1			1		K2_GIG_W11,W12,W14,W17, K2_GIG_U11, K2_GIG_K02, K03	30	60	2	2	2	T /Z(w)	Z		DN	P(1)	K
5	W06GIG-SM0073	Tunnel and Underground Excavation Design	2			2		K2_GIG_W07,W09,W10, W14,W16,W18,W19 K2_GIG_U07,U10,U15 K2_GIG_K02	60	150	5	5	4	T /Z(w)	E, Z		DN	P(3)	K
6	W06GIG-SM0078	Environmental Management	2				1	K2_GIG_W04,W12,W13, W18 K2_GIG_U05,U10,U11 K2_GIG_K02,K03	45	90	3	3	2	T /Z(w)	Z		DN	P(1)	K
		Total	**11**	**1**	**2**	**4**	**1**		**285**	**720**	**24**	**24**	**19**					**12**	

Altogether (for main field of study blocks):

Total number of hours					Total number of ZZU hours	Total number of CNPS hours	Total number of ECTS points	Total number of ECTS points for DN classes[5]	Number of ECTS points for BU classes[1]
lec	cl	lab	pr	sem					
11	**1**	**2**	**4**	**1**	**285**	**720**	**24**	**24**	**19**

[1]BU – number of ECTS points assigned to hours of classes requiring direct participation of academic teachers and other persons conducting classes
[2]Traditional – enter T, remote – enter Z
[3]Exam – enter E, crediting – enter Z. For the group of courses – after the letter E or Z - enter in brackets the final course form (lec, cl, lab, pr, sem)
[4]University-wide course /group of courses – enter O
[5]DN - number of ECTS points assigned to the classes related to the University's academic activity in the discipline/disciplines to which the main field of study is assigned
[6]Practical course / group of courses – enter P. For the group of courses – in brackets enter the number of ECTS points assigned to practical courses
[7]KO – general education courses, PD – basic sciences courses, K – main field of study courses, S – specialization courses

4.2 List of optional blocks

4.2.1 List of general education blocks

4.2.1.2 *Foreign languages* block *(min. 3 ECTS points):*

No.	Course/ group of courses code	Name of course/group of courses (denote group of courses with symbol **GK**)	Weekly number of hours					Learning effect symbol	Number of hours		Number of ECTS points			Form[2] of course/group of courses	Way[3] of crediting	Course/group of courses			
			lec	cl	lab	pr	sem		ZZU	CNPS	Total	DN[5] classes	BU[1] classes			University -wide[4]	Concerning scientific activities[5]	Practical[6]	Type[7]
1	SJO-SM0003	Foreign Language		3				K2_GIG_ U03	45	60	2		1	T	Z	O		P (2)	KO
2	SJO-SM0004	Foreign Language		1				K2_GIG_U01,U02	15	30	1		0,5	T	Z	O		P(1)	KO
		Total	**0**	**4**	**0**	**0**	**0**		**60**	**90**	**3**		**1,5**					**3**	

4.2.1.4 *Information technologies* block *(min. 2 ECTS points):*

No.	Course/ group of courses code	Name of course/group of courses (denote group of courses with symbol **GK**)	Weekly number of hours					Learning effect symbol	Number of hours		Number of ECTS points			Form[2] of course/group of courses	Way[3] of crediting	Course/group of courses			
			lec	cl	lab	pr	sem		ZZU	CNPS	Total	DN[5] classes	BU[1] classes			University -wide[4]	Concerning scientific activities[5]	Practical[6]	Type[7]
1	W06GIG-SM0077	AutoCad			2			K2_GIG_U20	30	60	2	0	1,5	T	Z(l)			P (2)	KO
		Total	**0**	**0**	**2**	**0**	**0**		**30**	**60**	**2**	**0**	**1,5**					**2**	

Altogether for general education blocks:

Total number of hours					Total number of ZZU hours	Total number of CNPS hours	Total number of ECTS points	Total number of ECTS points for DN classes[5]	Number of ECTS points for BU classes[1]
lec	cl	lab	pr	sem					
0	**4**	**2**	**0**	**0**	**90**	**150**	**5**	**0**	**3**

[1]BU – number of ECTS points assigned to hours of classes requiring direct participation of academic teachers and other persons conducting classes
[2]Traditional – enter T, remote – enter Z
[3]Exam – enter E, crediting – enter Z. For the group of courses – after the letter E or Z - enter in brackets the final course form (lec, cl, lab, pr, sem)
[4]University-wide course /group of courses – enter O
[5]DN - number of ECTS points assigned to the classes related to the University's academic activity in the discipline/disciplines to which the main field of study is assigned
[6]Practical course / group of courses – enter P. For the group of courses – in brackets enter the number of ECTS points assigned to practical courses
[7]KO – general education courses, PD – basic sciences courses, K – main field of study courses, S – specialization courses

4.2.4 List of specialization blocks

4.2.4.1 *Specialization subjects (e.g. whole specialization)* blocks *(33 ECTS points):*

No.	Course/ group of courses code	Name of course/group of courses (denote group of courses with symbol GK)	Weekly number of hours					Learning effect symbol	Number of hours		Number of ECTS points			Form[2] of course/group of courses	Way[3] of crediting	Course/group of courses			
			lec	cl	lab	pr	sem		ZZU	CNPS	Total	DN[5] classes	BU[1] classes			University-wide[4]	Concerning scientific activities[5]	Practical[6]	Type[7]
1	W06GIG-SM0040	Engineering Geophysics	1			1		K2_GIG_W02,W08,W10 K2_GIG_U04,U13	30	90	3	3	2	T /Z(w)	Z		DN	P(2)	S
2	W06GIG-SM0041G	Integrated Analysis of Deformations in Geomechanical Engineering (GK)	2		2			K2_GIG_W07,W13,W14 K2_GIG_U07,U08,U10	60	150	5	5	4	T /Z(w)	E, Z		DN	P(3)	S
3	W06GIG-SM0072	Machinery Systems	2		1	1		K2_GIG_W07,W09,W18,W19 K2_GIG_U04,U07,U08,U10	60	180	6	6	5	T /Z(w)	E, Z		DN	P(4)	S
4	W06GIG-SM0038	Computer Aided Mine Design	1		3			K2_GIG_W06,W07,W11,W12, W15,W18 K2_GIG_U04,U07,U08,U14,U15 K2_GIG_K01	60	150	5	5	4	T	E, Z		DN	P(3)	S
5	W06GIG-SM0075	Ventilation and Mine Fires	1			2		K2_GIG_W07,W10,W13,W16 K2_GIG_U04,U07,U08,U14,U15 K2_GIG_K02	45	120	4	4	3	T /Z(w)	E, Z		DN	P(2)	S
6	W06GIG-SM0067	Mineral Processing Systems	1			2		K2_GIG_W07,W12,W18 K2_GIG_U04,U05,U07,U15	45	90	3	3	2	T /Z(w)	E, Z		DN	P(2)	S
7	W06GIG-SM0069	Digital Mine	1		1			K2_GIG_W07,W12,W18,W19 K2_GIG_U04,U07,U08	30	60	2	2	1	T /Z(w)	Z		DN	P(1)	S
8	GIG-SM1111AN	Free Elective	2					K2_GIG_W07 K2_GIG_K03	30	90	3		2	T	Z				S
9	GIG-SM3111AN	Free Elective	2					K2_GIG_W07 K2_GIG_K03	30	60	2		2	T	Z				S
		Total	**13**	**0**	**7**	**6**	**0**		**390**	**990**	**33**	**28**	**25**					**17**	

[1]BU – number of ECTS points assigned to hours of classes requiring direct participation of academic teachers and other persons conducting classes
[2]Traditional – enter T, remote – enter Z
[3]Exam – enter E, crediting – enter Z. For the group of courses – after the letter E or Z - enter in brackets the final course form (lec, cl, lab, pr, sem)
[4]University-wide course /group of courses – enter O
[5]DN - number of ECTS points assigned to the classes related to the University's academic activity in the discipline/disciplines to which the main field of study is assigned
[6]Practical course / group of courses – enter P. For the group of courses – in brackets enter the number of ECTS points assigned to practical courses
[7]KO – general education courses, PD – basic sciences courses, K – main field of study courses, S – specialization courses

4.2.4.2 ***Diploma (e.g. diploma profile)*** **block** *(17 ECTS points):*

No.	Course/ group of courses code	Name of course/group of courses (denote group of courses with symbol **GK**)	Weekly number of hours					Learning effect symbol	Number of hours		Number of ECTS points			Form[2] of course/group of courses	Way[3] of crediting	Course/group of courses			
			lec	cl	lab	pr	sem		ZZU	CNPS	Total	DN[5] classes	BU[1] classes			University-wide[4]	Concerning scientific activities[5]	Practical[6]	Type[7]
1	W06GIG-SM0070S	Diploma Seminar					2	K2_GIG_W01 K2_GIG_U01,U13 K2_GIG_K03	30	60	2	2	1	T	Z		DN	P(2)	S
2	W06GIG-SM0054D	Master Thesis		1				K2_GIG_W01,W05,W10 K2_GIG_U01,U04, U08,U10,U13,U15 K2_GIG_K01,K03	15	450	15	15	5	T	Z		DN	P (15)	S
		Total	**0**	**1**	**0**	**0**	**2**		**45**	**510**	**17**	**17**	**6**					**17**	

Altogether for specialization blocks:

Total number of hours					Total number of ZZU hours	Total number of CNPS hours	Total number of ECTS points	Total number of ECTS points for DN classes[5]	Number of ECTS points for BU classes[1]
lec	cl	lab	pr	sem					
13	**1**	**7**	**6**	**2**	**435**	**1500**	**50**	**45**	**31**

[1]BU – number of ECTS points assigned to hours of classes requiring direct participation of academic teachers and other persons conducting classes
[2]Traditional – enter T, remote – enter Z
[3]Exam – enter E, crediting – enter Z. For the group of courses – after the letter E or Z - enter in brackets the final course form (lec, cl, lab, pr, sem)
[4]University-wide course /group of courses – enter O
[5]DN - number of ECTS points assigned to the classes related to the University's academic activity in the discipline/disciplines to which the main field of study is assigned
[6]Practical course / group of courses – enter P. For the group of courses – in brackets enter the number of ECTS points assigned to practical courses
[7]KO – general education courses, PD – basic sciences courses, K – main field of study courses, S – specialization courses

4.3 Training block - concerning principles of training crediting – attachment no. …

Opinion of the Advisory Faculty Council concerning the rules of crediting training block

Name of training			
Number of ECTS points	**Number of ECTS points for BU[1] classes**	**Training crediting mode**	**Code**
5	**5**	**Z**	

Training duration	**Training objective**
	Internship

4.4 „Diploma dissertation" block (*if it is foreseen at first level studies)*

Type of diploma dissertation	Licencjat / inżynier / magister / magister inżynier*	
Number of diploma dissertation semesters	**Number of ECTS points**	**Code**
1	**15**	**W06GIG-SM0054D**
Character of diploma dissertation		
Literature survey, project, computer program, etc.		
Number of BU[1] ECTS points	**5**	

[1]BU – number of ECTS points assigned to hours of classes requiring direct participation of academic teachers and other persons conducting classes
[2]Traditional – enter T, remote – enter Z
[3]Exam – enter E, crediting – enter Z. For the group of courses – after the letter E or Z - enter in brackets the final course form (lec, cl, lab, pr, sem)
[4]University-wide course /group of courses – enter O
[5]DN - number of ECTS points assigned to the classes related to the University's academic activity in the discipline/disciplines to which the main field of study is assigned
[6]Practical course / group of courses – enter P. For the group of courses – in brackets enter the number of ECTS points assigned to practical courses
[7]KO – general education courses, PD – basic sciences courses, K – main field of study courses, S – specialization courses

5. Ways of verifying assumed learning outcomes

Type of classes	Ways of verifying assumed learning outcomes
lecture	e.g. examination, progress/final test
class	e.g. progress/final test
laboratory	e.g. pretest, report from laboratory
project	e.g. project defence
seminar	e.g. participation in discussion, topic presentation, essay
training	e.g. report from training
diploma dissertation	prepared diploma dissertation

6. Range of diploma examination

1. Basic technologies of open pit exploitation
2. Machinery used in surface mining
3. Opening-up a surface mine. Development workings
4. Overburden stripping and dumping; Dumps; Dump slopes and their stability.
5. In-situ stresses. Methods for stress analysis.
6. Rock mass discontinuities and their strength. Slope stability problems and rock fall hazard.
7. Floor strata behavior in room-and-pillar mining. Interaction of roof, pillar and floor.
8. Surface subsidence due to underground mining. Structures resistance against earthquake and mining related motion
9. Occupational risk assessment methods. Identification of harmful, dangerous and nuisance factors in the work environment.
10. Costs as the subject of cost accounting. Variable and fixed costs. Break even point.
11. Capital budgeting, evaluation of different methods
12. Liquidity vs profitability of a company. Ways of their evaluation
13. Continuous transportation systems in mining - advantages and disadvantages
14. Machinery systems applied in surface mining.
15. Machinery systems applied in underground mining

[1]BU – number of ECTS points assigned to hours of classes requiring direct participation of academic teachers and other persons conducting classes
[2]Traditional – enter T, remote – enter Z
[3]Exam – enter E, crediting – enter Z. For the group of courses – after the letter E or Z - enter in brackets the final course form (lec, cl, lab, pr, sem)
[4]University-wide course /group of courses – enter O
[5]DN - number of ECTS points assigned to the classes related to the University's academic activity in the discipline/disciplines to which the main field of study is assigned
[6]Practical course / group of courses – enter P. For the group of courses – in brackets enter the number of ECTS points assigned to practical courses
[7]KO – general education courses, PD – basic sciences courses, K – main field of study courses, S – specialization courses

16. Proper maintenance of mining equipment and monitoring systems
17. Tunneling techniques for varying rock and soil materials.
18. Mining methods, equipment and basic requirements for underground mining.
19. Layout and design of underground mine; development and equipment requirements in soft and hard rocks.
20. Underground mining methods: longwall, shortwall, sublevel caving, block caving, sublevel stopping
21. Roof support, mine working support; different types and their application
22. Factors affecting climate conditions in mine excavations
23. Cooling processes in mines - air conditioning systems.
24. Rules of mines ventilation in terms of natural hazards.
25. Protecting people while underground fire.
26. Environmental management systems
27. Characteristics of hazards for the natural environment resulting from human activities
28. The basic structures of coal preparation and mining processing systems
29. Types and systematics of mineral processing operations.
30. Variogram and methods of its modelling
31. Kriging, its properties and types
32. Geophysical methods of exploration and identification of deposits.
33. Computer aided exploration and identification of deposits.
34. Decision models used in management.

[1]BU – number of ECTS points assigned to hours of classes requiring direct participation of academic teachers and other persons conducting classes
[2]Traditional – enter T, remote – enter Z
[3]Exam – enter E, crediting – enter Z. For the group of courses – after the letter E or Z - enter in brackets the final course form (lec, cl, lab, pr, sem)
[4]University-wide course /group of courses – enter O
[5]DN - number of ECTS points assigned to the classes related to the University's academic activity in the discipline/disciplines to which the main field of study is assigned
[6]Practical course / group of courses – enter P. For the group of courses – in brackets enter the number of ECTS points assigned to practical courses
[7]KO – general education courses, PD – basic sciences courses, K – main field of study courses, S – specialization courses

7. Requirements concerning deadlines for crediting courses/groups of courses for all courses in particular blocks

No.	Course / group of courses code	Name of course / group of courses	Crediting by deadline of... (number of semester)
1	W06GIG-SM0037	Principles and Application of InSAR and GIS in mining	1-4
2	W06GIG-SM0038	Computer Aided Geological Modelling & Geostatistics	1-4
3	W06GIG-SM0039G	Project Management, Appraisal and Risk Evaluation	1-4
4	W06GIG-SM0040	Engineering Geophysics	1-4
5	W06GIG-SM0041G	Integrated Analysis of Deformations in Geomechanical Engineering	1-4
6	W06GIG-SM0042	Occupational Health and Safety	1-4
7	SJO-SM0003	Foreign language	1-4
8	SJO-SM0004	Foreign language	1-4
9	GIG-SM1111AN	Free elective	1-4
10	W06GIG-SM0044G	Applied Remote Sensing in Geosciences	2-4
11	W06GIG-SM0045G	Underground Mine Surveying	2-4
12	W06GIG-SM0046G	Geomonitoring	2-4
13	W06GIG-SM0047G	Operations Management	2-4
14	W06GIG-SM0048G	Geomodelling – Geostatistics for Natural Resource Modelling	2-4
15	GIG-SM1111AN	Free elective	2-4
16	W06GIG-SM0049G	Special Topics Geokinematics	3-4
17	W06GIG-SM0050G	Applied Spatial Data Analysis and Modelling - Case Study (GIS 2)	3-4
18	W06GIG-SM0051G	Geomatics for Mineral Resource and Reserve Management	3-4
19	W06GIG-SM0052G	Reclamation	3-4
20	W06GIG-SM0053	Human Resources Management & Organizational Behaviour	3-4
21	GIG-SM1111AN	Free electives	3
22	W06GIG-SM0054D	Master Thesis	4
23	W06GIG-SM0070S	Diploma Seminar	4

8. Plan of studies (attachment no. 4)

[1]BU – number of ECTS points assigned to hours of classes requiring direct participation of academic teachers and other persons conducting classes
[2]Traditional – enter T, remote – enter Z
[3]Exam – enter E, crediting – enter Z. For the group of courses – after the letter E or Z - enter in brackets the final course form (lec, cl, lab, pr, sem)
[4]University-wide course /group of courses – enter O
[5]DN - number of ECTS points assigned to the classes related to the University's academic activity in the discipline/disciplines to which the main field of study is assigned
[6]Practical course / group of courses – enter P. For the group of courses – in brackets enter the number of ECTS points assigned to practical courses
[7]KO – general education courses, PD – basic sciences courses, K – main field of study courses, S – specialization courses

Approved by faculty student government legislative body:

Patrycja Haraj
President of the Student Government
of the Faculty of Geoengineerin, Mining and Geology

....

Date 21.10.2022 name and surname, signature of student representative

DZIEKAN
prof. dr hab. inż. Radosław Zimroz
(1)

....

Date 21.10.2022 Dean's signature

Zał. nr 4 do ZW 16/2020
Attachment no. 4 to Program of Studies

PLAN OF STUDIES

FACULTY: Geoengineering, Mining and Geology

MAIN FIELD OF STUDY: Mining and geology

EDUCATION LEVEL: second-level studies

FORM OF STUDIES: full-time studies

PROFILE: general academic

SPECIALIZATION: Mining Engineering

LANGUAGE OF STUDY: English

In effect since academic year 2022/23

sem./ hours	1	ECTS	2	ECTS	3	ECTS
1	Theory and Practice in Geomechanics 41000E *W06GIG-SM0043G*	6	Machinery Systems 20110E W06GIG-SM0072	6	Mineral Processing Systems 10020 E W06GIG-SM0067	3
2						
3						
4					Environmental Management 20001Z W06GIG-SM0078	3
5			Tunnel and Underground Excavation Design 20020E W06GIG-SM0073	5		
6	Computer Aided Geological Modelling & Geostatistics 10300Z W06GIG-SM0038	5				
7					Digital Mine 10100 Z W06GIG-SM0069	2
8						
9			Computer Aided Mine Design 10300 E W06GIG-SM0074	5	Operations Research 10100Z W06GIG-SM0079	3
10	Project Management, Appraisal and Risk Evaluation 10210E W06GIG-SM0039G	4				
11					Free Elective 20000 Z GIG-SM3111AN	2
12						
13			Foreign Language I 03000 Z SJO-SM0003BK	2	Diploma Seminar 00002Z W06GIG-SM0070S	2
14	Engineering Geophysics 10010 Z W06GIG-SM0040	3				
15					Master Thesis W06GIG-SM0071D	15
16	Integrated Analysis of Deformations in Geomechanical Engineering 20200E W06GIG-SM0041G	5	Foreign Language II 01000 Z SJO-SM0004BK	1		
17			Free Elective 20000Z GIG-SM1111AN	3		
18						
19			Ventilation and Mine Fires 10020 E W06GIG-SM0075	4		
20	Occupational Health and Safety 100100Z W06GIG-SM0042	2				
21						
22	Excavation Design in Open Pit Mining 20010E W06GIG-SM0068	5	Geochemistry 20000Z W06GIG-SM0076	2		
23						
24			Auto Cad 00200Z W06GIG-SM0077	2		
25						
26						
27						
suma		**30**		**30**		**30**

[1]BU – number of ECTS points assigned to hours of classes requiring direct participation of academic teachers and other persons conducting classes
[2]Traditional – enter T, remote – enter Z
[3]Exam – enter E, crediting – enter Z. For the group of courses – after the letter E or Z - enter in brackets the final course form (lec, cl, lab, pr, sem)
[4]University-wide course /group of courses – enter O
[5]DN - number of ECTS points assigned to the classes related to the University's academic activity in the discipline/disciplines to which the main field of study is assigned
[6]Practical course / group of courses – enter P. For the group of courses – in brackets enter the number of ECTS points assigned to practical courses
[7]KO – general education courses, PD – basic sciences courses, K – main field of study courses, S – specialization courses

Semester 1

Obligatory courses / groups of courses   Number of ECTS points 22

No.	Course/ group of courses code	Name of course/group of courses (denote group of courses with symbol **GK**)	Weekly number of hours					Learning effect symbol	Number of hours		Number of ECTS points			Form[2] of course/group of courses	Way[3] of crediting	Course/group of courses			
			lec	cl	lab	pr	sem		ZZU	CNPS	Total	DN[5] classes	BU[1] classes			University -wide[4]	Concerning scientific activities[5]	Practical[6]	Type[7]
1	W06GIG-SM0043G	Theory and Practice in Geomechanics	4	1				K2_GIG_W10,W14 K2_GIG_U04,U08, U10,U15	75	180	6	6	5	T/Z(w)	E		DN	P(2)	K
2	W06GIG-SM0038	Computer Aided Geological Modelling & Geostatistics	1		3			K2_GIG_W06,W08,W15 K2_GIG_U04,U08,U14	60	150	5	3	4	T /Z(w)	Z(w,l)		DN	P (3)	PD
3	W06GIG-SM0039G	Project Management, Appraisal and Risk Evaluation (GK)	1		2	1		K2_GIG_W10,W14 K2_GIG_U04,U08,U10,U15 K2_GIG_K01	60	120	4	4	3	T/Z(w)	E(w), Z(l,p)		DN	P (3)	KO
4	W06GIG-SM0042	Occupational Health and Safety	1			1		K2_GIG_W11,W12,W14, W17 K2_GIG_U11, K2_GIG_K02, K03	30	60	2	2	2	T /Z(w)	Z		DN	P(1)	K
5	W06GIG -SM0068	Excavation Design in Open Pit Mining	2			1		K2_GIG_W07,W09,W10, W14,W18,W19 K2_GIG_U07,U10,U15 K2_GIG_K02	45	150	5	5	4	T /Z(w)	E, Z		DN	P (2)	K
		Total	**9**	**1**	**5**	**3**	**0**		**270**	**660**	**22**	**20**	**18**					**11**	

Optional courses / groups of courses (8 ECTS points)

No.	Course/ group of courses code	Name of course/group of courses (denote group of courses with symbol **GK**)	Weekly number of hours					Learning effect symbol	Number of hours		Number of ECTS points			Form[2] of course/group of courses	Way[3] of crediting	Course/group of courses			
			lec	cl	lab	pr	sem		ZZU	CNPS	Total	DN[5] classes	BU[1] classes			University -wide[4]	Concerning scientific activities[5]	Practical[6]	Type[7]
1	W06GIG-SM0040	Engineering Geophysics	1			1		K2_GIG_W02,W08,W10 K2_GIG_U04,U13	30	90	3	3	2	T /Z(w)	Z		DN	P(2)	S
2	W06GIG-SM0041G	Integrated Analysis of Deformations in Geomechanical Engineering	2		2			K2_GIG_W07,W13,W14 K2_GIG_U07,U08,U10	60	150	5	5	4	T /Z(w)	E, Z		DN	P(3)	S
		Total	**3**	**0**	**2**	**1**	**0**		**90**	**240**	**8**	**8**	**6**					**5**	

[1]BU – number of ECTS points assigned to hours of classes requiring direct participation of academic teachers and other persons conducting classes
[2]Traditional – enter T, remote – enter Z
[3]Exam – enter E, crediting – enter Z. For the group of courses – after the letter E or Z - enter in brackets the final course form (lec, cl, lab, pr, sem)
[4]University-wide course /group of courses – enter O
[5]DN - number of ECTS points assigned to the classes related to the University's academic activity in the discipline/disciplines to which the main field of study is assigned
[6]Practical course / group of courses – enter P. For the group of courses – in brackets enter the number of ECTS points assigned to practical courses
[7]KO – general education courses, PD – basic sciences courses, K – main field of study courses, S – specialization courses

Altogether in semester

Total number of hours					Total number of ZZU hours	Total number of CNPS hours	Total number of ECTS points	Total number of ECTS points for DN classes[5]	Number of ECTS points for BU classes[1]
lec	cl	lab	pr	sem					
12	**1**	**7**	**4**	**0**	**360**	**900**	**30**	**28**	**24**

Semester 2

Obligatory courses / groups of courses Number of ECTS points 7

No.	Course/ group of courses code	Name of course/group of courses (denote group of courses with symbol **GK**)	Weekly number of hours					Learning effect symbol	Number of hours		Number of ECTS points			Form[2] of course/group of courses	Way[3] of crediting	Course/group of courses			
			lec	cl	lab	pr	sem		ZZU	CNPS	Total	DN[5] classes	BU[1] classes			University -wide[4]	Concerning scientific activities[5]	Practical[6]	Type[7]
	W06GIG-SM0073	Tunnel and Underground Excavation Design	2			2		K2_GIG_W07,W09,W10, W14,W16,W18,W19 K2_GIG_U07,U10,U15 K2_GIG_K02	60	150	5	5	4	T /Z(w)	E, Z		DN	P(3)	K
	W06GIG-SM0076	Geochemistry	2					K2_GIG_W02,W10 K2_GIG_K03	30	60	2	2	2	T /Z(w)	Z		DN		PD
		Total	**4**	**0**	**0**	**2**	**0**		**90**	**210**	**7**	**7**	**6**					**3**	

[1]BU – number of ECTS points assigned to hours of classes requiring direct participation of academic teachers and other persons conducting classes
[2]Traditional – enter T, remote – enter Z
[3]Exam – enter E, crediting – enter Z. For the group of courses – after the letter E or Z - enter in brackets the final course form (lec, cl, lab, pr, sem)
[4]University-wide course /group of courses – enter O
[5]DN - number of ECTS points assigned to the classes related to the University's academic activity in the discipline/disciplines to which the main field of study is assigned
[6]Practical course / group of courses – enter P. For the group of courses – in brackets enter the number of ECTS points assigned to practical courses
[7]KO – general education courses, PD – basic sciences courses, K – main field of study courses, S – specialization courses

Optional courses / groups of courses (23 ECTS points)

No.	Course/ group of courses code	Name of course/group of courses (denote group of courses with symbol **GK**)	Weekly number of hours					Learning effect symbol	Number of hours		Number of ECTS points			Form[2] of course/group of courses	Way[3] of crediting	Course/group of courses			
			lec	cl	lab	pr	sem		ZZU	CNPS	Total	DN[5] classes	BU[1] classes			University-wide[4]	Concerning scientific activities[5]	Practical[6]	Type[7]
1	W06GIG-SM0072	Machinery Systems	2		1	1		K2_GIG_W07,W09,W18,W19 K2_GIG_U04,U07,U08,U10	60	180	6	6	5	T /Z(w)	E, Z		DN	P(4)	S
2	W06GIG-SM0074	Computer Aided Mine Design	1		3			K2_GIG_W06,W07,W11,W12,W15, W18 K2_GIG_U04,U07,U08,U14,U15 K2_GIG_K01	60	150	5	5	4	T /Z(w)	E, Z		DN	P(3)	S
3	W06GIG-SM0075	Ventilation and Mine Fires	1			2		K2_GIG_W07,W10,W13,W16 K2_GIG_U04,U07,U08,U14,U15 K2_GIG_K02	45	120	4	4	3	T /Z(w)	E, Z		DN	P(2)	S
4	SJO-SM0003BK	Foreign Language I		3				K2_GIG_ U03	45	60	2		1	T	Z	O		P (2)	KO
5	SJO-SM0004BK	Foreign Language II		1				K2_GIG_U01,U02	15	30	1		0,5	T	Z	O		P(1)	KO
6	W06GIG-SM0077	Auto Cad			2			K2_GIG_U20	30	60	2		1,5	T	Z(l)			P(2)	KO
7	GIG-SM1111AN	Free elctive	2					K2_GIG_W07 K2_GIG_K03	30	90	3		2	T	Z				S
		Total	**6**	**4**	**6**	**3**	**0**		**285**	**690**	**23**	**15**	**17**					**14**	

Altogether in semester

Total number of hours					Total number of ZZU hours	Total number of CNPS hours	Total number of ECTS points	Total number of ECTS points for DN classes[5]	Number of ECTS points for BU classes[1]
lec	cl	lab	pr	sem					
10	**4**	**6**	**5**	**0**	**375**	**900**	**30**	**22**	**23**

[1]BU – number of ECTS points assigned to hours of classes requiring direct participation of academic teachers and other persons conducting classes
[2]Traditional – enter T, remote – enter Z
[3]Exam – enter E, crediting – enter Z. For the group of courses – after the letter E or Z - enter in brackets the final course form (lec, cl, lab, pr, sem)
[4]University-wide course /group of courses – enter O
[5]DN - number of ECTS points assigned to the classes related to the University's academic activity in the discipline/disciplines to which the main field of study is assigned
[6]Practical course / group of courses – enter P. For the group of courses – in brackets enter the number of ECTS points assigned to practical courses
[7]KO – general education courses, PD – basic sciences courses, K – main field of study courses, S – specialization courses

Semester 3

Obligatory courses / groups of courses Number of ECTS points 6

No.	Course/ group of courses code	Name of course/group of courses (denote group of courses with symbol **GK**)	Weekly number of hours					Learning effect symbol	Number of hours		Number of ECTS points			Form[2] of course/group of courses	Way[3] of crediting	Course/group of courses			
			lec	cl	lab	pr	sem		ZZU	CNPS	Total	DN[5] classes	BU[1] classes			University-wide[4]	Concerning scientific activities[5]	Practical[6]	Type[7]
1	W06GIG -SM0078	Environmental Management	2				1	K2_GIG_W04,W12,W13, W18 K2_GIG_U05,U10,U11 K2_GIG_K02,K03	45	90	3	3	2	T /Z(w)	Z		DN	P(1)	K
2	W06GIG -SM0079	Operations Research	1		1			K2_GIG_W06 K2_GIG_U10,U14 K2_GIG_K01	30	90	3	3	2	T /Z(w)	Z(w,l)		DN	P (1)	KO
		Total	**3**	**0**	**1**	**0**	**1**		**75**	**180**	**6**	**6**	**4**					**2**	

Optional courses / groups of courses (24 ECTS points)

No.	Course/ group of courses code	Name of course/group of courses (denote group of courses with symbol **GK**)	Weekly number of hours					Learning effect symbol	Number of hours		Number of ECTS points			Form[2] of course/group of courses	Way[3] of crediting	Course/group of courses			
			lec	cl	lab	pr	sem		ZZU	CNPS	Total	DN[5] classes	BU[1] classes			University-wide[4]	Concerning scientific activities[5]	Practical[6]	Type[7]
1	W06GIG-SM0069	Mineral Processing Systems	1			2		K2_GIG_W07,W12,W18 K2_GIG_U04,U05,U07,U15	45	90	3	3	2	T /Z(w)	E, Z		DN	P(2)	S
2	W06GIG-SM0069	Digital Mine	1		1			K2_GIG_W07,W12,W18,W19 K2_GIG_U04,U07,U08	30	60	2	2	1	T /Z(w)	Z		DN	P(1)	S
3	GIG-S3111AN	Free Elective	2					K2_GIG_W07 K2_GIG_K03	30	60	2		2	T	Z				S
4	GIG-SM3111AN	Free Elective	2					K2_GIG_W07 K2_GIG_K03	30	60	2		2	T	Z				S
5	W06GIG-SM0070S	Diploma Seminar					2	K2_GIG_W01 K2_GIG_U01,U13 K2_GIG_K03	30	60	2	2	1	T	Z			P(2)	S
6	W06GIG-SM0071D	Master Thesis		1				K2_GIG_W01,W05,W10 K2_GIG_U01,U04,U08,U10,U13,U15 K2_GIG_K01,K03	15	450	15	15	5	T	Z			P (15)	S
		Total	**4**	**1**	**1**	**2**	**2**		**150**	**720**	**24**	**22**	**11**					**20**	

Altogether in semester

Total number of hours					Total number of ZZU hours	Total number of CNPS hours	Total number of ECTS points	Total number of ECTS points for DN classes[5]	Number of ECTS points for BU classes[1]
lec	cl	lab	pr	sem					
7	**1**	**2**	**2**	**3**	**225**	**900**	**30**	**28**	**15**

[1]BU – number of ECTS points assigned to hours of classes requiring direct participation of academic teachers and other persons conducting classes
[2]Traditional – enter T, remote – enter Z
[3]Exam – enter E, crediting – enter Z. For the group of courses – after the letter E or Z - enter in brackets the final course form (lec, cl, lab, pr, sem)
[4]University-wide course /group of courses – enter O
[5]DN - number of ECTS points assigned to the classes related to the University's academic activity in the discipline/disciplines to which the main field of study is assigned
[6]Practical course / group of courses – enter P. For the group of courses – in brackets enter the number of ECTS points assigned to practical courses
[7]KO – general education courses, PD – basic sciences courses, K – main field of study courses, S – specialization courses

2. Set of examinations in semestral arrangement

Course / group of courses code	Names of courses / groups of courses ending with examination	Semester
W06GIG-SM0043G	1. Theory and Practice in Geomechanics	1
W06GIG-SM0039G	2. Project Management, Appraisal and Risk Evaluation	1
W06GIG-SM0041G	3. Integrated Analysis of Deformations in Geomechanical Engineering	
W06GIG-SM0068	4. Excavation Design in Open Pit Mining	1
W06GIG-SM0072	1. Machinery Systems	2
W06GIG-SM0073	2. Tunnel and Underground Excavation Design	2
W06GIG-SM0074	3. Computer Aided Mine Design	2
W06GIG-SM0035	4. Ventilation and Mine Fires	2
W06GIG-SM0067	1. Mineral Processing Systems	3

3. Numbers of allowable deficit of ECTS points after particular semesters

Semester	Allowable deficit of ECTS points after semester
1	12
2	8
3	0

[1]BU – number of ECTS points assigned to hours of classes requiring direct participation of academic teachers and other persons conducting classes
[2]Traditional – enter T, remote – enter Z
[3]Exam – enter E, crediting – enter Z. For the group of courses – after the letter E or Z - enter in brackets the final course form (lec, cl, lab, pr, sem)
[4]University-wide course /group of courses – enter O
[5]DN - number of ECTS points assigned to the classes related to the University's academic activity in the discipline/disciplines to which the main field of study is assigned
[6]Practical course / group of courses – enter P. For the group of courses – in brackets enter the number of ECTS points assigned to practical courses
[7]KO – general education courses, PD – basic sciences courses, K – main field of study courses, S – specialization courses

Opinion of student government legislative body

Patrycja Haraj

Patrycja Haraj
President of the Student Government
of the Faculty of Geoengineerin, Mining and Geology

....

Date 21.10.2022 name and surname, signature of student representative

DZIEKAN

prof. dr hab. inż. Radosław Zimroz

....

Date 21.10.2022 Dean's signature

FACULTY: **of Geoengineering, Mining and Geoology**

MAIN FIELD OF STUDY: **Mining and Geology**

LANGUAGE OF STUDY: English

SPECIALIZATION: **Geotechnical and Environmental Engineering**

DESCRIPTION OF THE PROGRAM OF STUDIES

Main field of study MINING AND GEOLOGY
Profile general academic
Level of studies second level studies
Form of studies full-time studies

1. General description

1.1 Number of semesters: **3**	*1.2 Total number of ECTS points necessary to complete studies at a given level*: **90**
1.3 Total number of hours: **975**	*1.4 Prerequisites (particularly for second-level studies):* professional title of an engineer, interview
1.5 Upon completion of studies graduate obtains professional degree of: Master of Science	*1.6 Graduate profile, employability:* The graduate will have the skills to use advanced knowledge in the field of basic, and specialized subjects. He/she will have the skills to lead teams, make high-risk decisions, and be fluent in using legal and economic knowledge. The graduate will be prepared to design technological processes, as well as to solve scientific and research problems and to undertake creative initiatives. He/she will be prepared to work in enterprises, technical supervision institutions, public state and local administration, in research and development organisations, in Poland and abroad, where advanced knowledge in the field of mining, geology and geomechanics is required. The graduate will be able to use English freely and will be prepared to work in an international environment and intercultural groups during his/her professional career.

1.7 Eligibility to apply for admission to a doctoral school, non-degree postgraduate programmes	*1.8 Indicate connection with University's mission and its development strategy:* The second level study program in the field of study Mining and Geology is in line with the mission and responds to the following strategic goals of Wroclaw University of Science and Technology: 1. Increasing the level of correlation of University activities with the needs of the market, 2. Raising the level of education quality through didactic interdisciplinarity 3. Raising the level of entrepreneurship and commitment in the research processes of students and doctoral students

[1]BU – number of ECTS points assigned to hours of classes requiring direct participation of academic teachers and other persons conducting classes
[2]Traditional – enter T, remote – enter Z
[3]Exam – enter E, crediting – enter Z. For the group of courses – after the letter E or Z - enter in brackets the final course form (lec, cl, lab, pr, sem)
[4]University-wide course /group of courses – enter O
[5]DN - number of ECTS points assigned to the classes related to the University's academic activity in the discipline/disciplines to which the main field of study is assigned
[6]Practical course / group of courses – enter P. For the group of courses – in brackets enter the number of ECTS points assigned to practical courses
[7]KO – general education courses, PD – basic sciences courses, K – main field of study courses, S – specialization courses

2. **Detailed description**

2.1 Total number of learning outcomes in the program of study: W (knowledge) = 19, U (skills) = 15, K (competences) = 3, W + U + K = 37

~~**2.2 For the main field of study assigned to more than one discipline - the number of learning outcomes assigned to the discipline:**~~

~~**D1 (major) .... (this number must be greater than half the total number of learning outcomes)**~~

~~**D2 ....**~~

~~**D3 ....**~~

~~**D4 ....**~~

~~**2.3 For the main field of study assigned to more than one discipline - percentage share of the number of ECTS points for each discipline:**~~

~~**D1 ....% ECTS points**~~

~~**D2 ....% ECTS points**~~

~~**D3 ....% ECTS points**~~

~~**D4 ....% ECTS points**~~

2.4a. For the general academic profile of the main field of study – the number of ECTS points assigned to the classes related to the University's academic activity in the discipline or disciplines to which the main field of study is assigned – DN (must be greater than 50% of the total number of ECTS points from 1.2) 55 ECTS

2.4b. ~~**For the practical profile of the main field of study - the number of ECTS points assigned to the classes shaping practical skills (must be greater than 50% of the total number of ECTS points from 1.2)**~~

[1]BU – number of ECTS points assigned to hours of classes requiring direct participation of academic teachers and other persons conducting classes
[2]Traditional – enter T, remote – enter Z
[3]Exam – enter E, crediting – enter Z. For the group of courses – after the letter E or Z - enter in brackets the final course form (lec, cl, lab, pr, sem)
[4]University-wide course /group of courses – enter O
[5]DN - number of ECTS points assigned to the classes related to the University's academic activity in the discipline/disciplines to which the main field of study is assigned
[6]Practical course / group of courses – enter P. For the group of courses – in brackets enter the number of ECTS points assigned to practical courses
[7]KO – general education courses, PD – basic sciences courses, K – main field of study courses, S – specialization courses

2.5 Concise analysis of compliance of the assumed learning outcomes with the needs of the labor market

The economic development of the country is closely dependent on natural resources, the ability to use them and having appropriate engineering workforce. The assumed learning outcomes correspond to the needs of practice in the field of the generally understood management of mineral resources - technologies and techniques for their identification, valuation, extraction, processing, revitalization of industrial areas, and the practice of managing an enterprise (especially mining) in the sense of managing information, environment and people, using the latest IT and marketing techniques and methods. This integration of economic needs and assumed educational effects favorably shape the labor market for the graduates of the Faculty. Additionally, a good command of English and experience of working in an international group will open up the possibility of working in foreign branches of Polish enterprises and in foreign companies.

2.6. The total number of ECTS points that a student must obtain in classes requiring direct participation of academic teachers or other persons conducting classes and students (enter the sum of ECTS points for courses / groups of courses marked with the BU[1] code) **58,5 ECTS**

2.7. Total number of ECTS points, which student has to obtain from basic sciences classes

Number of ECTS points for obligatory subjects	7
Number of ECTS points for optional subjects	0
Total number of ECTS points	7

2.8. Total number of ECTS points, which student has to obtain from practical classes, including project and laboratory classes (enter total number of ECTS points for courses/group of courses denoted with code P)

Number of ECTS points for obligatory subjects	14
Number of ECTS points for optional subjects	41
Total number of ECTS points	55

[1] BU – number of ECTS points assigned to hours of classes requiring direct participation of academic teachers and other persons conducting classes
[2] Traditional – enter T, remote – enter Z
[3] Exam – enter E, crediting – enter Z. For the group of courses – after the letter E or Z - enter in brackets the final course form (lec, cl, lab, pr, sem)
[4] University-wide course /group of courses – enter O
[5] DN - number of ECTS points assigned to the classes related to the University's academic activity in the discipline/disciplines to which the main field of study is assigned
[6] Practical course / group of courses – enter P. For the group of courses – in brackets enter the number of ECTS points assigned to practical courses
[7] KO – general education courses, PD – basic sciences courses, K – main field of study courses, S – specialization courses

2.9. Minimum number of ECTS points, which student has to obtain doing education blocks offered as part of University-wide classes or other main field of study (enter number of ECTS points for courses/groups of courses denoted with code O)

8 ECTS points

2.10. Total number of ECTS points, which student may obtain doing optional blocks (min. 30% of total number of ECTS points)

63 ECTS points

3. Description of the process leading to learning outcomes acquisition:

1. Upon starting classes in each subject, the student has an appropriate level of knowledge and skills which constitute the prerequisites for a given course (it is verified by the teacher or the dean's office).
2. The student participates in classes organized at the university.
3. The student carries out the assigned work in class and at home (projects, computational tasks, analyzes, prepares presentations) and studies the literature and materials recommended by the teacher.
4. The student uses the appointed hours of the tutor's consultation, explaining his uncertainties and verifying the correct understanding of the course content.
5. The student participates in periodic tests of knowledge and skills, completes the tests available on the e-portal and is familair with the correct answers, grades and comments from the teacher.
6. In some subjects, the student participates in group tasks, taking part in the organization of the group's work, assessment of the activities of individual participants and takes responsibility for the result of the group's work.
7. The student is encouraged to become involved in the work of research clubs, student organizations, discussion clubs, sports groups, participation in social life through work in public welfare organizations, voluntary work, thus gaining valuable interpersonal skills and social competences.
8. The student participates in meetings with companies from the industry, technical excursions, job fairs, tries to gain knowledge about the labor market and additional advantages when applying for a job
9. The student is encouraged to participate in an international student exchange, and through contact with foreigners at the faculty, he or she acquires additional interpersonal, cultural and language qualifications

[1]BU – number of ECTS points assigned to hours of classes requiring direct participation of academic teachers and other persons conducting classes
[2]Traditional – enter T, remote – enter Z
[3]Exam – enter E, crediting – enter Z. For the group of courses – after the letter E or Z - enter in brackets the final course form (lec, cl, lab, pr, sem)
[4]University-wide course /group of courses – enter O
[5]DN - number of ECTS points assigned to the classes related to the University's academic activity in the discipline/disciplines to which the main field of study is assigned
[6]Practical course / group of courses – enter P. For the group of courses – in brackets enter the number of ECTS points assigned to practical courses
[7]KO – general education courses, PD – basic sciences courses, K – main field of study courses, S – specialization courses

4. List of education blocks:

4.1. List of obligatory blocks:

4.1.1 List of general education blocks

4.1.1.1 *Liberal-managerial subjects* block *(4 ECTS points):*

No.	Course/ group of courses code	Name of course/group of courses (denote group of courses with symbol **GK**)	Weekly number of hours					Learning effect symbol	Number of hours		Number of ECTS points			Form[2] of course/group of courses	Way[3] of crediting	Course/group of courses			
			lec	cl	lab	pr	sem		ZZU	CNPS	Total	DN[5] classes	BU[1] classes			University -wide[4]	Concerning scientific activities[5]	Practical[6]	Type[7]
1	W06GIG-SM0039G	Project Management, Appraisal and Risk Evaluation (GK)	1		2	1		K2_GIG_W08,W10, W11 K2_GIG_U04,U08,U10,U15 K2_GIG_K01	60	120	4	4	3	T/Z(w)	E(w), Z(l,p)		DN	P (3)	KO
		Total	**1**	**0**	**2**	**1**	**0**		**60**	**120**	**4**	**4**	**3**					**3**	

Altogether for general education blocks

Total number of hours					Total number of ZZU hours	Total number of CNPS hours	Total number of ECTS points	Total number of ECTS points for DN classes[5]	Number of ECTS points for BU classes[1]
lec	cl	lab	pr	sem					
1	**0**	**2**	**1**	**0**	**60**	**120**	**4**	**4**	**3**

[1]BU – number of ECTS points assigned to hours of classes requiring direct participation of academic teachers and other persons conducting classes
[2]Traditional – enter T, remote – enter Z
[3]Exam – enter E, crediting – enter Z. For the group of courses – after the letter E or Z - enter in brackets the final course form (lec, cl, lab, pr, sem)
[4]University-wide course /group of courses – enter O
[5]DN - number of ECTS points assigned to the classes related to the University's academic activity in the discipline/disciplines to which the main field of study is assigned
[6]Practical course / group of courses – enter P. For the group of courses – in brackets enter the number of ECTS points assigned to practical courses
[7]KO – general education courses, PD – basic sciences courses, K – main field of study courses, S – specialization courses

4.1.2 List of basic sciences blocks

4.1.2.1 *Mathematics* block

No.	Course/ group of courses code	Name of course/group of courses (denote group of courses with symbol **GK**)	Weekly number of hours					Learning effect symbol	Number of hours		Number of ECTS points			Form[2] of course/group of courses	Way[3] of crediting	Course/group of courses			
			lec	cl	lab	pr	sem		ZZU	CNPS	Total	DN[5] classes	BU[1] classes			University -wide[4]	Concerning scientific activities[5]	Practical[6]	Type[7]
1	W06GIG-SM0038	Computer Aided Geological Modelling & Geostatistics (część: Geostatistics)	1		1			K2_GIG_W06,W08,W15 K2_GIG_U04,U08,U14	30	60	2		2	T	Z(w,l)			P (1)	PD
		Total	**1**	**0**	**1**	**0**	**0**		**30**	**60**	**2**		**2**					**1**	

4.1.2.3 *Chemistry* block

No.	Course/ group of courses code	Name of course/group of courses (denote group of courses with symbol **GK**)	Weekly number of hours					Learning effect symbol	Number of hours		Number of ECTS points			Form[2] of course/group of courses	Way[3] of crediting	Course/group of courses			
			lec	cl	lab	pr	sem		ZZU	CNPS	Total	DN[5] classes	BU[1] classes			University -wide[4]	Concerning scientific activities[5]	Practical[6]	Type[7]
1	W07GIG-SM0051	Environmental Chemistry	2		1			K2_GIG_W02,W10 K2_GIG_U10 K2_GIG_K03	45	150	5	5	4	T	Z	O	DN	P(2)	PD
		Total	**2**	**0**	**1**	**0**	**0**		**45**	**150**	**5**	**5**	**4**					**2**	

Altogether for basic sciences blocks:

Total number of hours					Total number of ZZU hours	Total number of CNPS hours	Total number of ECTS points	Total number of ECTS points for DN classes[5]	Number of ECTS points for BU classes[1]
lec	cl	lab	pr	sem					
3	**0**	**2**	**0**	**0**	**75**	**210**	**7**	**5**	**6**

[1]BU – number of ECTS points assigned to hours of classes requiring direct participation of academic teachers and other persons conducting classes
[2]Traditional – enter T, remote – enter Z
[3]Exam – enter E, crediting – enter Z. For the group of courses – after the letter E or Z - enter in brackets the final course form (lec, cl, lab, pr, sem)
[4]University-wide course /group of courses – enter O
[5]DN - number of ECTS points assigned to the classes related to the University's academic activity in the discipline/disciplines to which the main field of study is assigned
[6]Practical course / group of courses – enter P. For the group of courses – in brackets enter the number of ECTS points assigned to practical courses
[7]KO – general education courses, PD – basic sciences courses, K – main field of study courses, S – specialization courses

4.1.3 List of the main field of study blocks

4.1.3.1 *Obligatory main field of study* blocks

No.	Course/ group of courses code	Name of course/group of courses (denote group of courses with symbol **GK**)	Weekly number of hours					Learning effect symbol	Number of hours		Number of ECTS points			Form[2] of course/group of courses	Way[3] of crediting	Course/group of courses			
			lec	cl	lab	pr	sem		ZZU	CNPS	Total	DN[5] classes	BU[1] classes			University-wide[4]	Concerning scientific activities[5]	Practical[6]	Type[7]
1	W06GIG-SM0038	Computer Aided Geological Modelling & Geostatistics (Part: Computer Aided Geological Modelling)			2			K2_GIG_W06,W08,W15 K2_GIG_U04,U08,U14	30	90	3	3	2	T	Z		DN	P(3)	K
2	W06GIG-SM0068	Excavation Design in Open Pit Mining	2			1		K2_GIG_W07,W09,W10, W14,W18,W19 K2_GIG_U07,U10,U15 K2_GIG_K02	45	150	5	5	4	T /Z(w)	E, Z		DN	P (2)	K
3	W06GIG-SM0043 G	Theory and Practice in Geomechanics (GK)	4	1				K2_GIG_W10,W14 K2_GIG_U04,U08,U10,U15	75	180	6	6	5	T /Z(w)	E,Z		DN	P(2)	K
4	W06GIG-SM0042	Occupational Health and Safety	1			1		K2_GIG_W11,W12,W14,W17, K2_GIG_U11, K2_GIG_K02, K03	30	60	2	2	2	T /Z(w)	Z		DN	P(1)	K
		Total	**7**	**1**	**2**	**2**	**0**		**180**	**480**	**16**	**16**	**13**					**8**	

Altogether (for main field of study blocks):

Total number of hours					Total number of ZZU hours	Total number of CNPS hours	Total number of ECTS points	Total number of ECTS points for DN classes[5]	Number of ECTS points for BU classes[1]
lec	cl	lab	pr	sem					
7	**1**	**2**	**2**	**0**	**180**	**480**	**16**	**16**	**13**

[1]BU – number of ECTS points assigned to hours of classes requiring direct participation of academic teachers and other persons conducting classes
[2]Traditional – enter T, remote – enter Z
[3]Exam – enter E, crediting – enter Z. For the group of courses – after the letter E or Z - enter in brackets the final course form (lec, cl, lab, pr, sem)
[4]University-wide course /group of courses – enter O
[5]DN - number of ECTS points assigned to the classes related to the University's academic activity in the discipline/disciplines to which the main field of study is assigned
[6]Practical course / group of courses – enter P. For the group of courses – in brackets enter the number of ECTS points assigned to practical courses
[7]KO – general education courses, PD – basic sciences courses, K – main field of study courses, S – specialization courses

4.2 List of optional blocks

4.2.1 List of general education blocks

4.2.1.1 Liberal-managerial subjects blocks *(2 ECTS points):*

No.	Course/ group of courses code	Name of course/group of courses (denote group of courses with symbol **GK**)	Weekly number of hours					Learning effect symbol	Number of hours		Number of ECTS points			Form[2] of course/group of courses	Way[3] of crediting	Course/group of courses			
			lec	cl	lab	pr	sem		ZZU	CNPS	Total	DN[5] classes	BU[1] classes			University-wide[4]	Concerning scientific activities[5]	Practical[6]	Type[7]
1	W06GIG-SM0074G	Numerical Methods and Optimisation (GK)	1				1	K2_GIG_W06 K2_GIG_U04,U14	30	60	2		1	T	Z			P (1)	KO
		Total	**1**	**0**	**0**	**0**	**1**		**30**	**60**	**2**		**1**					**1**	

4.2.1.2 ***Foreign languages* block** *(min. 3 ECTS points):*

No.	Course/ group of courses code	Name of course/group of courses (denote group of courses with symbol **GK**)	Weekly number of hours					Learning effect symbol	Number of hours		Number of ECTS points			Form[2] of course/group of courses	Way[3] of crediting	Course/group of courses			
			lec	cl	lab	pr	sem		ZZU	CNPS	Total	DN[5] classes	BU[1] classes			University-wide[4]	Concerning scientific activities[5]	Practical[6]	Type[7]
1	SJO-SM0003	Foreign Language I		3				K2_GIG_ U03	45	60	2		1	T	Z	O		P (2)	KO
2	SJO-SM0004	Foreign Language II		1				K2_GIG_U01,U02	15	30	1		0,5	T	Z	O		P(1)	KO
		Total	**0**	**4**	**0**	**0**	**0**		**60**	**90**	**3**		**1,5**					**3**	

[1]BU – number of ECTS points assigned to hours of classes requiring direct participation of academic teachers and other persons conducting classes
[2]Traditional – enter T, remote – enter Z
[3]Exam – enter E, crediting – enter Z. For the group of courses – after the letter E or Z - enter in brackets the final course form (lec, cl, lab, pr, sem)
[4]University-wide course /group of courses – enter O
[5]DN - number of ECTS points assigned to the classes related to the University's academic activity in the discipline/disciplines to which the main field of study is assigned
[6]Practical course / group of courses – enter P. For the group of courses – in brackets enter the number of ECTS points assigned to practical courses
[7]KO – general education courses, PD – basic sciences courses, K – main field of study courses, S – specialization courses

Altogether for general education blocks:

Total number of hours					Total number of ZZU hours	Total number of CNPS hours	Total number of ECTS points	Total number of ECTS points for DN classes[5]	Number of ECTS points for BU classes[1]
lec	cl	lab	pr	sem					
1	**4**	**0**	**0**	**1**	**90**	**150**	**5**	**0**	**2,5**

4.2.4 List of specialization blocks

4.2.4.1 *Specialization subjects (e.g. whole specialization)* blocks *(41 ECTS points):*

No.	Course/ group of courses code	Name of course/group of courses (denote group of courses with symbol GK)	Weekly number of hours					Learning effect symbol	Number of hours		Number of ECTS points			Form[2] of course/group of courses	Way[3] of crediting	Course/group of courses			
			lec	cl	lab	pr	sem		ZZU	CNPS	Total	DN[5] classes	BU[1] classes			University-wide[4]	Concerning scientific activities[5]	Practical[6]	Type[7]
1	W06GIG-SM0040	Engineering Geophysics	1			1		K2_GIG_W02,W08,W10 K2_GIG_U04,U13	30	90	3	3	2	T /Z(w)	Z		DN	P(2)	S
2	W06GIG-SM0041G	Integrated Analysis of Deformations in Geomechanical Engineering (GK)	2		2			K2_GIG_W07,W13,W14 K2_GIG_U07,U08,U10	60	150	5	5	4	T /Z(w)	E, Z		DN	P(3)	S
3	W06GIG-SM0067	Mineral Processing Systems	1			2		K2_GIG_W07,W12,W18 K2_GIG_U04,U05,U07,U15	45	90	3	3	2	T /Z(w)	E, Z		DN	P(2)	S
4	W06GIG-SM0069	Digital Mine	1		1			K2_GIG_W07,W12,W18,W19 K2_GIG_U04,U07,U08	30	60	2	2	1	T /Z(w)	Z		DN	P(1)	S
5	GIG-SM3111AN	Free Elective	2					K2_GIG_W07 K2_GIG_K03	30	60	2		2	T	Z				S
6	W06GIG-SM0056	Methods of Environmental Assessment					2	K2_GIG_W05, W11,W13 K2_GIG_U05,U11,U12,U15	30	60	2		1	T	Z			P(2)	S
7	W06GIG-SM0057G	Waste Incineration and Air Quality Protection (GK)	2				1	K2_GIG_W05,W12 K2_GIG_U05,U07,U10	45	120	4		3	T /Z(w)	E			P(2)	S
8	W06GIG-SM0058G	Water and Wastewater Treatment (GK)	1				1	K2_GIG_W07,W12 K2_GIG_U05,U07,U10	30	60	2		1	T /Z(w)	Z			P(1)	S
9	W06GIG-SM0072G	Environmental Geotechnics (GK)	1				1	K2_GIG_W10,W12 K2_GIG_U05,U07, U10	30	60	2		1	T /Z(w)	Z			P(1)	S
10	W06GIG-SM0060G	Chemical Technologies in Environmental Protection (GK)	1				1	K2_GIG_W07,W12 K2_GIG_U05,U07	30	60	2		1	T /Z(w)	Z			P(1)	S
11	W06GIG-SM0061	Environmental Risk Assessment and Remediation	2					K2_GIG_W04,W11,W14 K2_GIG_U09	30	90	3		2	T /Z(w)	E				S

[1]BU – number of ECTS points assigned to hours of classes requiring direct participation of academic teachers and other persons conducting classes
[2]Traditional – enter T, remote – enter Z
[3]Exam – enter E, crediting – enter Z. For the group of courses – after the letter E or Z - enter in brackets the final course form (lec, cl, lab, pr, sem)
[4]University-wide course /group of courses – enter O
[5]DN - number of ECTS points assigned to the classes related to the University's academic activity in the discipline/disciplines to which the main field of study is assigned
[6]Practical course / group of courses – enter P. For the group of courses – in brackets enter the number of ECTS points assigned to practical courses
[7]KO – general education courses, PD – basic sciences courses, K – main field of study courses, S – specialization courses

No.	Course/ group of courses code	Name of course/group of courses (denote group of courses with symbol **GK**)	lec	cl	lab	pr	sem	Learning effect symbol	ZZU	CNPS	Total	DN[5] classes	BU[1] classes	Form[2] of course/group of courses	Way[3] of crediting	University-wide[4]	Concerning scientific activities[5]	Practical[6]	Type[7]
12	W06GIG-SM0073G	Soil and Water Chemistry (GK)	1		2			K2_GIG_W02,W10 K2_GIG_U05,08, U10	45	120	4		3	T /Z(w)	E			P(2)	S
13	W06GIG-SM0075G	Basics of Waste Management (GK)	2				1	K2_GIG_W04,W07,W12 K2_GIG_U05,U13	45	90	3		2	T /Z(w)	Z			P(1)	S
14	W06GIG-SM0066G	Environmental Geology (GK)	2				1	K2_GIG_W08,W10,W14 K2_GIG_U05,U10	45	120	4		3	T /Z(w)	E			P(2)	S
		Total	**19**	**0**	**5**	**3**	**8**		**525**	**1230**	**41**	**13**	**28**					**20**	

4.2.4.2 *Diploma (e.g. diploma profile)* block *(17 ECTS points):*

No.	Course/ group of courses code	Name of course/group of courses (denote group of courses with symbol **GK**)	Weekly number of hours					Learning effect symbol	Number of hours		Number of ECTS points			Form[2] of course/group of courses	Way[3] of crediting	Course/group of courses			
			lec	cl	lab	pr	sem		ZZU	CNPS	Total	DN[5] classes	BU[1] classes			University-wide[4]	Concerning scientific activities[5]	Practical[6]	Type[7]
1	W06GIG-SM0070S	Diploma Seminar					2	K2_GIG_W01 K2_GIG_U01,U13 K2_GIG_K03	30	60	2	2	1	T	Z		DN	P(2)	S
2	W06GIG-SM0054D	Master Thesis		1				K2_GIG_W01,W05,W10 K2_GIG_U01,U04, U08,U10,U13,U15 K2_GIG_K01,K03	15	450	15	15	5	T	Z		DN	P (15)	S
		Total	**0**	**1**	**0**	**0**	**2**		**45**	**510**	**17**	**17**	**6**					**17**	

Altogether for specialization blocks:

Total number of hours					Total number of ZZU hours	Total number of CNPS hours	Total number of ECTS points	Total number of ECTS points for DN classes[5]	Number of ECTS points for BU classes[1]
lec	cl	lab	pr	sem					
19	**1**	**5**	**3**	**10**	**570**	**1740**	**58**	**30**	**34**

[1]BU – number of ECTS points assigned to hours of classes requiring direct participation of academic teachers and other persons conducting classes
[2]Traditional – enter T, remote – enter Z
[3]Exam – enter E, crediting – enter Z. For the group of courses – after the letter E or Z - enter in brackets the final course form (lec, cl, lab, pr, sem)
[4]University-wide course /group of courses – enter O
[5]DN - number of ECTS points assigned to the classes related to the University's academic activity in the discipline/disciplines to which the main field of study is assigned
[6]Practical course / group of courses – enter P. For the group of courses – in brackets enter the number of ECTS points assigned to practical courses
[7]KO – general education courses, PD – basic sciences courses, K – main field of study courses, S – specialization courses

4.3 Training block - concerning principles of training crediting – attachment no. …

Opinion of the Advisory Faculty Council concerning the rules of crediting training block

Name of training			
Number of ECTS points	**Number of ECTS points for BU[1] classes**	**Training crediting mode**	**Code**
5	**5**	**Z**	

Training duration	Training objective
	Internship

4.4 „Diploma dissertation" block (*if it is foreseen at first level studies)*

Type of diploma dissertation	Licencjat / inżynier / magister / magister inżynier*	
Number of diploma dissertation semesters	**Number of ECTS points**	**Code**
1	**15**	**W06GIG-SM0054D**
Character of diploma dissertation		
Literature survey, project, computer program, etc.		
Number of BU[1] ECTS points	**5**	

[1]BU – number of ECTS points assigned to hours of classes requiring direct participation of academic teachers and other persons conducting classes
[2]Traditional – enter T, remote – enter Z
[3]Exam – enter E, crediting – enter Z. For the group of courses – after the letter E or Z - enter in brackets the final course form (lec, cl, lab, pr, sem)
[4]University-wide course /group of courses – enter O
[5]DN - number of ECTS points assigned to the classes related to the University's academic activity in the discipline/disciplines to which the main field of study is assigned
[6]Practical course / group of courses – enter P. For the group of courses – in brackets enter the number of ECTS points assigned to practical courses
[7]KO – general education courses, PD – basic sciences courses, K – main field of study courses, S – specialization courses

5. Ways of verifying assumed learning outcomes

Type of classes	Ways of verifying assumed learning outcomes
lecture	e.g. examination, progress/final test
class	e.g. progress/final test
laboratory	e.g. pretest, report from laboratory
project	e.g. project defence
seminar	e.g. participation in discussion, topic presentation, essay
training	e.g. report from training
diploma dissertation	prepared diploma dissertation

6. Range of diploma examination

1. Basic technologies of open pit exploitation
2. Machinery used in surface mining
3. Opening-up a surface mine. Development workings
4. Overburden stripping and dumping; Dumps; Dump slopes and their stability
5. In-situ stresses. Methods for stress analysis.
6. Rock mass discontinuities and their strength. Slope stability problems and rock fall hazard.
7. Floor strata behavior in room-and-pillar mining. Interaction of roof, pillar and floor.
8. Surface subsidence due to underground mining. Structures resistance against earthquake and mining related motion
9. Methods of deformation analysis: using the analysis of solid systems and mechanics.
10. Occupational risk assessment methods. Identification of harmful, dangerous and nuisance factors in the work environment.
11. Costs as the subject of cost accounting. Variable and fixed costs. Break even point.
12. Capital budgeting, evaluation of different methods
13. Liquidity vs profitability of a company. Ways of their evaluation
14. Basic elements and concepts of modern water and waste water purification technology and processes
15. Basic concepts of environmental geotechnics
16. The objects, methods and legal background of environmental geology
17. Definition and classification of soils.
18. Contamination of soils and remediation possibilities.

[1]BU – number of ECTS points assigned to hours of classes requiring direct participation of academic teachers and other persons conducting classes
[2]Traditional – enter T, remote – enter Z
[3]Exam – enter E, crediting – enter Z. For the group of courses – after the letter E or Z - enter in brackets the final course form (lec, cl, lab, pr, sem)
[4]University-wide course /group of courses – enter O
[5]DN - number of ECTS points assigned to the classes related to the University's academic activity in the discipline/disciplines to which the main field of study is assigned
[6]Practical course / group of courses – enter P. For the group of courses – in brackets enter the number of ECTS points assigned to practical courses
[7]KO – general education courses, PD – basic sciences courses, K – main field of study courses, S – specialization courses

19. Chemical techniques on environmental pollution treatment, waste recycling and treatment, as well as on pollution control.
20. Environmental impact assessment. Impact Assessment. Monitoring
21. Characteristics of hazards for the natural environment resulting from human activities
22. The basic structures of coal preparation and mining processing systems
23. Types and systematics of mineral processing operations.
24. Variogram and methods of its modelling
25. Kriging, its properties and types
26. Geophysical methods of exploration and identification of deposits.
27. Computer aided exploration and identification of deposits.
28. Decision models used in management.

[1]BU – number of ECTS points assigned to hours of classes requiring direct participation of academic teachers and other persons conducting classes
[2]Traditional – enter T, remote – enter Z
[3]Exam – enter E, crediting – enter Z. For the group of courses – after the letter E or Z - enter in brackets the final course form (lec, cl, lab, pr, sem)
[4]University-wide course /group of courses – enter O
[5]DN - number of ECTS points assigned to the classes related to the University's academic activity in the discipline/disciplines to which the main field of study is assigned
[6]Practical course / group of courses – enter P. For the group of courses – in brackets enter the number of ECTS points assigned to practical courses
[7]KO – general education courses, PD – basic sciences courses, K – main field of study courses, S – specialization courses

7. Requirements concerning deadlines for crediting courses/groups of courses for all courses in particular blocks

No.	Course / group of courses code	Name of course / group of courses	Crediting by deadline of... (number of semester)
1	W06GIG-SM0040	Engineering Geophysics	1-3
2	W06GIG-SM0042	Occupational Health and Safety	1-3
3	W06GIG-SM0038	Computer Aided Geological Modelling & Geostatistics	1-3
4	W06GIG-SM0039G	Project Management, Appraisal and Risk Evaluation (GK)	1-3
5	W06GIG-SM0043G	Theory and Practice in Geomechanics (GK)	1-3
6	W06GIG-SM0041G	Integrated Analysis of Deformations in Geomechanical Engineering	1-3
7	W07GIG-SM0051	Environmental Chemistry	1-3
8	W06GIG-SM0056	Methods of Environmental Assessment	2-3
9	W06GIG-SM0057G	Waste incineration and air quality protection (GK)	2-3
10	W06GIG-SM0058G	Water and Wastewater Treatment (GK)	2-3
11	W06GIG-SM0072G	Environmental Geotechnics (GK)	2-3
12	W06GIG-SM0060G	Chemical Technologies in Environmental Protection (GK)	2-3
13	W06GIG-SM0061	Environmental Risk Assessment and Remediation	2-3
14	W06GIG-SM0073G	Soil and Water Chemistry (GK)	2-3
15	W06GIG-SM0074G	Numerical Methods and Optimisation (GK)	2-3
16	W06GIG-SM0075G	Basics of Waste Management (GK)	2-3
17	W06GIG-SM0066G	Environmental Geology (GK)	2-3
18	SJO-SM0003BK	Foreign language (Język obcy)	2-3
19	SJO-SM0004BK	Foreign language (Język obcy)	3
20	W06GIG-SM0068	Excavation Design in Open Pit Mining	3
21	W06GIG-SM0067	Mineral Processing Systems	3
22	W06GIG-SM0069	Digital Mine	3
23	GIG-SM3111AN	Free elective (kurs wybieralny)	3
24	W06GIG-SM0070S	Diploma Seminar	3
25	W06GIG-SM0071D	Master Thesis	3

8. Plan of studies (attachment no. 4)

[1]BU – number of ECTS points assigned to hours of classes requiring direct participation of academic teachers and other persons conducting classes
[2]Traditional – enter T, remote – enter Z
[3]Exam – enter E, crediting – enter Z. For the group of courses – after the letter E or Z - enter in brackets the final course form (lec, cl, lab, pr, sem)
[4]University-wide course /group of courses – enter O
[5]DN - number of ECTS points assigned to the classes related to the University's academic activity in the discipline/disciplines to which the main field of study is assigned
[6]Practical course / group of courses – enter P. For the group of courses – in brackets enter the number of ECTS points assigned to practical courses
[7]KO – general education courses, PD – basic sciences courses, K – main field of study courses, S – specialization courses

Approved by faculty student government legislative body:

Patrycja Haraj

Patrycja Haraj
President of the Student Government
of the Faculty of Geoengineerin, Mining and Geology

....

Date 21.10.2022 name and surname, signature of student representative

DZIEKAN

prof. dr hab. inż. Radosław Zimroz

(1)

....

Date 21.10.2022 Dean's signature

Zał. nr 4 do ZW 16/2020
Attachment no. 4 to Program of Studies

PLAN OF STUDIES

FACULTY: Geoengineering, Mining and Geology

MAIN FIELD OF STUDY: Mining and geology

EDUCATION LEVEL: second-level studies

FORM OF STUDIES: full-time studies

PROFILE: general academic

SPECIALIZATION: Geotechnical and Environmental Engineering

LANGUAGE OF STUDY: English

In effect since academic year 2022/23

1. Plan of studies structure (optionally)

<table>
<tr><th>sem./ hours.</th><th>1</th><th>ECTS.</th><th>2</th><th>ECTS.</th><th>3</th><th>ECTS</th></tr>
<tr><td>1</td><td rowspan="5">Theory and Practice in Geomechanics 41000E
W06GIG-SM0043G</td><td rowspan="5">6</td><td rowspan="2">Methods of Environmental Assessment 00002Z
W06GIG-SM0056</td><td rowspan="2">2</td><td rowspan="3">Mineral Processing Systems 10020 E
W06GIG-SM0067</td><td rowspan="3">3</td></tr>
<tr><td>2</td></tr>
<tr><td>3</td><td rowspan="3">Waste Incineration and Air Quality Protection 20001 E
W06GIG-SM0057G</td><td rowspan="3">4</td></tr>
<tr><td>4</td><td rowspan="3">Excavation Design in Open Pit Mining 20010E
W06GIG-SM0068</td><td rowspan="3">5</td></tr>
<tr><td>5</td></tr>
<tr><td>6</td><td rowspan="4">Computer Aided Geological Modelling & Geostatistics 10300Z
W06GIG-SM0038</td><td rowspan="4">5</td><td rowspan="2">Water and Wastewater Treatment 10001Z
W06GIG-SM0058G</td><td rowspan="2">2</td></tr>
<tr><td>7</td><td rowspan="2">Digital Mine 10100 Z
W06GIG-SM0069</td><td rowspan="2">2</td></tr>
<tr><td>8</td><td rowspan="2">Environmental Geotechnics 10001Z
W06GIG-SM0072G</td><td rowspan="2">2</td></tr>
<tr><td>9</td><td rowspan="2">Free Elective 20000
GIG-SM3111AN</td><td rowspan="2">2</td></tr>
<tr><td>10</td><td rowspan="4">Project Management, Appraisal and Risk Evaluation 10210E
W06GIG-SM0039G</td><td rowspan="4">4</td><td rowspan="2">Chemical Technologies in Environmental Protection 10001Z
W06GIG-SM0060G</td><td rowspan="2">2</td></tr>
<tr><td>11</td><td rowspan="2">Diploma Seminar 00002Z
W06GIG-SM0070S</td><td rowspan="2">2</td></tr>
<tr><td>12</td><td rowspan="2">Environmental Risk Assessment and Remediation 20000E
W06GIG-SM0061</td><td rowspan="2">3</td></tr>
<tr><td>13</td><td>Foreign Language II 01000 Z
SJO-SM0004BK</td><td>1</td></tr>
<tr><td>14</td><td rowspan="2">Engineering Geophysics 10010 Z
W06GIG-SM0040</td><td rowspan="2">3</td><td rowspan="3">Soil and Water Chemistry 10200E
W06GIG-SM0073G</td><td rowspan="3">4</td><td rowspan="11">Master Thesis
W06GIG-SM0071D</td><td rowspan="11">15</td></tr>
<tr><td>15</td></tr>
<tr><td>16</td><td rowspan="4">Integrated Analysis of Deformations in Geomechanical Engineering 20200E
W06GIG-SM0041G</td><td rowspan="4">5</td></tr>
<tr><td>17</td><td rowspan="2">Numerical Methods and Optimisation 10001Z
W06GIG-SM0074G</td><td rowspan="2">2</td></tr>
<tr><td>18</td></tr>
<tr><td>19</td><td rowspan="2">Foreign language I 03000 Z
SJO-SM0003BK</td><td rowspan="2">2</td></tr>
<tr><td>20</td><td rowspan="2">Occupational Health and Safety 100100Z
W06GIG-SM0042</td><td rowspan="2">2</td></tr>
<tr><td>21</td><td rowspan="3">Basics of Waste Management 20001Z
W06GIG-SM0075G</td><td rowspan="3">3</td></tr>
<tr><td>22</td><td rowspan="3">Environmental Chemistry 20100Z
W07GIG-SM0051</td><td rowspan="3">5</td></tr>
<tr><td>23</td></tr>
<tr><td>24</td><td rowspan="3">Environmental Geology 20001E
W06GIG-SM0066G</td><td rowspan="3">4</td></tr>
<tr><td>25</td><td rowspan="2"></td><td rowspan="2"></td><td rowspan="2"></td><td rowspan="2"></td></tr>
<tr><td>26</td></tr>
<tr><td colspan="2">sum</td><td>30</td><td></td><td>30</td><td></td><td>30</td></tr>
</table>

[1]BU – number of ECTS points assigned to hours of classes requiring direct participation of academic teachers and other persons conducting classes
[2]Traditional – enter T, remote – enter Z
[3]Exam – enter E, crediting – enter Z. For the group of courses – after the letter E or Z - enter in brackets the final course form (lec, cl, lab, pr, sem)
[4]University-wide course /group of courses – enter O
[5]DN - number of ECTS points assigned to the classes related to the University's academic activity in the discipline/disciplines to which the main field of study is assigned
[6]Practical course / group of courses – enter P. For the group of courses – in brackets enter the number of ECTS points assigned to practical courses
[7]KO – general education courses, PD – basic sciences courses, K – main field of study courses, S – specialization courses

Semester 1

Obligatory courses / groups of courses Number of ECTS points 22

No.	Course/ group of courses code	Name of course/group of courses (denote group of courses with symbol **GK**)	Weekly number of hours					Learning effect symbol	Number of hours		Number of ECTS points			Form[2] of course/group of courses	Way[3] of crediting	Course/group of courses			
			lec	cl	lab	pr	sem		ZZU	CNPS	Total	DN[5] classes	BU[1] classes			University -wide[4]	Concerning scientific activities[5]	Practical[6]	Type[7]
1	W06GIG-SM0043G	Theory and Practice in Geomechanics	4	1				K2_GIG_W10,W14 K2_GIG_U04,U08, U10,U15	75	180	6	6	5	T/Z(w)	E		DN	P(2)	K
2	W06GIG-SM0038	Computer Aided Geological Modelling & Geostatistics	1		3			K2_GIG_W06,W08,W15 K2_GIG_U04,U08,U14	60	150	5	3	4	T /Z(w)	Z(w,l)		DN	P (4)	PD
3	W06GIG-SM0039G	Project Management, Appraisal and Risk Evaluation (GK)	1		2	1		K2_GIG_W10,W14 K2_GIG_U04,U08,U10,U15 K2_GIG_K01	60	120	4	4	3	T/Z(w)	E(w), Z(l,p)		DN	P (3)	KO
4	W07GIG-SM0051	Environmental Chemistry	2		1			K2_GIG_W02,W10 K2_GIG_U10 K2_GIG_K03	45	150	5	5	4	T/Z(w)	Z	O	DN	P(2)	PD
5	W06GIG-SM0042	Occupational Health and Safety	1			1		K2_GIG_W11,W12,W14, W17 K2_GIG_U11, K2_GIG_K02, K03	30	60	2	2	2	T /Z(w)	Z		DN	P(1)	K
		Total	**9**	**1**	**6**	**2**	**0**		**270**	**660**	**22**	**20**	**18**					**12**	

Optional courses / groups of courses (8 ECTS points)

No.	Course/ group of courses code	Name of course/group of courses (denote group of courses with symbol **GK**)	Weekly number of hours					Learning effect symbol	Number of hours		Number of ECTS points			Form[2] of course/group of courses	Way[3] of crediting	Course/group of courses			
			lec	cl	lab	pr	sem		ZZU	CNPS	Total	DN[5] classes	BU[1] classes			University -wide[4]	Concerning scientific activities[5]	Practical[6]	Type[7]
1	W06GIG-SM0040	Engineering Geophysics	1			1		K2_GIG_W02,W08,W10 K2_GIG_U04,U13	30	90	3	3	2	T /Z(w)	Z		DN	P(2)	S
2	W06GIG-SM0041G	Integrated Analysis of Deformations in Geomechanical Engineering	2		2			K2_GIG_W07,W13,W14 K2_GIG_U07,U08,U10	60	150	5	5	4	T /Z(w)	E, Z		DN	P(3)	S
		Total	**3**	**0**	**2**	**1**	**0**		**90**	**240**	**8**	**8**	**6**					**5**	

Altogether in semester

Total number of hours					Total number of ZZU hours	Total number of CNPS hours	Total number of ECTS points	Total number of ECTS points for DN classes[5]	Number of ECTS points for BU classes[1]
lec	cl	lab	pr	sem					
12	**1**	**8**	**3**	**0**	**360**	**900**	**30**	**28**	**24**

[1]BU – number of ECTS points assigned to hours of classes requiring direct participation of academic teachers and other persons conducting classes
[2]Traditional – enter T, remote – enter Z
[3]Exam – enter E, crediting – enter Z. For the group of courses – after the letter E or Z - enter in brackets the final course form (lec, cl, lab, pr, sem)
[4]University-wide course /group of courses – enter O
[5]DN - number of ECTS points assigned to the classes related to the University's academic activity in the discipline/disciplines to which the main field of study is assigned
[6]Practical course / group of courses – enter P. For the group of courses – in brackets enter the number of ECTS points assigned to practical courses
[7]KO – general education courses, PD – basic sciences courses, K – main field of study courses, S – specialization courses

Semester 2

Obligatory courses / groups of courses Number of ECTS points 0

No.	Course/ group of courses code	Name of course/group of courses (denote group of courses with symbol **GK**)	Weekly number of hours					Learning effect symbol	Number of hours		Number of ECTS points			Form[2] of course/group of courses	Way[3] of crediting	Course/group of courses			
			lec	cl	lab	pr	sem		ZZU	CNPS	Total	DN[5] classes	BU[1] classes			University-wide[4]	Concerning scientific activities[5]	Practical[6]	Type[7]
		Total																	

[1]BU – number of ECTS points assigned to hours of classes requiring direct participation of academic teachers and other persons conducting classes
[2]Traditional – enter T, remote – enter Z
[3]Exam – enter E, crediting – enter Z. For the group of courses – after the letter E or Z - enter in brackets the final course form (lec, cl, lab, pr, sem)
[4]University-wide course /group of courses – enter O
[5]DN - number of ECTS points assigned to the classes related to the University's academic activity in the discipline/disciplines to which the main field of study is assigned
[6]Practical course / group of courses – enter P. For the group of courses – in brackets enter the number of ECTS points assigned to practical courses
[7]KO – general education courses, PD – basic sciences courses, K – main field of study courses, S – specialization courses

Optional courses / groups of courses (30 ECTS points)

No.	Course/ group of courses code	Name of course/group of courses (denote group of courses with symbol **GK**)	Weekly number of hours					Learning effect symbol	Number of hours		Number of ECTS points			Form[2] of course/group of courses	Way[3] of crediting	Course/group of courses			
			lec	cl	lab	pr	sem		ZZU	CNPS	Total	DN[5] classes	BU[1] classes			University-wide[4]	Concerning scientific activities[5]	Practical[6]	Type[7]
1	W06GIG-SM0057G	Waste incineration and air quality protection (GK)	2				1	K2_GIG_W05,W12 K2_GIG_U05,U07,U10	45	120	4		3	T/Z(w)	E			P(2)	S
2	W06GIG-SM0058G	Water and Wastewater Treatment (GK)	1				1	K2_GIG_W07,W12 K2_GIG_U05,U07,U10	30	60	2		1	T/Z(w)	Z			P(1)	S
3	W06GIG-SM0072G	Environmental Geotechnics (GK)	1				1	K2_GIG_W10,W12 K2_GIG_U05,U07,U10	30	60	2		1	T/Z(w)	Z			P(1)	S
4	W06GIG-SM0060G	Chemical Technologies in Environmental Protection (GK)	1				1	K2_GIG_W07,W12 K2_GIG_U05,U07	30	60	2		1	T/Z(w)	Z			P(1)	S
5	W06GIG-SM0061	Environmental Risk Assessment and Remediation	2					K2_GIG_W04,W11,W14 K2_GIG_U09	30	90	3		2	T /Z(w)	E				S
6	W06GIG-SM0073G	Soil and Water Chemistry (GK)	1		2			K2_GIG_W02,W10 K2_GIG_U05,08,U10	45	120	4		3	T /Z(w)	E			P(2)	S
7	W06GIG-SM75G	Basics of Waste Management (GK)	2				1	K2_GIG_W04,W07,W12 K2_GIG_U05,U13	45	90	3		2	T/Z(w)	Z			P(1)	S
8	W06GIG-SM0066G	Environmental Geology (GK)	2				1	K2_GIG_W08,W10,W14 K2_GIG_U05,U10	45	120	4		3	T/Z(w)	E			P(2)	S
9	W06GIG-SM0056	Methods of Environmental Assessment					2	K2_GIG_W05, W11,W13 K2_GIG_U05,U11,U12,U15	30	60	2		1	T/Z(w)	Z			P(2)	S
10	W06GIG-SM0074G	Numerical Methods and Optimisation (GK)	1				1	K2_GIG_W06 K2_GIG_U04,U14	30	60	2		1	T/Z(w)	Z			P (1)	KO
11	SJO-SM0003BK	Foreign Language I		3				K2_GIG_ U03	45	60	2		1	T	Z	O		P (2)	KO
		Total	**13**	**3**	**2**	**0**	**9**		**405**	**900**	**30**		**19**					**15**	

Altogether in semester

Total number of hours					Total number of ZZU hours	Total number of CNPS hours	Total number of ECTS points	Total number of ECTS points for DN classes[5]	Number of ECTS points for BU classes[1]
lec	cl	lab	pr	sem					
13	**3**	**2**	**0**	**9**	**405**	**900**	**30**	**0**	**19**

[1]BU – number of ECTS points assigned to hours of classes requiring direct participation of academic teachers and other persons conducting classes
[2]Traditional – enter T, remote – enter Z
[3]Exam – enter E, crediting – enter Z. For the group of courses – after the letter E or Z - enter in brackets the final course form (lec, cl, lab, pr, sem)
[4]University-wide course /group of courses – enter O
[5]DN - number of ECTS points assigned to the classes related to the University's academic activity in the discipline/disciplines to which the main field of study is assigned
[6]Practical course / group of courses – enter P. For the group of courses – in brackets enter the number of ECTS points assigned to practical courses
[7]KO – general education courses, PD – basic sciences courses, K – main field of study courses, S – specialization courses

Semester 3

Obligatory courses / groups of courses Number of ECTS points 3

No.	Course/ group of courses code	Name of course/group of courses (denote group of courses with symbol **GK**)	Weekly number of hours					Learning effect symbol	Number of hours		Number of ECTS points			Form[2] of course/group of courses	Way[3] of crediting	Course/group of courses			
			lec	cl	lab	pr	sem		ZZU	CNPS	Total	DN[5] classes	BU[1] classes			University -wide[4]	Concerning scientific activities[5]	Practical[6]	Type[7]
1	W06GIG-SM0068	Excavation Design in Open Pit Mining	2			1		K2_GIG_W07,W09,W10, W14,W18,W19 K2_GIG_U07,U10,U15 K2_GIG_K02	45	150	5	5	4	T /Z(w)	E, Z		DN	P (2)	K
		Total	**2**	**0**	**0**	**1**	**0**		**45**	**150**	**5**	**5**	**4**					**2**	

Optional courses / groups of courses (27 ECTS points)

No.	Course/ group of courses code	Name of course/group of courses (denote group of courses with symbol **GK**)	Weekly number of hours					Learning effect symbol	Number of hours		Number of ECTS points			Form[2] of course/group of courses	Way[3] of crediting	Course/group of courses			
			lec	cl	lab	pr	sem		ZZU	CNPS	Total	DN[5] classes	BU[1] classes			University-wide[4]	Concerning scientific activities[5]	Practical[6]	Type[7]
1	W06GIG-SM0067	Mineral Processing Systems	1			2		K2_GIG_W07,W12,W18 K2_GIG_U04,U05,U07,U15	45	90	3	3	2	T /Z(w)	E, Z		DN	P(2)	S
2	W06GIG-SM0069	Digital Mine	1		1			K2_GIG_W07,W12,W18,W19 K2_GIG_U04,U07,U08	30	60	2	2	1	T /Z(w)	Z		DN	P(1)	S
3	GIG-S3111AN	Free Elective	2					K2_GIG_W07 K2_GIG_K03	30	60	2		2	T	Z				S
4	SJO-SM0004BK	Foreign Language II		1				K2_GIG_U01,U02	15	30	1		0,5	T	Z	O		P(1)	KO
5	W06GIG-SM0070S	Diploma Seminar					2	K2_GIG_W01 K2_GIG_U01,U13 K2_GIG_K03	30	60	2	2	1	T	Z			P(2)	S
6	W06GIG-SM0071D	Master Thesis		1				K2_GIG_W01,W05,W10 K2_GIG_U01,U04,U08,U10,U13, U15 K2_GIG_K01,K03	15	450	15	15	5	T	Z			P (15)	S
		Total	**4**	**2**	**1**	**2**	**2**		**165**	**750**	**25**	**22**	**11,5**					**21**	

Altogether in semester

Total number of hours					Total number of ZZU hours	Total number of CNPS hours	Total number of ECTS points	Total number of ECTS points for DN classes[5]	Number of ECTS points for BU classes[1]
lec	cl	lab	pr	sem					
6	**2**	**1**	**3**	**2**	**210**	**900**	**30**	**27**	**15,5**

[1]BU – number of ECTS points assigned to hours of classes requiring direct participation of academic teachers and other persons conducting classes
[2]Traditional – enter T, remote – enter Z
[3]Exam – enter E, crediting – enter Z. For the group of courses – after the letter E or Z - enter in brackets the final course form (lec, cl, lab, pr, sem)
[4]University-wide course /group of courses – enter O
[5]DN - number of ECTS points assigned to the classes related to the University's academic activity in the discipline/disciplines to which the main field of study is assigned
[6]Practical course / group of courses – enter P. For the group of courses – in brackets enter the number of ECTS points assigned to practical courses
[7]KO – general education courses, PD – basic sciences courses, K – main field of study courses, S – specialization courses

2. Set of examinations in semestral arrangement

Course / group of courses code	Names of courses / groups of courses ending with examination	Semester
W06GIG-SM0043G	1. Theory and Practice in Geomechanics	1
W06GIG-SM0039G	2. Project Management, Appraisal and Risk Evaluation	1
W06GIG-SM0041G	3. Integrated Analysis of Deformations in Geomechanical Engineering	1
W06GIG-SM0057G	4. Waste incineration and air quality protection	2
W06GIG-SM0061	5. Environmental Risk Assessment and Remediation	2
W06GIG-SM0073G	6. Soil and Water Chemistry	2
W06GIG-SM0066G	7. Environmental Geology	2
W06GIG-SM0067	1. Mineral Processing Systems	3
W06GIG-SM0068	2. Excavation Design in Open Pit Mining	3

3. Numbers of allowable deficit of ECTS points after particular semesters

Semester	Allowable deficit of ECTS points after semester
1	12
2	12
3	8
4	0

[1]BU – number of ECTS points assigned to hours of classes requiring direct participation of academic teachers and other persons conducting classes
[2]Traditional – enter T, remote – enter Z
[3]Exam – enter E, crediting – enter Z. For the group of courses – after the letter E or Z - enter in brackets the final course form (lec, cl, lab, pr, sem)
[4]University-wide course /group of courses – enter O
[5]DN - number of ECTS points assigned to the classes related to the University's academic activity in the discipline/disciplines to which the main field of study is assigned
[6]Practical course / group of courses – enter P. For the group of courses – in brackets enter the number of ECTS points assigned to practical courses
[7]KO – general education courses, PD – basic sciences courses, K – main field of study courses, S – specialization courses

Opinion of student government legislative body

Patrycja Haraj

Patrycja Haraj
President of the Student Government
of the Faculty of Geoengineerin, Mining and Geology

....
Date 21.10.2022

....
name and surname, signature of student representative

DZIEKAN

prof. dr hab. inż. Radosław Zimroz

....
Date 21.10.2022

....
Dean's signature

WYDZIAŁ: **Geoinżynierii, Górnictwa i Geologii**

KIERUNEK STUDIÓW: **Górnictwo i geologia**

JĘZYK STUDIÓW: angielski

SPECJALNOŚĆ: **Geomatics for Mineral Resource Management**

ŚCIEŻKA KSZTAŁCENIA: **Freiberg**

Zał. nr 3 do ZW 16/2020

Attachment no. 2. to the Program of Studies

DESCRIPTION OF THE PROGRAM OF STUDIES

Main field of study MINING AND GEOLOGY

Level of studies second level studies

Profile general academic

Form of studies full-time studies

1. General description

1.1 Number of semesters: **4**	*1.2 Total number of ECTS points necessary to complete studies at a given level:* **120**
1.3 Total number of hours: **1140**	*1.4 Prerequisites (particularly for second-level studies):* professional title of an engineer, interview
1.5 Upon completion of studies graduate obtains professional degree of: **Magister inżynier** (Master of Science in Engineering)	1.6 Graduate profile, employability: The graduate of the international specialisation Geomatics for Mineral Resource Management will have the skills to use advanced knowledge in the field of basic, and specialized subjects. He/she will have the skills to lead teams, make high-risk decisions, and be fluent in using legal and economic knowledge. The graduate will be prepared to design technological processes, as well as to solve scientific and research problems and to undertake creative initiatives. He/she will be prepared to work in enterprises, technical supervision institutions, public state and local administration, in research and development organisations, in Poland and abroad, where advanced knowledge in the field of mining, geology and geomatics is required. The graduate be able to use English freely and will be prepared to work in an

	international environment and intercultural groups during his/her professional career.
1.7 Possibility of continuing studies: Eligibility to apply for admission to a doctoral school, non-degree postgraduate programmes	*1.8 Indicate connection with University's mission and its development strategy:* The second level study program in the field of study Mining and Geology is in line with the mission and responds to the following strategic goals of Wroclaw University of Science and Technology: 1. Increasing the level of correlation of University activities with the needs of the market, 2. Raising the level of education quality through didactic interdisciplinarity 3. Raising the level of entrepreneurship and commitment in the research processes of students and doctoral students.

[1]BU – number of ECTS points assigned to hours of classes requiring direct participation of academic teachers and other persons conducting classes
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[3]Exam – enter E, crediting – enter Z. For the group of courses – after the letter E or Z - enter in brackets the final course form (lec, cl, lab, pr, sem)
[4]University-wide course /group of courses – enter O
[5]DN - number of ECTS points assigned to the classes related to the University's academic activity in the discipline/disciplines to which the main field of study is assigned
[6]Practical course / group of courses – enter P. For the group of courses – in brackets enter the number of ECTS points assigned to practical courses
[7]KO – general education courses, PD – basic sciences courses, K – main field of study courses, S – specialization courses

2. **Detailed description**

2.1 Total number of learning outcomes in the program of study: W (knowledge) = 19, U (skills) = 15, K (competences) = 3, W + U + K = 37

~~**2.2 For the main field of study assigned to more than one discipline - the number of learning outcomes assigned to the discipline:**~~

~~**D1 (major) .... (this number must be greater than half the total number of learning outcomes)**~~

~~**D2 ....**~~

~~**D3 ....**~~

~~**D4 ....**~~

~~**2.3 For the main field of study assigned to more than one discipline - percentage share of the number of ECTS points for each discipline:**~~

~~**D1 ....% ECTS points**~~

~~**D2 ....% ECTS points**~~

~~**D3 ....% ECTS points**~~

~~**D4 ....% ECTS points**~~

2.4a. For the general academic profile of the main field of study – the number of ECTS points assigned to the classes related to the University's academic activity in the discipline or disciplines to which the main field of study is assigned – DN (must be greater than 50% of the total number of ECTS points from 1.2) 85 **ECTS**

2.4b. ~~**For the practical profile of the main field of study - the number of ECTS points assigned to the classes shaping practical skills (must be greater than 50% of the total number of ECTS points from 1.2)**~~

[1]BU – number of ECTS points assigned to hours of classes requiring direct participation of academic teachers and other persons conducting classes
[2]Traditional – enter T, remote – enter Z
[3]Exam – enter E, crediting – enter Z. For the group of courses – after the letter E or Z - enter in brackets the final course form (lec, cl, lab, pr, sem)
[4]University-wide course /group of courses – enter O
[5]DN - number of ECTS points assigned to the classes related to the University's academic activity in the discipline/disciplines to which the main field of study is assigned
[6]Practical course / group of courses – enter P. For the group of courses – in brackets enter the number of ECTS points assigned to practical courses
[7]KO – general education courses, PD – basic sciences courses, K – main field of study courses, S – specialization courses

2.5 Concise analysis of compliance of the assumed learning outcomes with the needs of the labor market

The economic development of the country is closely dependent on natural resources, the ability to use them and having appropriate engineering workforce. The assumed learning outcomes correspond to the needs of practice in the field of the generally understood management of mineral resources - technologies and techniques for their identification, valuation, extraction, processing, revitalization of industrial areas, and the practice of managing an enterprise (especially mining) in the sense of managing information, environment and people, using the latest IT and marketing techniques and methods. This integration of economic needs and assumed educational effects favorably shape the labor market for the graduates of the Faculty. Additionally, a good command of English and experience of working in an international group will open up the possibility of working in foreign branches of Polish enterprises and in foreign companies.

2.6. The total number of ECTS points that a student must obtain in classes requiring direct participation of academic teachers or other persons conducting classes and students (enter the sum of ECTS points for courses / groups of courses marked with the BU[1] code) **74,5 ECTS**

2.7. Total number of ECTS points, which student has to obtain from basic sciences classes

Number of ECTS points for obligatory subjects	5
Number of ECTS points for optional subjects	0
Total number of ECTS points	5

2.8. Total number of ECTS points, which student has to obtain from practical classes, including project and laboratory classes (enter total number of ECTS points for courses/group of courses denoted with code P)

Number of ECTS points for obligatory subjects	16
Number of ECTS points for optional subjects	64
Total number of ECTS points	80

[1]BU – number of ECTS points assigned to hours of classes requiring direct participation of academic teachers and other persons conducting classes
[2]Traditional – enter T, remote – enter Z
[3]Exam – enter E, crediting – enter Z. For the group of courses – after the letter E or Z - enter in brackets the final course form (lec, cl, lab, pr, sem)
[4]University-wide course /group of courses – enter O
[5]DN - number of ECTS points assigned to the classes related to the University's academic activity in the discipline/disciplines to which the main field of study is assigned
[6]Practical course / group of courses – enter P. For the group of courses – in brackets enter the number of ECTS points assigned to practical courses
[7]KO – general education courses, PD – basic sciences courses, K – main field of study courses, S – specialization courses

2.9. Minimum number of ECTS points, which student has to obtain doing education blocks offered as part of University-wide classes or other main field of study (enter number of ECTS points for courses/groups of courses denoted with code O)

3 ECTS points

2.10. Total number of ECTS points, which student may obtain doing optional blocks (min. 30% of total number of ECTS points)

93 ECTS points

3. Description of the process leading to learning outcomes acquisition:

1. Upon starting classes in each subject, the student has an appropriate level of knowledge and skills which constitute the prerequisites for a given course (it is verified by the teacher or the dean's office).
2. The student participates in classes organized at the university.
3. The student carries out the assigned work in class and at home (projects, computational tasks, analyzes, prepares presentations) and studies the literature and materials recommended by the teacher.
4. The student uses the appointed hours of the tutor's consultation, explaining his uncertainties and verifying the correct understanding of the course content.
5. The student participates in periodic tests of knowledge and skills, completes the tests available on the e-portal and is familair with the correct answers, grades and comments from the teacher.
6. In some subjects, the student participates in group tasks, taking part in the organization of the group's work, assessment of the activities of individual participants and takes responsibility for the result of the group's work.
7. The student is encouraged to become involved in the work of research clubs, student organizations, discussion clubs, sports groups, participation in social life through work in public welfare organizations, voluntary work, thus gaining valuable interpersonal skills and social competences.
8. The student participates in meetings with companies from the industry, technical excursions, job fairs, tries to gain knowledge about the labor market and additional advantages when applying for a job
9. The student is encouraged to participate in an international student exchange, and through contact with foreigners at the faculty, he or she acquires additional interpersonal, cultural and language qualifications

[1]BU – number of ECTS points assigned to hours of classes requiring direct participation of academic teachers and other persons conducting classes
[2]Traditional – enter T, remote – enter Z
[3]Exam – enter E, crediting – enter Z. For the group of courses – after the letter E or Z - enter in brackets the final course form (lec, cl, lab, pr, sem)
[4]University-wide course /group of courses – enter O
[5]DN - number of ECTS points assigned to the classes related to the University's academic activity in the discipline/disciplines to which the main field of study is assigned
[6]Practical course / group of courses – enter P. For the group of courses – in brackets enter the number of ECTS points assigned to practical courses
[7]KO – general education courses, PD – basic sciences courses, K – main field of study courses, S – specialization courses

4. List of education blocks:

4.1. List of obligatory blocks:

4.1.1 List of general education blocks

4.1.1.1 ***Liberal-managerial subjects*** **block** *(6 ECTS points):*

No.	Course/ group of courses code	Name of course/group of courses (denote group of courses with symbol **GK**)	Weekly number of hours					Learning effect symbol	Number of hours		Number of ECTS points			Form[2] of course/group of courses	Way[3] of crediting	Course/group of courses			
			lec	cl	lab	pr	sem		ZZU	CNPS	Total	DN[5] classes	BU[1] classes			University -wide[4]	Concerning scientific activities[5]	Practical[6]	Type[7]
1	W06GIG-SM0039G	Project Management, Appraisal and Risk Evaluation (GK)	1		2	1		K2_GIG_W08,W10, W11 K2_GIG_U04,U08,U10,U15 K2_GIG_K01	60	120	4	4	3	T/Z(w)	E(w), Z(l,p)		DN	P (3)	KO
2	W06GIG-SM0053	Human Resources Management & Organizational Behaviour	2					K2_GIG_W05,W09 K2_GIG_U08,U09 K2_GIG_K02, K03	30	90	3		2	T	E				KO
		Total	**3**	**0**	**2**	**1**	**0**		**90**	**210**	**7**	**4**	**5**					**3**	

Altogether for general education blocks

Total number of hours					Total number of ZZU hours	Total number of CNPS hours	Total number of ECTS points	Total number of ECTS points for DN classes[5]	Number of ECTS points for BU classes[1]
lec	cl	lab	pr	sem					
3	**0**	**2**	**1**	**0**	**90**	**210**	**7**	**4**	**5**

[1]BU – number of ECTS points assigned to hours of classes requiring direct participation of academic teachers and other persons conducting classes
[2]Traditional – enter T, remote – enter Z
[3]Exam – enter E, crediting – enter Z. For the group of courses – after the letter E or Z - enter in brackets the final course form (lec, cl, lab, pr, sem)
[4]University-wide course /group of courses – enter O
[5]DN - number of ECTS points assigned to the classes related to the University's academic activity in the discipline/disciplines to which the main field of study is assigned
[6]Practical course / group of courses – enter P. For the group of courses – in brackets enter the number of ECTS points assigned to practical courses
[7]KO – general education courses, PD – basic sciences courses, K – main field of study courses, S – specialization courses

4.1.2 List of basic sciences blocks

4.1.2.1 *Mathematics* block

No.	Course/ group of courses code	Name of course/group of courses (denote group of courses with symbol **GK**)	Weekly number of hours					Learning effect symbol	Number of hours		Number of ECTS points			Form[2] of course/group of courses	Way[3] of crediting	Course/group of courses			
			lec	cl	lab	pr	sem		ZZU	CNPS	Total	DN[5] classes	BU[1] classes			University -wide[4]	Concerning scientific activities[5]	Practical[6]	Type[7]
1	W06GIG-SM0038	Computer Aided Geological Modelling & Geostatistics (część: Geostatistics)	1		1			K2_GIG_W06,W08,W15 K2_GIG_U04,U08,U14	30	60	2		2	T	Z(w,l)			P (1)	PD
		Total	**1**	**0**	**1**	**0**	**0**		**30**	**60**	**2**		**2**					**1**	

4.1.2.2 *Physics* block

No.	Course/ group of courses code	Name of course/group of courses (denote group of courses with symbol **GK**)	Weekly number of hours					Learning effect symbol	Number of hours		Number of ECTS points			Form[2] of course/group of courses	Way[3] of crediting	Course/group of courses			
			lec	cl	lab	pr	sem		ZZU	CNPS	Total	DN[5] classes	BU[1] classes			University -wide[4]	Concerning scientific activities[5]	Practical[6]	Type[7]
1	W06GIG-SM0040	Engineering Geophysics	1			1		K2_GIG_W02,W08,W10 K2_GIG_U04,U13	30	90	3	3	2	T /Z(w)	Z		DN	P(2)	PD
		Total	**1**	**0**	**0**	**1**	**0**		**30**	**90**	**3**	**3**	**2**					**2**	

Altogether for basic sciences blocks:

Total number of hours					Total number of ZZU hours	Total number of CNPS hours	Total number of ECTS points	Total number of ECTS points for DN classes[5]	Number of ECTS points for BU classes[1]
lec	cl	lab	pr	sem					
2	**0**	**1**	**1**	**0**	**60**	**150**	**5**	**3**	**4**

[1]BU – number of ECTS points assigned to hours of classes requiring direct participation of academic teachers and other persons conducting classes
[2]Traditional – enter T, remote – enter Z
[3]Exam – enter E, crediting – enter Z. For the group of courses – after the letter E or Z - enter in brackets the final course form (lec, cl, lab, pr, sem)
[4]University-wide course /group of courses – enter O
[5]DN - number of ECTS points assigned to the classes related to the University's academic activity in the discipline/disciplines to which the main field of study is assigned
[6]Practical course / group of courses – enter P. For the group of courses – in brackets enter the number of ECTS points assigned to practical courses
[7]KO – general education courses, PD – basic sciences courses, K – main field of study courses, S – specialization courses

4.1.3 List of the main field of study blocks

4.1.3.1 *Obligatory main field of study* blocks

No.	Course/ group of courses code	Name of course/group of courses (denote group of courses with symbol **GK**)	Weekly number of hours					Learning effect symbol	Number of hours		Number of ECTS points			Form[2] of course/group of courses	Way[3] of crediting	Course/group of courses			
			lec	cl	lab	pr	sem		ZZU	CNPS	Total	DN[5] classes	BU[1] classes			University-wide[4]	Concerning scientific activities[5]	Practical[6]	Type[7]
1	W06GIG-SM0038	Computer Aided Geological Modelling & Geostatistics (Część: Computer Aided Geological Modelling)			2			K2_GIG_W06,W08,W15 K2_GIG_U04,U08,U14	30	90	3	3	2	T	Z		DN	P(3)	K
2	W06GIG-SM0037	Principles and Application of InSAR and GIS in mining	2		3			K2_GIG_W15,W16,W18 K2_GIG_U04,U07,U08	75	150	5	5	4	T /Z(w)	E(w) Z(l)			P(3)	K
3	W06GIG-SM0041G	Integrated Analysis of Deformations in Geomechanical Engineering (GK)	2		2			K2_GIG_W07,W13,W14 K2_GIG_U07,U08,U10	60	150	5	5	4	T /Z(w)	E, Z		DN	P(3)	K
4	W06GIG-SM0042	Occupational Health and Safety	1			1		K2_GIG_W11,W12,W14, W17, K2_GIG_U11, K2_GIG_K02, K03	30	60	2	2	2	T /Z(w)	Z		DN	P(1)	K
		Total	**5**	**0**	**7**	**1**	**0**		**195**	**450**	**15**	**15**	**12**					**10**	

Altogether (for main field of study blocks):

Total number of hours					Total number of ZZU hours	Total number of CNPS hours	Total number of ECTS points	Total number of ECTS points for DN classes[5]	Number of ECTS points for BU classes[1]
lec	cl	lab	pr	sem					
5	**0**	**7**	**1**	**0**	**195**	**450**	**15**	**15**	**12**

[1]BU – number of ECTS points assigned to hours of classes requiring direct participation of academic teachers and other persons conducting classes
[2]Traditional – enter T, remote – enter Z
[3]Exam – enter E, crediting – enter Z. For the group of courses – after the letter E or Z - enter in brackets the final course form (lec, cl, lab, pr, sem)
[4]University-wide course /group of courses – enter O
[5]DN - number of ECTS points assigned to the classes related to the University's academic activity in the discipline/disciplines to which the main field of study is assigned
[6]Practical course / group of courses – enter P. For the group of courses – in brackets enter the number of ECTS points assigned to practical courses
[7]KO – general education courses, PD – basic sciences courses, K – main field of study courses, S – specialization courses

4.2 List of optional blocks

4.2.1 List of general education blocks

4.2.1.2 *Foreign languages* block *(min. 3 ECTS points):*

No.	Course/ group of courses code	Name of course/group of courses (denote group of courses with symbol **GK**)	Weekly number of hours					Learning effect symbol	Number of hours		Number of ECTS points			Form[2] of course/group of courses	Way[3] of crediting	Course/group of courses			
			lec	cl	lab	pr	sem		ZZU	CNPS	Total	DN[5] classes	BU[1] classes			University -wide[4]	Concerning scientific activities[5]	Practical[6]	Type[7]
1	SJO-SM0003	Foreign Language I		3				K2_GIG_ U03	45	60	2		1	T	Z	O		P (2)	KO
2	SJO-SM0004	Foreign Language II		1				K2_GIG_U01,U02	15	30	1		0,5	T	Z	O		P(1)	KO
		Total	**0**	**4**	**0**	**0**	**0**		**60**	**90**	**3**		**1,5**					**3**	

Altogether for general education blocks:

Total number of hours					Total number of ZZU hours	Total number of CNPS hours	Total number of ECTS points	Total number of ECTS points for DN classes[5]	Number of ECTS points for BU classes[1]
lec	cl	lab	pr	sem					
0	**4**	**0**	**0**	**0**	**60**	**90**	**3**	**0**	**1,5**

[1]BU – number of ECTS points assigned to hours of classes requiring direct participation of academic teachers and other persons conducting classes
[2]Traditional – enter T, remote – enter Z
[3]Exam – enter E, crediting – enter Z. For the group of courses – after the letter E or Z - enter in brackets the final course form (lec, cl, lab, pr, sem)
[4]University-wide course /group of courses – enter O
[5]DN - number of ECTS points assigned to the classes related to the University's academic activity in the discipline/disciplines to which the main field of study is assigned
[6]Practical course / group of courses – enter P. For the group of courses – in brackets enter the number of ECTS points assigned to practical courses
[7]KO – general education courses, PD – basic sciences courses, K – main field of study courses, S – specialization courses

4.2.4 List of specialization blocks

4.2.4.1 *Specialization subjects (e.g. whole specialization)* blocks *(61 ECTS points):*

No.	Course/ group of courses code	Name of course/group of courses (denote group of courses with symbol GK)	Weekly number of hours					Learning effect symbol	Number of hours		Number of ECTS points			Form[2] of course/group of courses	Way[3] of crediting	Course/group of courses			
			lec	cl	lab	p r	s e m		ZZU	CNPS	Total	DN[5] classes	BU[1] classes			University-wide[4]	Concerning scientific activities[5]	Practical[6]	Type[7]
1	W06GIG-SM0044G	Applied Remote Sensing in Geosciences (GK)	1		3			K2_GIG_W07,W12,W18 K2_GIG_U04,U07,U08,U10 K2_GIG_K03	60	180	6	4	4	T	E		DN	P(4)	S
2	W06GIG-SM0045G	Underground Mine Surveying (GK)	2		3			K2_GIG_W07,W14 K2_GIG_U04,U07,U10 K2_GIG_K03	75	150	5	5	5	T	E		DN	P(4)	S
3	W06GIG-SM0046G	Geomonitoring (GK)	2		2			K2_GIG_W10,W16 K2_GIG_U04,U07,U10,U12 K2_GIG_K03	60	150	5	5	4	T	E		DN	P(3)	S
4	W06GIG-SM0047G	Operations Management (GK)	2		2			K2_GIG_W05,W06,W09,W13, W14 K2_GIG_U07,U08,U10,U14, U15, K2_GIG_K01	60	180	6		4	T	E			P(4)	S
5	W06GIG-SM0048G	Geomodelling – Geostatistics for Natural Resource Modelling (GK)	2		2			K2_GIG_W06,W08,W18 K2_GIG_U04,U10	60	150	5	5	4	T	E		DN	P(3)	S
6	W06GIG-SM0049G	Special Topics Geokinematics (GK)	2		2			K2_GIG_W07,W10,W16 K2_GIG_U04,U07,U08 K2_GIG_K03	60	120	4	2	4	T	E		DN	P(2)	S
7	W06GIG-SM0050	Applied Spatial Data Analysis and Modelling - Case Study (GIS 2)	3					K2_GIG_W08,W18 K2_GIG_U04,U10	45	150	5		3	T	E		DN	P(3)	S
8	W06GIG-SM0051G	Geomatics for Mineral Resource and Reserve Management (GK)	2			2		K2_GIG_W07,W10,W11,W12, W13 K2_GIG_U04,U05,U10,U12	60	180	6	6	4	T	E		DN	P(4)	S
9	W06GIG-SM0052G	Reclamation (GK)	3		2	1		K2_GIG_W04,W07,W10,W11, W12,W19 K2_GIG_U04,U05,U07,U10, U12	90	180	6	6	6	T	E		DN	P(4)	S
10	W06GIG-SM0091G	Rock Mechanics GK	2		2			K2_GIG_W10,W14,W18 K2_GIG_U04,U07,U10	60	150	5	3	3	T	E		DN	P(3)	S
11	W06GIG-SM0092G	Applied Geodesy GK	2		2			K2_GIG_W10 K2_GIG_U04,U07,U15	60	120	4	2	2	T	E		DN	P(2)	S

[1]BU – number of ECTS points assigned to hours of classes requiring direct participation of academic teachers and other persons conducting classes
[2]Traditional – enter T, remote – enter Z
[3]Exam – enter E, crediting – enter Z. For the group of courses – after the letter E or Z - enter in brackets the final course form (lec, cl, lab, pr, sem)
[4]University-wide course /group of courses – enter O
[5]DN - number of ECTS points assigned to the classes related to the University's academic activity in the discipline/disciplines to which the main field of study is assigned
[6]Practical course / group of courses – enter P. For the group of courses – in brackets enter the number of ECTS points assigned to practical courses
[7]KO – general education courses, PD – basic sciences courses, K – main field of study courses, S – specialization courses

12	W06GIG-SM0093G	Selected Aspects of Engineering Surveying in Mining and Tunnelling GK	2		3			K2_GIG_W07,W09 K2_GIG_U04,U07,U15	75	180	6	6	4	T	E		DN	P(4)	S
10	GIG-SM1111AN	Free elctive	2					K2_GIG_W07 K2_GIG_K03	30	90	3		2	T	Z				S
11	GIG-SM1111AN	Free elctive	2					K2_GIG_W07 K2_GIG_K03	30	90	3		2	T	Z				S
12	GIG-SM1111AN	Free elctive	2					K2_GIG_W07 K2_GIG_K03	30	90	3		2	T	Z				S
13	GIG-SM1111AN	Free elctive	2					K2_GIG_W07 K2_GIG_K03	30	90	3		2	T	Z				S
		Total	**27**	**0**	**16**	**3**	**0**		**690**	**1800**	**60**	**33**	**46**					**31**	

[1]BU – number of ECTS points assigned to hours of classes requiring direct participation of academic teachers and other persons conducting classes
[2]Traditional – enter T, remote – enter Z
[3]Exam – enter E, crediting – enter Z. For the group of courses – after the letter E or Z - enter in brackets the final course form (lec, cl, lab, pr, sem)
[4]University-wide course /group of courses – enter O
[5]DN - number of ECTS points assigned to the classes related to the University's academic activity in the discipline/disciplines to which the main field of study is assigned
[6]Practical course / group of courses – enter P. For the group of courses – in brackets enter the number of ECTS points assigned to practical courses
[7]KO – general education courses, PD – basic sciences courses, K – main field of study courses, S – specialization courses

4.2.4.2 ***Diploma (e.g. diploma profile)*** **block** *(30 ECTS points):*

No.	Course/ group of courses code	Name of course/group of courses (denote group of courses with symbol **GK**)	Weekly number of hours					Learning effect symbol	Number of hours		Number of ECTS points			Form[2] of course/group of courses	Way[3] of crediting	Course/group of courses			
			lec	cl	lab	pr	sem		ZZU	CNPS	Total	DN[5] classes	BU[1] classes			University-wide[4]	Concerning scientific activities[5]	Practical[6]	Type[7]
1	W06GIG-SM0070S	Diploma Seminar					2	K2_GIG_W01 K2_GIG_U01,U13 K2_GIG_K03	30	60	2	2	1	T	Z		DN	P(2)	S
2	W06GIG-SM0054D	Master Thesis		1				K2_GIG_W01,W05,W10 K2_GIG_U01,U04, U08,U10,U13,U15 K2_GIG_K01,K03	15	840	28	28	5	T	Z		DN	P(28)	S
		Total	**0**	**1**	**0**	**0**	**2**		**45**	**900**	**30**	**30**	**6**					**30**	

Altogether for specialization blocks:

Total number of hours					Total number of ZZU hours	Total number of CNPS hours	Total number of ECTS points	Total number of ECTS points for DN classes[5]	Number of ECTS points for BU classes[1]
lec	cl	lab	pr	sem					
27	**1**	**16**	**3**	**2**	**735**	**2700**	**90**	**63**	**52**

[1]BU – number of ECTS points assigned to hours of classes requiring direct participation of academic teachers and other persons conducting classes
[2]Traditional – enter T, remote – enter Z
[3]Exam – enter E, crediting – enter Z. For the group of courses – after the letter E or Z - enter in brackets the final course form (lec, cl, lab, pr, sem)
[4]University-wide course /group of courses – enter O
[5]DN - number of ECTS points assigned to the classes related to the University's academic activity in the discipline/disciplines to which the main field of study is assigned
[6]Practical course / group of courses – enter P. For the group of courses – in brackets enter the number of ECTS points assigned to practical courses
[7]KO – general education courses, PD – basic sciences courses, K – main field of study courses, S – specialization courses

4.3 Training block - concerning principles of training crediting – attachment no. …

Opinion of the Advisory Faculty Council concerning the rules of crediting training block

Name of training			
Number of ECTS points	Number of ECTS points for BU[1] classes	Training crediting mode	Code

Training duration	Training objective

4.4 „Diploma dissertation" block (*if it is foreseen at first level studies)*

Type of diploma dissertation	Licencjat / inżynier / magister / magister inżynier*	
Number of diploma dissertation semesters	**Number of ECTS points**	**Code**
1	**28**	**W06GIG-SM0054D**
Character of diploma dissertation		
Literature survey, project, computer program, etc.		
Number of BU[1] ECTS points	**5**	

[1]BU – number of ECTS points assigned to hours of classes requiring direct participation of academic teachers and other persons conducting classes
[2]Traditional – enter T, remote – enter Z
[3]Exam – enter E, crediting – enter Z. For the group of courses – after the letter E or Z - enter in brackets the final course form (lec, cl, lab, pr, sem)
[4]University-wide course /group of courses – enter O
[5]DN - number of ECTS points assigned to the classes related to the University's academic activity in the discipline/disciplines to which the main field of study is assigned
[6]Practical course / group of courses – enter P. For the group of courses – in brackets enter the number of ECTS points assigned to practical courses
[7]KO – general education courses, PD – basic sciences courses, K – main field of study courses, S – specialization courses

5. Ways of verifying assumed learning outcomes

Type of classes	Ways of verifying assumed learning outcomes
lecture	e.g. examination, progress/final test
class	e.g. progress/final test
laboratory	e.g. pretest, report from laboratory
project	e.g. project defence
seminar	e.g. participation in discussion, topic presentation, essay
training	e.g. report from training
diploma dissertation	prepared diploma dissertation

6. Range of diploma examination

1. Stochastic interpretation of numerical values of a given feature, measured at points with known spatial location.
2. Covariance, correlation and semivariance as measures of continuity of a regionalized variable.
3. Variogram and methods of its modelling.
4. Assessment of the linear error of the estimator of the local value of a given feature.
5. Factors influencing the error value.
6. Kriging, its properties and types.
7. Securing people during an underground fire, escape routes.
8. Occupational risk - assessment methods, estimating occupational risk.
9. Geophysical methods of exploration and identification of deposits.
10. Computer aided exploration and identification of deposits.
11. Basic principles of corporate finance management.
12. Methods of assessing the profitability of investments and their applications.
13. Decision models used in management.
14. Types of environmental management systems.
15. Types and systematics of operations, information model of operations, concepts of system and operation process, efficiency, reliability, effective working time.

[1]BU – number of ECTS points assigned to hours of classes requiring direct participation of academic teachers and other persons conducting classes
[2]Traditional – enter T, remote – enter Z
[3]Exam – enter E, crediting – enter Z. For the group of courses – after the letter E or Z - enter in brackets the final course form (lec, cl, lab, pr, sem)
[4]University-wide course /group of courses – enter O
[5]DN - number of ECTS points assigned to the classes related to the University's academic activity in the discipline/disciplines to which the main field of study is assigned
[6]Practical course / group of courses – enter P. For the group of courses – in brackets enter the number of ECTS points assigned to practical courses
[7]KO – general education courses, PD – basic sciences courses, K – main field of study courses, S – specialization courses

16. Methods of reclamation of post-mining land.
17. Assessment of the accuracy of geodetic measurements.
18. The measurement network used for surveys in mines.
19. Absolute and relative deformation monitoring methods.
20. Geodetic networks for determining deformations and displacements of engineering structures.
21. Geodetic surveys in recognition and development of mineral deposits.
22. Methods of interpolation of measurement data.
23. Spatial data models in GIS.
24. Basic types of spatial analyses in GIS.
25. Types of mining damages and their geodetic monitoring.
26. The principle of assessing the accuracy of displacements.
27. Applications of remote sensing in environmental protection and management of the Earth's natural resources.
28. Advantages and disadvantages of using satellite radar interferometry in monitoring the activity of the land surface.
29. Differences between PsInSAR and SBAS methods.
30. Examples and description of selected remote sensing programs.
31. Methods of geodetic use of SAR images.
32. Applications of active remote sensing systems.
33. Advantages and disadvantages of multispectral and hyperspectral imaging.
34. model of errors of numerical terrain models.

[1]BU – number of ECTS points assigned to hours of classes requiring direct participation of academic teachers and other persons conducting classes
[2]Traditional – enter T, remote – enter Z
[3]Exam – enter E, crediting – enter Z. For the group of courses – after the letter E or Z - enter in brackets the final course form (lec, cl, lab, pr, sem)
[4]University-wide course /group of courses – enter O
[5]DN - number of ECTS points assigned to the classes related to the University's academic activity in the discipline/disciplines to which the main field of study is assigned
[6]Practical course / group of courses – enter P. For the group of courses – in brackets enter the number of ECTS points assigned to practical courses
[7]KO – general education courses, PD – basic sciences courses, K – main field of study courses, S – specialization courses

7. Requirements concerning deadlines for crediting courses/groups of courses for all courses in particular blocks

No.	*Course / group of courses code*	*Name of course / group of courses*	*Crediting by deadline of... (number of semester)*
1	*W06GIG-SM0037*	*Principles and Application of InSAR and GIS in mining*	*1-4*
2	*W06GIG-SM0038*	*Computer Aided Geological Modelling & Geostatistics*	*1-4*
3	*W06GIG-SM0039G*	*Project Management, Appraisal and Risk Evaluation*	*1-4*
4	*W06GIG-SM0040*	*Engineering Geophysics*	*1-4*
5	*W06GIG-SM0041G*	*Integrated Analysis of Deformations in Geomechanical Engineering*	*1-4*
6	*W06GIG-SM0042*	*Occupational Health and Safety*	*1-4*
7	*SJO-SM0003*	*Foreign language*	*1-4*
8	*SJO-SM0004*	*Foreign language*	*1-4*
9	*GIG-SM1111AN*	*Free elective*	*1-4*
10	*W06GIG-SM0044G*	*Applied Remote Sensing in Geosciences*	*2-4*
11	*W06GIG-SM0045G*	*Underground Mine Surveying*	*2-4*
12	*W06GIG-SM0046G*	*Geomonitoring*	*2-4*
13	*W06GIG-SM0047G*	*Operations Management*	*2-4*
14	*W06GIG-SM0048G*	*Geomodelling – Geostatistics for Natural Resource Modelling*	*2-4*
15	*GIG-SM1111AN*	*Free elective*	*2-4*
16	*W06GIG-SM0049G*	*Special Topics Geokinematics*	*3-4*
17	*W06GIG-SM0050G*	*Applied Spatial Data Analysis and Modelling - Case Study (GIS 2)*	*3-4*
18	*W06GIG-SM0051G*	*Geomatics for Mineral Resource and Reserve Management*	*3-4*
19	*W06GIG-SM0052G*	*Reclamation*	*3-4*
20	*W06GIG-SM0053*	*Human Resources Management & Organizational Behaviour*	*3-4*
21	*GIG-SM1111AN*	*Free electives*	*3*
22	*W06GIG-SM0054D*	*Master Thesis*	*4*
23	*W06GIG-SM0070S*	*Diploma Seminar*	*4*

8. Plan of studies (attachment no. 4)

[1]BU – number of ECTS points assigned to hours of classes requiring direct participation of academic teachers and other persons conducting classes
[2]Traditional – enter T, remote – enter Z
[3]Exam – enter E, crediting – enter Z. For the group of courses – after the letter E or Z - enter in brackets the final course form (lec, cl, lab, pr, sem)
[4]University-wide course /group of courses – enter O
[5]DN - number of ECTS points assigned to the classes related to the University's academic activity in the discipline/disciplines to which the main field of study is assigned
[6]Practical course / group of courses – enter P. For the group of courses – in brackets enter the number of ECTS points assigned to practical courses
[7]KO – general education courses, PD – basic sciences courses, K – main field of study courses, S – specialization courses

Approved by faculty student government legislative body:

Patrycja Haraj
President of the Student Government
of the Faculty of Geoengineerin, Mining and Geology

....
Date 21.10.2022

....
name and surname, signature of student representative

DZIEKAN
prof. dr hab. inż. Radosław Zimroz

....
Date 21.10.2022

....
Dean's signature

PLAN OF STUDIES

FACULTY: Geoengineering, Mining and Geology

MAIN FIELD OF STUDY: Mining and geology

EDUCATION LEVEL: second-level studies

FORM OF STUDIES: full-time studies

PROFILE: general academic

SPECIALIZATION: Geomatics for Mineral Resources Management Pathway Freiberg (Geomatyka w zarządzaniu surowcami mineralnymi)

LANGUAGE OF STUDY: English

In effect since academic year 2022/23

Plan of studies structure (optionally)

1. Set of obligatory and optional courses and groups of courses in semestral arrangement

sem./ hours	1	ECTS	2	ECTS	3	ECTS	4	ECTS
1 2 3 4 5	Principles and Application of InSAR and GIS in mining 20300E W06GIG-SM0037	5	Applied Remote Sensing in Geosciences 10300E W06GIG-SM0044G	6	Special Topics Geokinematics 20200E W06GIG-SM0049G	4	Master Thesis 01000Z W06GIG-SM0054D	28
6 7 8 9	Computer Aided Geological Modelling & Geostatistics 10300Z W06GIG-SM0038	5	Underground Mine Surveying 20300E W06GIG-SM0045G	5	Applied Spatial Data Analysis and Modelling - Case Study (GIS 2) 30000E W06GIG-SM0050	5		
10 11 12 13	Project Management, Appraisal and Risk Evaluation 10210E W06GIG-SM0039G	4	Geomonitoring 20200E W06GIG-SM0046G	5	Geomatics for Mineral Resource and Reserve Management 20020E W06GIG-SM0051G	6		
14 15	Engineering Geophysics 10010Z W06GIG-SM0040	3	Operations Management 20200E W06GIG-SM0047G	6	Reclamation 30210E W06GIG-SM0052G	6		
16 17 18 19	Integrated Analysis of Deformations in Geomechanical Engineering 20200E W06GIG-SM0041G	5	Geomodelling – Geostatistics for Natural Resource Modelling 20200E W06GIG-SM0048G	5	Human Resources Management & Organizational Behaviour 20000E W06GIG-SM0053	3	Diploma Seminar 00002Z W06GIG-SM0070S	2
20 21	Occupational Health and Safety 100100Z W06GIG-SM0042	2			Free elective 20000Z GIG-SM1111AN	3		
22 23 24	Foreign Language I 03000 Z SJO-SM0003	2	Free Elective 20000 Z GIG-SM1111AN	3	Free elective 20000Z GIG-SM111AN	3		
25 26	Free Elective 20000 Z GIG-SM1111AN	3						
27	Foreign Language II 01000 Z SJO-SM0004	1						
sum		**30**		**30**		**30**		**30**

[1]BU – number of ECTS points assigned to hours of classes requiring direct participation of academic teachers and other persons conducting classes
[2]Traditional – enter T, remote – enter Z
[3]Exam – enter E, crediting – enter Z. For the group of courses – after the letter E or Z - enter in brackets the final course form (lec, cl, lab, pr, sem)
[4]University-wide course /group of courses – enter O
[5]DN - number of ECTS points assigned to the classes related to the University's academic activity in the discipline/disciplines to which the main field of study is assigned
[6]Practical course / group of courses – enter P. For the group of courses – in brackets enter the number of ECTS points assigned to practical courses
[7]KO – general education courses, PD – basic sciences courses, K – main field of study courses, S – specialization courses

Semester 1

Obligatory courses / groups of courses Number of ECTS points 24

No.	Course/ group of courses code	Name of course/group of courses (denote group of courses with symbol **GK**)	Weekly number of hours					Learning effect symbol	Number of hours		Number of ECTS points			Form[2] of course/group of courses	Way[3] of crediting	Course/group of courses			
			lec	cl	lab	pr	sem		ZZU	CNPS	Total	DN[5] classes	BU[1] classes			University -wide[4]	Concerning scientific activities[5]	Practical[6]	Type[7]
1	W06GIG -SM0037	Principles and Application of InSAR and GIS in mining	2		3			K2_GIG_W15,W16,W18 K2_GIG_U04,U07,U08	75	150	5	5	4	T/Z(w)	E(w) Z(l)		DN	P(3)	K
2	W06GIG-SM0038	Computer Aided Geological Modelling & Geostatistics	1		3			K2_GIG_W06,W08,W15 K2_GIG_U04,U08,U14	60	150	5	3	4	T /Z(w)	Z(w,l)		DN	P (4)	PD
3	W06GIG-SM0039G	Project Management, Appraisal and Risk Evaluation (GK)	1		2	1		K2_GIG_W10,W14 K2_GIG_U04,U08,U10,U15 K2_GIG_K01	60	120	4	4	3	T/Z(w)	E(w), Z(l,p)		DN	P (3)	KO
4	W06GIG-SM0040	Engineering Geophysics	1			1		K2_GIG_W02,W08,W10 K2_GIG_U04,U13	30	90	3	3	2	T /Z(w)	Z		DN	P(2)	PD
5	W06GIG-SM0041G	Integrated Analysis of Deformations in Geomechanical Engineering (GK)	2		2			K2_GIG_W07,W13,W14 K2_GIG_U07,U08,U10	60	150	5	5	4	T /Z(w)	E, Z		DN	P(3)	K
6	W06GIG-SM0042	Occupational Health and Safety	1			1		K2_GIG_W11,W12,W14, W17 K2_GIG_U11, K2_GIG_K02, K03	30	60	2	2	2	T /Z(w)	Z		DN	P(1)	K
		Total	**8**	**0**	**10**	**3**	**0**		**315**	**720**	**24**	**22**	**19**					**16**	

[1]BU – number of ECTS points assigned to hours of classes requiring direct participation of academic teachers and other persons conducting classes
[2]Traditional – enter T, remote – enter Z
[3]Exam – enter E, crediting – enter Z. For the group of courses – after the letter E or Z - enter in brackets the final course form (lec, cl, lab, pr, sem)
[4]University-wide course /group of courses – enter O
[5]DN - number of ECTS points assigned to the classes related to the University's academic activity in the discipline/disciplines to which the main field of study is assigned
[6]Practical course / group of courses – enter P. For the group of courses – in brackets enter the number of ECTS points assigned to practical courses
[7]KO – general education courses, PD – basic sciences courses, K – main field of study courses, S – specialization courses

Optional courses / groups of courses (6 ECTS points)

No.	Course/ group of courses code	Name of course/group of courses (denote group of courses with symbol **GK**)	Weekly number of hours					Learning effect symbol	Number of hours		Number of ECTS points			Form[2] of course/group of courses	Way[3] of crediting	Course/group of courses			
			lec	cl	lab	pr	sem		ZZU	CNPS	Total	DN[5] classes	BU[1] classes			University -wide[4]	Concerning scientific activities[5]	Practical[6]	Type[7]
1	SJO-SM0003	Foreign Language I		3				K2_GIG_ U03	45	60	2		1	T	Z	O		P (2)	KO
2	SJO-SM0004	Foreign Language II		1				K2_GIG_U01,U02	15	30	1		0,5	T	Z	O		P(1)	KO
3	GIG-SM1111AN	Free elctive	2					K2_GIG_W07 K2_GIG_K03	30	90	3		2	T	Z				S
		Total	**2**	**4**	**0**	**0**	**0**		**90**	**180**	**6**		**3,5**					**3**	

Altogether in semester

Total number of hours					Total number of ZZU hours	Total number of CNPS hours	Total number of ECTS points	Total number of ECTS points for DN classes[5]	Number of ECTS points for BU classes[1]
lec	cl	lab	pr	sem					
10	**4**	**10**	**3**	**0**	**405**	**900**	**30**	**22**	**22,5**

Semester 2

Obligatory courses / groups of courses Number of ECTS points 0

No.	Course/ group of courses code	Name of course/group of courses (denote group of courses with symbol **GK**)	Weekly number of hours					Learning effect symbol	Number of hours		Number of ECTS points			Form[2] of course/group of courses	Way[3] of crediting	Course/group of courses			
			lec	cl	lab	pr	sem		ZZU	CNPS	Total	DN[5] classes	BU[1] classes			University -wide[4]	Concerning scientific activities[5]	Practical[6]	Type[7]
		Total																	

[1]BU – number of ECTS points assigned to hours of classes requiring direct participation of academic teachers and other persons conducting classes
[2]Traditional – enter T, remote – enter Z
[3]Exam – enter E, crediting – enter Z. For the group of courses – after the letter E or Z - enter in brackets the final course form (lec, cl, lab, pr, sem)
[4]University-wide course /group of courses – enter O
[5]DN - number of ECTS points assigned to the classes related to the University's academic activity in the discipline/disciplines to which the main field of study is assigned
[6]Practical course / group of courses – enter P. For the group of courses – in brackets enter the number of ECTS points assigned to practical courses
[7]KO – general education courses, PD – basic sciences courses, K – main field of study courses, S – specialization courses

Optional courses / groups of courses (30 ECTS points)

No.	Course/ group of courses code	Name of course/group of courses (denote group of courses with symbol **GK**)	Weekly number of hours					Learning effect symbol	Number of hours		Number of ECTS points			Form[2] of course/group of courses	Way[3] of crediting	Course/group of courses			
			lec	cl	lab	pr	sem		ZZU	CNPS	Total	DN[5] classes	BU[1] classes			University-wide[4]	Concerning scientific activities[5]	Practical[6]	Type[7]
1	W06GIG-SM0044G	Applied Remote Sensing in Geosciences (GK)	1		3			K2_GIG_W07,W12,W18 K2_GIG_U04,U07,U08, U10 K2_GIG_K03	60	180	6	4	4	T	E		DN	P(4)	S
2	W06GIG-SM0045G	Underground Mine Surveying (GK)	2		3			K2_GIG_W07,W14 K2_GIG_U04,U07,U10 K2_GIG_K03	75	150	5	5	5	T	E		DN	P(4)	S
3	W06GIG-SM0046G	Geomonitoring (GK)	2		2			K2_GIG_W10,W16 K2_GIG_U04,U07, U10,U12 K2_GIG_K03	60	150	5	5	4	T	E		DN	P(3)	S
4	W06GIG-SM0047G	Operations Management (GK)	2		2			K2_GIG_W05,W06,W09,W13,W14 K2_GIG_U07,U08, U10,U14,U15 K2_GIG_K01	60	180	6		4	T	E			P(4)	S
5	W06GIG-SM0048G	Geomodelling – Geostatistics for Natural Resource Modelling (GK)	2		2			K2_GIG_W06,W08,W18 K2_GIG_U04,U10	60	150	5	5	4	T	E		DN	P(3)	S
6	GIG-SM1111AN	Free elctive	2					K2_GIG_W07 K2_GIG_K03	30	90	3		2	T	Z				S
		Total	**11**	**0**	**12**	**0**	**0**		**345**	**900**	**30**	**19**	**23**					**18**	

Altogether in semester

Total number of hours					Total number of ZZU hours	Total number of CNPS hours	Total number of ECTS points	Total number of ECTS points for DN classes[5]	Number of ECTS points for BU classes[1]
lec	cl	lab	pr	sem					
11	**0**	**12**	**0**	**0**	**345**	**900**	**30**	**19**	**23**

[1]BU – number of ECTS points assigned to hours of classes requiring direct participation of academic teachers and other persons conducting classes
[2]Traditional – enter T, remote – enter Z
[3]Exam – enter E, crediting – enter Z. For the group of courses – after the letter E or Z - enter in brackets the final course form (lec, cl, lab, pr, sem)
[4]University-wide course /group of courses – enter O
[5]DN - number of ECTS points assigned to the classes related to the University's academic activity in the discipline/disciplines to which the main field of study is assigned
[6]Practical course / group of courses – enter P. For the group of courses – in brackets enter the number of ECTS points assigned to practical courses
[7]KO – general education courses, PD – basic sciences courses, K – main field of study courses, S – specialization courses

Semester 3

Obligatory courses / groups of courses Number of ECTS points 3

No.	Course/ group of courses code	Name of course/group of courses (denote group of courses with symbol **GK**)	Weekly number of hours					Learning effect symbol	Number of hours		Number of ECTS points			Form[2] of course/group of courses	Way[3] of crediting	Course/group of courses			
			lec	cl	lab	pr	sem		ZZU	CNPS	Total	DN[5] classes	BU[1] classes			University-wide[4]	Concerning scientific activities[5]	Practical[6]	Type[7]
1	W06GIG-SM0053	Human Resources Management & Organizational Behaviour	2					K2_GIG_W05,W09 K2_GIG_U08,U09 K2_GIG_K02, K03	30	90	3		2	T	E				KO
		Total	**2**	**0**	**0**	**0**	**0**		**30**	**90**	**3**	**0**	**2**						

Optional courses / groups of courses (27 ECTS points)

No.	Course/ group of courses code	Name of course/group of courses (denote group of courses with symbol **GK**)	Weekly number of hours					Learning effect symbol	Number of hours		Number of ECTS points			Form[2] of course/group of courses	Way[3] of crediting	Course/group of courses			
			lec	cl	lab	pr	sem		ZZU	CNPS	Total	DN[5] classes	BU[1] classes			University-wide[4]	Concerning scientific activities[5]	Practical[6]	Type[7]
1	W06GIG-SM0049G	Special Topics Geokinematics (GK)	2		2			K2_GIG_W07,W10,W16 K2_GIG_U04,U07, U08 K2_GIG_K03	60	120	4	2	4	T	E		2	P(2)	S
2	W06GIG-SM0050	Applied Spatial Data Analysis and Modelling - Case Study (GIS 2)	3					K2_GIG_W08,W18 K2_GIG_U04,U10	45	150	5		3	T	E		-	P(3)	S
3	W06GIG-SM0041G	Geomatics for Mineral Resource and Reserve Management (GK)	2			2		K2_GIG_W07,W10, W11,W12,W13 K2_GIG_U04,U05, U10,U12	60	180	6	6	4	T	E		6	P(4)	S
4	W06GIG-SM0052G	Reclamation (GK)	3		2	1		K2_GIG_W04,W07, W10,W11,W12,W19 K2_GIG_U04,U05,U07,U10,U12	90	180	6	6	6	T	E		6	P(4)	S
5	GIG-SM3111AN	Free elctive	2					K2_GIG_W07 K2_GIG_K03	30	90	3		2	T	Z				S
6	GIG-SM3111AN	Free elctive	2					K2_GIG_W07 K2_GIG_K03	30	90	3		2	T	Z				S
		Total	**14**	**0**	**4**	**3**	**0**		**315**	**810**	**27**	**14**	**21**					**13**	

[1]BU – number of ECTS points assigned to hours of classes requiring direct participation of academic teachers and other persons conducting classes
[2]Traditional – enter T, remote – enter Z
[3]Exam – enter E, crediting – enter Z. For the group of courses – after the letter E or Z - enter in brackets the final course form (lec, cl, lab, pr, sem)
[4]University-wide course /group of courses – enter O
[5]DN - number of ECTS points assigned to the classes related to the University's academic activity in the discipline/disciplines to which the main field of study is assigned
[6]Practical course / group of courses – enter P. For the group of courses – in brackets enter the number of ECTS points assigned to practical courses
[7]KO – general education courses, PD – basic sciences courses, K – main field of study courses, S – specialization courses

Altogether in semester

Total number of hours					Total number of ZZU hours	Total number of CNPS hours	Total number of ECTS points	Total number of ECTS points for DN classes[5]	Number of ECTS points for BU classes[1]
lec	cl	lab	pr	sem					
16	**0**	**4**	**3**	**0**	**345**	**900**	**30**	**14**	**23**

Semester 4

Optional courses / groups of courses (30 ECTS points)

No.	Course/ group of courses code	Name of course/group of courses (denote group of courses with symbol **GK**)	Weekly number of hours					Learning effect symbol	Number of hours		Number of ECTS points			Form[2] of course/group of courses	Way[3] of crediting	Course/group of courses			
			lec	cl	lab	pr	sem		ZZU	CNPS	Total	DN[5] classes	BU[1] classes			University -wide[4]	Concerning scientific activities[5]	Practical[6]	Type[7]
1	W06GIG-SM0070S	Diploma Seminar					2	K2_GIG_W01 K2_GIG_U01,U13 K2_GIG_K03	30	60	2	2	1	T	Z		DN	P(2)	S
2	W06GIG-SM0054D	Master Thesis		1				K2_GIG_W01,W05,W10 K2_GIG_U01,U04, U08,U10,U13,U15 K2_GIG_K01,K03	15	840	28	28	5	T	Z		DN	P(28)	S
		Total	**0**	**1**	**0**	**0**	**2**		**45**	**900**	**30**	**30**	**6**					**30**	

Altogether in semester

Total number of hours					Total number of ZZU hours	Total number of CNPS hours	Total number of ECTS points	Total number of ECTS points for DN classes[5]	Number of ECTS points for BU classes[1]
lec	cl	lab	pr	sem					
0	**1**	**0**	**0**	**2**	**45**	**900**	**30**	**30**	**6**

[1]BU – number of ECTS points assigned to hours of classes requiring direct participation of academic teachers and other persons conducting classes
[2]Traditional – enter T, remote – enter Z
[3]Exam – enter E, crediting – enter Z. For the group of courses – after the letter E or Z - enter in brackets the final course form (lec, cl, lab, pr, sem)
[4]University-wide course /group of courses – enter O
[5]DN - number of ECTS points assigned to the classes related to the University's academic activity in the discipline/disciplines to which the main field of study is assigned
[6]Practical course / group of courses – enter P. For the group of courses – in brackets enter the number of ECTS points assigned to practical courses
[7]KO – general education courses, PD – basic sciences courses, K – main field of study courses, S – specialization courses

2. Set of examinations in semestral arrangement

Course / group of courses code	Names of courses / groups of courses ending with examination	Semester
W06GIG-SM0037 W06GIG-SM0039G W06GIG-SM0041G	1. Principles and Application of InSAR and GIS in mining 2. Project Management, Appraisal and Risk Evaluation 3. Integrated Analysis of Deformations in Geomechanical Engineering	1 1 1
W06GIG-SM0044G W06GIG-SM0045G W06GIG-SM0046G W06GIG-SM0047G W06GIG-SM0048G	1. Applied Remote Sensing in Geosciences 2. Underground Mine Surveying 3. Geomonitoring 4. Operations Management 5. Geomodelling – Geostatistics for Natural Resource Modelling	2 2 2 2 2
W06GIG-SM0049G W06GIG-SM0050 W06GIG-SM0051G W06GIG-SM0052G W06GIG-SM0053	1. Special Topics Geokinematic 2. Applied Spatial Data Analysis and Modelling - Case Study 3. Geomatics for Mineral Resource and Reserve Management 4. Reclamation 5. Human Resources Management & Organizational Behaviour	3 3 3 3 3

3. Numbers of allowable deficit of ECTS points after particular semesters

Semester	Allowable deficit of ECTS points after semester
1	12
2	12
3	8
4	0

[1]BU – number of ECTS points assigned to hours of classes requiring direct participation of academic teachers and other persons conducting classes
[2]Traditional – enter T, remote – enter Z
[3]Exam – enter E, crediting – enter Z. For the group of courses – after the letter E or Z - enter in brackets the final course form (lec, cl, lab, pr, sem)
[4]University-wide course /group of courses – enter O
[5]DN - number of ECTS points assigned to the classes related to the University's academic activity in the discipline/disciplines to which the main field of study is assigned
[6]Practical course / group of courses – enter P. For the group of courses – in brackets enter the number of ECTS points assigned to practical courses
[7]KO – general education courses, PD – basic sciences courses, K – main field of study courses, S – specialization courses

Opinion of student government legislative body

Patrycja Haraj

Patrycja Haraj
President of the Student Government
of the Faculty of Geoengineerin, Mining and Geology

....

Date 21.10.2022 name and surname, signature of student representative

DZIEKAN
prof. dr hab. inż. Radosław Zimroz

....

Date 21.10.2022 Dean's signature

FACULTY: **of Geoengineering, Mining and Geoology**

MAIN FIELD OF STUDY: **Mining and Geology**

LANGUAGE OF STUDY: English

SPECIALIZATION: **Geomatics for Mineral Resource Management**

STUDY TRACK: **Leoben**

Zał. nr 3 do ZW 16/2020

Attachment no. 2. to the Program of Studies

DESCRIPTION OF THE PROGRAM OF STUDIES

Main field of study MINING AND GEOLOGY **Profile** general academic
Level of studies second level studies **Form of studies** full-time studies

1. General description

1.1 Number of semesters: **4**	*1.2 Total number of ECTS points necessary to complete studies at a given level:* **120**
1.3 Total number of hours: **1185**	*1.4 Prerequisites (particularly for second-level studies):* professional title of an engineer, interview
1.5 Upon completion of studies graduate obtains professional degree of: **Magister inżynier** (Master of Science in Engineering)	*1.6 Graduate profile, employability:* The graduate of the international specialisation Geomatics for Mineral Resource Management will have the skills to use advanced knowledge in the field of basic, and specialized subjects. He/she will have the skills to lead teams, make high-risk decisions, and be fluent in using legal and economic knowledge. The graduate will be prepared to design technological processes, as well as to solve scientific and research problems and to undertake creative initiatives. He/she will be prepared to work in enterprises, technical supervision institutions, public state and local administration, in research and development organisations, in Poland and abroad, where advanced knowledge in the field of mining, geology and geomatics is required. The graduate be able to use English freely and will be prepared to work in an

	international environment and intercultural groups during his/her professional career.
1.7 Possibility of continuing studies: Eligibility to apply for admission to a doctoral school, non-degree postgraduate programmes	*1.8 Indicate connection with University's mission and its development strategy:* The second level study program in the field of study Mining and Geology is in line with the mission and responds to the following strategic goals of Wroclaw University of Science and Technology: 1. Increasing the level of correlation of University activities with the needs of the market, 2. Raising the level of education quality through didactic interdisciplinarity *3.* Raising the level of entrepreneurship and commitment in the research processes of students and doctoral students

[1]BU – number of ECTS points assigned to hours of classes requiring direct participation of academic teachers and other persons conducting classes
[2]Traditional – enter T, remote – enter Z
[3]Exam – enter E, crediting – enter Z. For the group of courses – after the letter E or Z - enter in brackets the final course form (lec, cl, lab, pr, sem)
[4]University-wide course /group of courses – enter O
[5]DN - number of ECTS points assigned to the classes related to the University's academic activity in the discipline/disciplines to which the main field of study is assigned
[6]Practical course / group of courses – enter P. For the group of courses – in brackets enter the number of ECTS points assigned to practical courses
[7]KO – general education courses, PD – basic sciences courses, K – main field of study courses, S – specialization courses

2. Detailed description

2.1 Total number of learning outcomes in the program of study: W (knowledge) = 19, U (skills) = 15, K (competences) = 3, W + U + K = 37

~~**2.2 For the main field of study assigned to more than one discipline - the number of learning outcomes assigned to the discipline:**~~

~~**D1 (major) .... (this number must be greater than half the total number of learning outcomes)**~~
~~**D2 ....**~~
~~**D3 ....**~~
~~**D4 ....**~~

~~**2.3 For the main field of study assigned to more than one discipline - percentage share of the number of ECTS points for each discipline:**~~

~~**D1 ....% ECTS points**~~
~~**D2 ....% ECTS points**~~
~~**D3 ....% ECTS points**~~
~~**D4 ....% ECTS points**~~

2.4a. For the general academic profile of the main field of study – the number of ECTS points assigned to the classes related to the University's academic activity in the discipline or disciplines to which the main field of study is assigned – DN (must be greater than 50% of the total number of ECTS points from 1.2) 95 ECTS

2.4b. ~~**For the practical profile of the main field of study - the number of ECTS points assigned to the classes shaping practical skills (must be greater than 50% of the total number of ECTS points from 1.2)**~~

[1]BU – number of ECTS points assigned to hours of classes requiring direct participation of academic teachers and other persons conducting classes
[2]Traditional – enter T, remote – enter Z
[3]Exam – enter E, crediting – enter Z. For the group of courses – after the letter E or Z - enter in brackets the final course form (lec, cl, lab, pr, sem)
[4]University-wide course /group of courses – enter O
[5]DN - number of ECTS points assigned to the classes related to the University's academic activity in the discipline/disciplines to which the main field of study is assigned
[6]Practical course / group of courses – enter P. For the group of courses – in brackets enter the number of ECTS points assigned to practical courses
[7]KO – general education courses, PD – basic sciences courses, K – main field of study courses, S – specialization courses

2.5 Concise analysis of compliance of the assumed learning outcomes with the needs of the labor market

The economic development of the country is closely dependent on natural resources, the ability to use them and having appropriate engineering workforce. The assumed learning outcomes correspond to the needs of practice in the field of the generally understood management of mineral resources - technologies and techniques for their identification, valuation, extraction, processing, revitalization of industrial areas, and the practice of managing an enterprise (especially mining) in the sense of managing information, environment and people, using the latest IT and marketing techniques and methods. This integration of economic needs and assumed educational effects favorably shape the labor market for the graduates of the Faculty. Additionally, a good command of English and experience of working in an international group will open up the possibility of working in foreign branches of Polish enterprises and in foreign companies.

2.6. The total number of ECTS points that a student must obtain in classes requiring direct participation of academic teachers or other persons conducting classes and students (enter the sum of ECTS points for courses / groups of courses marked with the BU[1] code) **71,5 ECTS**

2.7. Total number of ECTS points, which student has to obtain from basic sciences classes

Number of ECTS points for obligatory subjects	5
Number of ECTS points for optional subjects	0
Total number of ECTS points	5

2.8. Total number of ECTS points, which student has to obtain from practical classes, including project and laboratory classes (enter total number of ECTS points for courses/group of courses denoted with code P)

Number of ECTS points for obligatory subjects	16
Number of ECTS points for optional subjects	68
Total number of ECTS points	84

[1]BU – number of ECTS points assigned to hours of classes requiring direct participation of academic teachers and other persons conducting classes
[2]Traditional – enter T, remote – enter Z
[3]Exam – enter E, crediting – enter Z. For the group of courses – after the letter E or Z - enter in brackets the final course form (lec, cl, lab, pr, sem)
[4]University-wide course /group of courses – enter O
[5]DN - number of ECTS points assigned to the classes related to the University's academic activity in the discipline/disciplines to which the main field of study is assigned
[6]Practical course / group of courses – enter P. For the group of courses – in brackets enter the number of ECTS points assigned to practical courses
[7]KO – general education courses, PD – basic sciences courses, K – main field of study courses, S – specialization courses

2.9. Minimum number of ECTS points, which student has to obtain doing education blocks offered as part of University-wide classes or other main field of study (enter number of ECTS points for courses/groups of courses denoted with code O)

3 ECTS points

2.10. Total number of ECTS points, which student may obtain doing optional blocks (min. 30% of total number of ECTS points)

94 ECTS points

3. Description of the process leading to learning outcomes acquisition:

1. Upon starting classes in each subject, the student has an appropriate level of knowledge and skills which constitute the prerequisites for a given course (it is verified by the teacher or the dean's office).
2. The student participates in classes organized at the university.
3. The student carries out the assigned work in class and at home (projects, computational tasks, analyzes, prepares presentations) and studies the literature and materials recommended by the teacher.
4. The student uses the appointed hours of the tutor's consultation, explaining his uncertainties and verifying the correct understanding of the course content.
5. The student participates in periodic tests of knowledge and skills, completes the tests available on the e-portal and is familair with the correct answers, grades and comments from the teacher.
6. In some subjects, the student participates in group tasks, taking part in the organization of the group's work, assessment of the activities of individual participants and takes responsibility for the result of the group's work.
7. The student is encouraged to become involved in the work of research clubs, student organizations, discussion clubs, sports groups, participation in social life through work in public welfare organizations, voluntary work, thus gaining valuable interpersonal skills and social competences.
8. The student participates in meetings with companies from the industry, technical excursions, job fairs, tries to gain knowledge about the labor market and additional advantages when applying for a job
9. The student is encouraged to participate in an international student exchange, and through contact with foreigners at the faculty, he or she acquires additional interpersonal, cultural and language qualifications

[1]BU – number of ECTS points assigned to hours of classes requiring direct participation of academic teachers and other persons conducting classes
[2]Traditional – enter T, remote – enter Z
[3]Exam – enter E, crediting – enter Z. For the group of courses – after the letter E or Z - enter in brackets the final course form (lec, cl, lab, pr, sem)
[4]University-wide course /group of courses – enter O
[5]DN - number of ECTS points assigned to the classes related to the University's academic activity in the discipline/disciplines to which the main field of study is assigned
[6]Practical course / group of courses – enter P. For the group of courses – in brackets enter the number of ECTS points assigned to practical courses
[7]KO – general education courses, PD – basic sciences courses, K – main field of study courses, S – specialization courses

4. List of education blocks:

4.1. List of obligatory blocks:

4.1.1 List of general education blocks

4.1.1.1 *Liberal-managerial subjects* block *(6 ECTS points):*

No.	Course/ group of courses code	Name of course/group of courses (denote group of courses with symbol **GK**)	Weekly number of hours					Learning effect symbol	Number of hours		Number of ECTS points			Form[2] of course/group of courses	Way[3] of crediting	Course/group of courses			
			lec	cl	lab	pr	sem		ZZU	CNPS	Total	DN[5] classes	BU[1] classes			University-wide[4]	Concerning scientific activities[5]	Practical[6]	Type[7]
1	W06GIG-SM0039G	Project Management, Appraisal and Risk Evaluation (GK)	1		2	1		K2_GIG_W08,W10, W11 K2_GIG_U04,U08,U10,U15 K2_GIG_K01	60	120	4	4	3	T/Z(w)	E(w), Z(l,p)		DN	P (3)	KO
3	W06GIG-SM0080	Spatial planning	1					K2_GIG_W10,W14 K2_GIG_U11,U13 K2_GIG_K02, K03	15	60	2		1	T	Z				KO
		Total	**2**	**0**	**2**	**1**	**0**		**75**	**180**	**6**	**4**	**4**					**3**	

Altogether for general education blocks

Total number of hours					Total number of ZZU hours	Total number of CNPS hours	Total number of ECTS points	Total number of ECTS points for DN classes[5]	Number of ECTS points for BU classes[1]
lec	cl	lab	pr	sem					
2	**0**	**2**	**1**	**0**	**75**	**180**	**6**	**4**	**4**

[1]BU – number of ECTS points assigned to hours of classes requiring direct participation of academic teachers and other persons conducting classes
[2]Traditional – enter T, remote – enter Z
[3]Exam – enter E, crediting – enter Z. For the group of courses – after the letter E or Z - enter in brackets the final course form (lec, cl, lab, pr, sem)
[4]University-wide course /group of courses – enter O
[5]DN - number of ECTS points assigned to the classes related to the University's academic activity in the discipline/disciplines to which the main field of study is assigned
[6]Practical course / group of courses – enter P. For the group of courses – in brackets enter the number of ECTS points assigned to practical courses
[7]KO – general education courses, PD – basic sciences courses, K – main field of study courses, S – specialization courses

4.1.2 List of basic sciences blocks

4.1.2.1 *Mathematics* block

No.	Course/ group of courses code	Name of course/group of courses (denote group of courses with symbol **GK**)	Weekly number of hours					Learning effect symbol	Number of hours		Number of ECTS points			Form[2] of course/group of courses	Way[3] of crediting	Course/group of courses			
			lec	cl	lab	pr	sem		ZZU	CNPS	Total	DN[5] classes	BU[1] classes			University -wide[4]	Concerning scientific activities[5]	Practical[6]	Type[7]
1	W06GIG-SM0038	Computer Aided Geological Modelling & Geostatistics (part: Geostatistics)	1		1			K2_GIG_W06,W08,W15 K2_GIG_U04,U08,U14	30	60	2		2	T	Z(w,l)			P (1)	PD
		Total	**1**	**0**	**1**	**0**	**0**		**30**	**60**	**2**		**2**					**1**	

4.1.2.2 *Physics* block

No.	Course/ group of courses code	Name of course/group of courses (denote group of courses with symbol **GK**)	Weekly number of hours					Learning effect symbol	Number of hours		Number of ECTS points			Form[2] of course/group of courses	Way[3] of crediting	Course/group of courses			
			lec	cl	lab	pr	sem		ZZU	CNPS	Total	DN[5] classes	BU[1] classes			University -wide[4]	Concerning scientific activities[5]	Practical[6]	Type[7]
1	W06GIG-SM0040	Engineering Geophysics	1			1		K2_GIG_W02,W08,W10 K2_GIG_U04,U13	30	90	3	3	2	T /Z(w)	Z		DN	P(2)	PD
		Total	**1**	**0**	**0**	**1**	**0**		**30**	**90**	**3**	**3**	**2**					**2**	

Altogether for basic sciences blocks:

Total number of hours					Total number of ZZU hours	Total number of CNPS hours	Total number of ECTS points	Total number of ECTS points for DN classes[5]	Number of ECTS points for BU classes[1]
lec	cl	lab	pr	sem					
2	**0**	**1**	**1**	**0**	**60**	**150**	**5**	**3**	**4**

[1]BU – number of ECTS points assigned to hours of classes requiring direct participation of academic teachers and other persons conducting classes
[2]Traditional – enter T, remote – enter Z
[3]Exam – enter E, crediting – enter Z. For the group of courses – after the letter E or Z - enter in brackets the final course form (lec, cl, lab, pr, sem)
[4]University-wide course /group of courses – enter O
[5]DN - number of ECTS points assigned to the classes related to the University's academic activity in the discipline/disciplines to which the main field of study is assigned
[6]Practical course / group of courses – enter P. For the group of courses – in brackets enter the number of ECTS points assigned to practical courses
[7]KO – general education courses, PD – basic sciences courses, K – main field of study courses, S – specialization courses

4.1.3 List of the main field of study blocks

4.1.3.1 *Obligatory main field of study* blocks

No.	Course/ group of courses code	Name of course/group of courses (denote group of courses with symbol **GK**)	Weekly number of hours					Learning effect symbol	Number of hours		Number of ECTS points			Form[2] of course/group of courses	Way[3] of crediting	Course/group of courses			
			lec	cl	lab	pr	sem		ZZU	CNPS	Total	DN[5] classes	BU[1] classes			University-wide[4]	Concerning scientific activities[5]	Practical[6]	Type[7]
1	W06GIG-SM0038	Computer Aided Geological Modelling & Geostatistics (Część: Computer Aided Geological Modelling)			2			K2_GIG_W06,W08,W15 K2_GIG_U04,U08,U14	30	90	3	3	2	T	Z		DN	P(3)	K
2	W06GIG-SM0037	Principles and Application of InSAR and GIS in mining	2		3			K2_GIG_W15,W16,W18 K2_GIG_U04,U07,U08	75	150	5	5	4	T /Z(w)	E(w) Z(l)			P(3)	K
3	W06GIG-SM0041G	Integrated Analysis of Deformations in Geomechanical Engineering (GK)	2		2			K2_GIG_W07,W13,W14 K2_GIG_U07,U08,U10	60	150	5	5	4	T /Z(w)	E, Z		DN	P(3)	K
4	W06GIG-SM0042	Occupational Health and Safety	1			1		K2_GIG_W11,W12,W14, W17, K2_GIG_U11, K2_GIG_K02, K03	30	60	2	2	2	T /Z(w)	Z		DN	P(1)	K
		Total	**5**	**0**	**7**	**1**	**0**		**195**	**450**	**15**	**15**	**12**					**10**	

Altogether (for main field of study blocks):

Total number of hours					Total number of ZZU hours	Total number of CNPS hours	Total number of ECTS points	Total number of ECTS points for DN classes[5]	Number of ECTS points for BU classes[1]
lec	cl	lab	pr	sem					
5	**0**	**7**	**1**	**0**	**195**	**450**	**15**	**15**	**12**

[1]BU – number of ECTS points assigned to hours of classes requiring direct participation of academic teachers and other persons conducting classes
[2]Traditional – enter T, remote – enter Z
[3]Exam – enter E, crediting – enter Z. For the group of courses – after the letter E or Z - enter in brackets the final course form (lec, cl, lab, pr, sem)
[4]University-wide course /group of courses – enter O
[5]DN - number of ECTS points assigned to the classes related to the University's academic activity in the discipline/disciplines to which the main field of study is assigned
[6]Practical course / group of courses – enter P. For the group of courses – in brackets enter the number of ECTS points assigned to practical courses
[7]KO – general education courses, PD – basic sciences courses, K – main field of study courses, S – specialization courses

4.2 List of optional blocks

4.2.1 List of general education blocks

4.2.1.2 *Foreign languages* block *(min. 3 ECTS points):*

No.	Course/ group of courses code	Name of course/group of courses (denote group of courses with symbol **GK**)	Weekly number of hours					Learning effect symbol	Number of hours		Number of ECTS points			Form[2] of course/group of courses	Way[3] of crediting	Course/group of courses			
			lec	cl	lab	pr	sem		ZZU	CNPS	Total	DN[5] classes	BU[1] classes			University -wide[4]	Concerning scientific activities[5]	Practical[6]	Type[7]
1	SJO-SM0003	Foreign Language I		3				K2_GIG_ U03	45	60	2		1	T	Z	O		P (2)	KO
2	SJO-SM0004	Foreign Language II		1				K2_GIG_U01,U02	15	30	1		0,5	T	Z	O		P(1)	KO
		Total	**0**	**4**	**0**	**0**	**0**		**60**	**90**	**3**		**1,5**					**3**	

Altogether for general education blocks:

Total number of hours					Total number of ZZU hours	Total number of CNPS hours	Total number of ECTS points	Total number of ECTS points for DN classes[5]	Number of ECTS points for BU classes[1]
lec	cl	lab	pr	sem					
0	**4**	**0**	**0**	**0**	**60**	**90**	**3**	**0**	**1,5**

[1]BU – number of ECTS points assigned to hours of classes requiring direct participation of academic teachers and other persons conducting classes
[2]Traditional – enter T, remote – enter Z
[3]Exam – enter E, crediting – enter Z. For the group of courses – after the letter E or Z - enter in brackets the final course form (lec, cl, lab, pr, sem)
[4]University-wide course /group of courses – enter O
[5]DN - number of ECTS points assigned to the classes related to the University's academic activity in the discipline/disciplines to which the main field of study is assigned
[6]Practical course / group of courses – enter P. For the group of courses – in brackets enter the number of ECTS points assigned to practical courses
[7]KO – general education courses, PD – basic sciences courses, K – main field of study courses, S – specialization courses

4.2.4 List of specialization blocks

4.2.4.1 *Specialization subjects (e.g. whole specialization)* blocks *(61 ECTS points):*

No.	Course/ group of courses code	Name of course/group of courses (denote group of courses with symbol GK)	Weekly number of hours					Learning effect symbol	Number of hours		Number of ECTS points			Form[2] of course/group of courses	Way[3] of crediting	Course/group of courses			
			lec	cl	lab	pr	sem		ZZU	CNPS	Total	DN[5] classes	BU[1] classes			University-wide[4]	Concerning scientific activities[5]	Practical[6]	Type[7]
1	W06GIG-SM0081G	Risk Management in Mines GK	1		1			K2_GIG_W05,W09,W11,W14,W17 K2_GIG_U11,U12	30	90	3	3	1	T	E		DN	P(1)	S
2	W06GIG-SM0082G	Deposit Modelling and Associated Software GK	1		1			K2_GIG_W06,W15 K2_GIG_U04 K2_GIG_K03	30	60	2	2	1	T	Z		DN	P(1)	S
3	W06GIG-SM0083G	Underground Mining GK	2	1				K2_GIG_W07,W09,W19 K2_GIG_U04,U07,U09	45	120	4	4	2	T	E		DN	P(4)	S
4	W06GIG-SM0084G	Mining Subsidence Engineering GK	1		2			K2_GIG_W07,W10,W16 K2_GIG_U07 K2_GIG_K03	45	90	3	5	4	T	E		DN	P(3)	S
5	W06GIG-SM0085G	Geotechnical Monitoring and Instrumentation GK	1		1			K2_GIG_W07,W10,W18 K2_GIG_U07	30	45	1,5	1	1	T	Z		DN	P(1)	S
6	W06GIG-SM0087P	Mine Surveying Project Study				3		K2_GIG_U07,U10,U15	45	90	3	3	3	T	Z		DN	P(3)	S
7	W06GIG-SM0088W	Regulation of Mining Damages and Ensuring Land Use	1					K2_GIG_W05,W11,W13 K2_GIG_U05 K2_GIG_K02,K03	15	45	1,5	1	1	T	Z		DN	P(1)	S
8	W06GIG-SM0089G	Automatic Surface Inspection GK	1		1			K2_GIG_W14,W16 K2_GIG_U07,U08	30	90	3	2	1	T	Z		DN	P(2)	S
9	W06GIG-SM0090G	Environmental Aspects of Mineral Extraction GK	2	1				K2_GIG_W04,W11,W12,W13 K2_GIG_U05,U10,U12,U15 K2_GIG_K02,K03	45	90	3	2	4	T	E		DN	P(2)	S
10	W06GIG-SM0091G	Rock Mechanics GK	2		2			K2_GIG_W10,W14,W18 K2_GIG_U04,U07,U10	60	150	5	3	3	T	E		DN	P(3)	S
11	W06GIG-SM0092G	Applied Geodesy GK	2		2			K2_GIG_W10 K2_GIG_U04,U07,U15	60	120	4	2	2	T	E		DN	P(2)	S
12	W06GIG-SM0093G	Selected Aspects of Engineering Surveying in Mining and Tunnelling GK	2		3			K2_GIG_W07,W09 K2_GIG_U04,U07,U15	75	180	6	6	4	T	E		DN	P(4)	S

[1]BU – number of ECTS points assigned to hours of classes requiring direct participation of academic teachers and other persons conducting classes
[2]Traditional – enter T, remote – enter Z
[3]Exam – enter E, crediting – enter Z. For the group of courses – after the letter E or Z - enter in brackets the final course form (lec, cl, lab, pr, sem)
[4]University-wide course /group of courses – enter O
[5]DN - number of ECTS points assigned to the classes related to the University's academic activity in the discipline/disciplines to which the main field of study is assigned
[6]Practical course / group of courses – enter P. For the group of courses – in brackets enter the number of ECTS points assigned to practical courses
[7]KO – general education courses, PD – basic sciences courses, K – main field of study courses, S – specialization courses

13	W06GIG-SM0094W	Mine Mapping	2					K2_GIG_W18 K2_GIG_U07,U08 K2_GIG_K02	30	90	3	2	1	T	Z		DN	P(1)	S
14	W06GIG-SM0086G	CAD-Constructions in Tunneling	1		1			K2_GIG_W18 K2_GIG_U04,U07	30	90	3	2	1	T	Z		DN	P(2)	S
15	GIG-SM1111AN	Free elctive	2					K2_GIG_W07 K2_GIG_K03	30	90	3		2	T	Z				S
16	GIG-SM3111AN	Free Elective	2					K2_GIG_W07 K2_GIG_K03	30	60	2		2	T	Z				S
17	GIG-SM3111AN	Free Elective	2					K2_GIG_W07 K2_GIG_K03	30	60	2		2	T	Z				S
18	GIG-SM3111AN	Free Elective	2					K2_GIG_W07 K2_GIG_K03	30	60	2		2	T	Z				S
19	GIG-SM3111AN	Free Elective	2					K2_GIG_W07 K2_GIG_K03	30	60	2		2	T	Z				S
20	W06GIG-SM0095C	Compulsory Internship		2				K2_GIG_W09 K2_GIG_U09,U15 K2_GIG_K01	30	150	5	5	5		Z		DN	P(5)	S
		Total	**29**	**4**	**14**	**3**	**0**		**750**	**1830**	**61**	**43**	**44**					**35**	

[1]BU – number of ECTS points assigned to hours of classes requiring direct participation of academic teachers and other persons conducting classes
[2]Traditional – enter T, remote – enter Z
[3]Exam – enter E, crediting – enter Z. For the group of courses – after the letter E or Z - enter in brackets the final course form (lec, cl, lab, pr, sem)
[4]University-wide course /group of courses – enter O
[5]DN - number of ECTS points assigned to the classes related to the University's academic activity in the discipline/disciplines to which the main field of study is assigned
[6]Practical course / group of courses – enter P. For the group of courses – in brackets enter the number of ECTS points assigned to practical courses
[7]KO – general education courses, PD – basic sciences courses, K – main field of study courses, S – specialization courses

4.2.4.2 *Diploma (e.g. diploma profile)* block *(30 ECTS points):*

No.	Course/ group of courses code	Name of course/group of courses (denote group of courses with symbol **GK**)	Weekly number of hours					Learning effect symbol	Number of hours		Number of ECTS points			Form[2] of course/group of courses	Way[3] of crediting	Course/group of courses			
			lec	cl	lab	pr	sem		ZZU	CNPS	Total	DN[5] classes	BU[1] classes			University-wide[4]	Concerning scientific activities[5]	Practical[6]	Type[7]
1	W06GIG-SM0070S	Diploma Seminar					2	K2_GIG_W01 K2_GIG_U01,U13 K2_GIG_K03	30	60	2	2	1	T	Z		DN	P(2)	S
2	W06GIG-SM0054D	Master Thesis		1				K2_GIG_W01,W05,W10 K2_GIG_U01,U04, U08,U10,U13,U15 K2_GIG_K01,K03	15	840	28	28	5	T	Z		DN	P(28)	S
		Total	**0**	**1**	**0**	**0**	**2**		**45**	**900**	**30**	**30**	**6**					**30**	

Altogether for specialization blocks:

Total number of hours					Total number of ZZU hours	Total number of CNPS hours	Total number of ECTS points	Total number of ECTS points for DN classes[5]	Number of ECTS points for BU classes[1]
lec	cl	lab	pr	sem					
29	**5**	**14**	**3**	**2**	**795**	**2730**	**91**	**73**	**50**

[1]BU – number of ECTS points assigned to hours of classes requiring direct participation of academic teachers and other persons conducting classes
[2]Traditional – enter T, remote – enter Z
[3]Exam – enter E, crediting – enter Z. For the group of courses – after the letter E or Z - enter in brackets the final course form (lec, cl, lab, pr, sem)
[4]University-wide course /group of courses – enter O
[5]DN - number of ECTS points assigned to the classes related to the University's academic activity in the discipline/disciplines to which the main field of study is assigned
[6]Practical course / group of courses – enter P. For the group of courses – in brackets enter the number of ECTS points assigned to practical courses
[7]KO – general education courses, PD – basic sciences courses, K – main field of study courses, S – specialization courses

4.3 Training block - concerning principles of training crediting – attachment no. …

Opinion of the Advisory Faculty Council concerning the rules of crediting training block

Name of training			
Number of ECTS points	**Number of ECTS points for BU[1] classes**	**Training crediting mode**	**Code**

Training duration	Training objective

4.4 „Diploma dissertation" block (*if it is foreseen at first level studies)*

Type of diploma dissertation	Licencjat / inżynier / magister / magister inżynier*	
Number of diploma dissertation semesters	**Number of ECTS points**	**Code**
1	**28**	**W06GIG-SM0054D**
Character of diploma dissertation		
Literature survey, project, computer program, etc.		
Number of BU[1] ECTS points	**5**	

[1]BU – number of ECTS points assigned to hours of classes requiring direct participation of academic teachers and other persons conducting classes
[2]Traditional – enter T, remote – enter Z
[3]Exam – enter E, crediting – enter Z. For the group of courses – after the letter E or Z - enter in brackets the final course form (lec, cl, lab, pr, sem)
[4]University-wide course /group of courses – enter O
[5]DN - number of ECTS points assigned to the classes related to the University's academic activity in the discipline/disciplines to which the main field of study is assigned
[6]Practical course / group of courses – enter P. For the group of courses – in brackets enter the number of ECTS points assigned to practical courses
[7]KO – general education courses, PD – basic sciences courses, K – main field of study courses, S – specialization courses

5. Ways of verifying assumed learning outcomes

Type of classes	Ways of verifying assumed learning outcomes
lecture	e.g. examination, progress/final test
class	e.g. progress/final test
laboratory	e.g. pretest, report from laboratory
project	e.g. project defence
seminar	e.g. participation in discussion, topic presentation, essay
training	e.g. report from training
diploma dissertation	prepared diploma dissertation

6. Range of diploma examination

1. Stochastic interpretation of numerical values of a given feature, measured at points with known spatial location.
2. Covariance, correlation and semivariance as measures of continuity of a regionalized variable.
3. Variogram and methods of its modelling.
4. Assessment of the linear error of the estimator of the local value of a given feature.
5. Factors influencing the error value.
6. Kriging, its properties and types.
7. Securing people during an underground fire, escape routes.
8. Occupational risk - assessment methods, estimating occupational risk.
9. Geophysical methods of exploration and identification of deposits.
10. Computer aided exploration and identification of deposits.
11. Basic principles of corporate finance management.
12. Methods of assessing the profitability of investments and their applications.
13. Decision models used in management.
14. Types of environmental management systems.
15. Types and systematics of operations, information model of operations, concepts of system and operation process, efficiency, reliability, effective working time.

[1]BU – number of ECTS points assigned to hours of classes requiring direct participation of academic teachers and other persons conducting classes
[2]Traditional – enter T, remote – enter Z
[3]Exam – enter E, crediting – enter Z. For the group of courses – after the letter E or Z - enter in brackets the final course form (lec, cl, lab, pr, sem)
[4]University-wide course /group of courses – enter O
[5]DN - number of ECTS points assigned to the classes related to the University's academic activity in the discipline/disciplines to which the main field of study is assigned
[6]Practical course / group of courses – enter P. For the group of courses – in brackets enter the number of ECTS points assigned to practical courses
[7]KO – general education courses, PD – basic sciences courses, K – main field of study courses, S – specialization courses

16. Methods of reclamation of post-mining land.
17. Assessment of the accuracy of geodetic measurements.
18. The measurement network used for surveys in mines.
19. Absolute and relative deformation monitoring methods.
20. Geodetic networks for determining deformations and displacements of engineering structures.
21. Geodetic surveys in recognition and development of mineral deposits.
22. Methods of interpolation of measurement data.
23. Spatial data models in GIS.
24. Basic types of spatial analyses in GIS.
25. Types of mining damages and their geodetic monitoring.
26. The principle of assessing the accuracy of displacements.
27. Applications of remote sensing in environmental protection and management of the Earth's natural resources.
28. Advantages and disadvantages of using satellite radar interferometry in monitoring the activity of the land surface.
29. Differences between PsInSAR and SBAS methods.
30. Examples and description of selected remote sensing programs.
31. Methods of geodetic use of SAR images.
32. Applications of active remote sensing systems.
33. Advantages and disadvantages of multispectral and hyperspectral imaging.
34. model of errors of numerical terrain models.

[1]BU – number of ECTS points assigned to hours of classes requiring direct participation of academic teachers and other persons conducting classes
[2]Traditional – enter T, remote – enter Z
[3]Exam – enter E, crediting – enter Z. For the group of courses – after the letter E or Z - enter in brackets the final course form (lec, cl, lab, pr, sem)
[4]University-wide course /group of courses – enter O
[5]DN - number of ECTS points assigned to the classes related to the University's academic activity in the discipline/disciplines to which the main field of study is assigned
[6]Practical course / group of courses – enter P. For the group of courses – in brackets enter the number of ECTS points assigned to practical courses
[7]KO – general education courses, PD – basic sciences courses, K – main field of study courses, S – specialization courses

7. Requirements concerning deadlines for crediting courses/groups of courses for all courses in particular blocks

No.	*Course / group of courses code*	*Name of course / group of courses*	*Crediting by deadline of... (number of semester)*
1	*W06GIG-SM0037*	*Principles and Application of InSAR and GIS in mining*	*1-4*
2	*W06GIG-SM0038*	*Computer Aided Geological Modelling & Geostatistics*	*1-4*
3	*W06GIG-SM0039G*	*Project Management, Appraisal and Risk Evaluation*	*1-4*
4	*W06GIG-SM0040*	*Engineering Geophysics*	*1-4*
5	*W06GIG-SM0041G*	*Integrated Analysis of Deformations in Geomechanical Engineering*	*1-4*
6	*W06GIG-SM0042*	*Occupational Health and Safety*	*1-4*
7	*SJO-SM0003*	*Foreign language*	*1-4*
8	*SJO-SM0004*	*Foreign language*	*1-4*
9	*GIG-SM1111AN*	*Free elective*	*1-4*
10	*W06GIG-SM0080W*	*Spatial Planning*	*2-4*
11	*W06GIG-SM0081G*	*Risk Management in Mines*	*2-4*
12	*W06GIG-SM0082G*	*Deposit Modelling and Associated Software*	*2-4*
13	*W06GIG-SM0083G*	*Underground Mining*	*2-4*
14	*W06GIG-SM0084G*	*Mining Subsidence Engineering*	*2-4*
15	*W06GIG-SM0085G*	*Geotechnical Monitoring and Instrumentation*	*2-4*
16	*W06GIG-SM0086G*	*CAD-Constructions in Tunneling*	*2-4*
17	*W06GIG-SM0087P*	*Mine Surveying Project Study*	*2-4*
18	*W06GIG-SM0088W*	*Regulation of Mining Damages and Ensuring Land Use*	*2-4*
19	*W06GIG-SM0089G*	*Automatic Surface Inspection*	*2-4*

[1]BU – number of ECTS points assigned to hours of classes requiring direct participation of academic teachers and other persons conducting classes
[2]Traditional – enter T, remote – enter Z
[3]Exam – enter E, crediting – enter Z. For the group of courses – after the letter E or Z - enter in brackets the final course form (lec, cl, lab, pr, sem)
[4]University-wide course /group of courses – enter O
[5]DN - number of ECTS points assigned to the classes related to the University's academic activity in the discipline/disciplines to which the main field of study is assigned
[6]Practical course / group of courses – enter P. For the group of courses – in brackets enter the number of ECTS points assigned to practical courses
[7]KO – general education courses, PD – basic sciences courses, K – main field of study courses, S – specialization courses

20	GIG-SM3111AN	Free Elective	2-4
21	W06GIG-SM0090G	Environmental Aspects of Mineral Extraction	3-4
22	W06GIG-SM0091G	Rock Mechanics	3-4
23	W06GIG-SM0092G	Applied Geodesy	3-4
24	W06GIG-SM0093G	Selected Aspects of Engineering Surveying in Mining and Tunnelling	3-4
25	W06GIG-SM0094W	Mine Mapping	3-4
26	W06GIG-SM0095C	Compulsory Internship	3-4
27	GIG-SM3111AN	Free Elective	3-4
28	W06GIG-SM0054D	Master Thesis	4
29	W06GIG-SM0070S	Diploma Seminar	4

8. Plan of studies (attachment no. 4)

[1]BU – number of ECTS points assigned to hours of classes requiring direct participation of academic teachers and other persons conducting classes
[2]Traditional – enter T, remote – enter Z
[3]Exam – enter E, crediting – enter Z. For the group of courses – after the letter E or Z - enter in brackets the final course form (lec, cl, lab, pr, sem)
[4]University-wide course /group of courses – enter O
[5]DN - number of ECTS points assigned to the classes related to the University's academic activity in the discipline/disciplines to which the main field of study is assigned
[6]Practical course / group of courses – enter P. For the group of courses – in brackets enter the number of ECTS points assigned to practical courses
[7]KO – general education courses, PD – basic sciences courses, K – main field of study courses, S – specialization courses

Approved by faculty student government legislative body:

POLITECHNIKA WROCŁAWSKA

Patrycja Haraj

Patrycja Haraj
President of the Student Government
of the Faculty of Geoengineerin, Mining and Geology

....

Date 21.10.2022 name and surname, signature of student representative

DZIEKAN

prof. dr hab. inż. Radosław Zimroz

....

Date 21.10.2022 Dean's signature

Zał. nr 4 do ZW 16/2020
Attachment no. 4 to Program of Studies

PLAN OF STUDIES

FACULTY: Geoengineering, Mining and Geology

MAIN FIELD OF STUDY: Mining and geology

EDUCATION LEVEL: second-level studies

FORM OF STUDIES: full-time studies

PROFILE: general academic

SPECIALIZATION: Geomatics for Mineral Resources Management Pathway Leoben (Geomatyka w zarządzaniu surowcami mineralnymi)

LANGUAGE OF STUDY: English

In effect since academic year 2022/23

*delete as applicable

Plan of studies structure (optionally)

sem./ hours	1	ECTS	2	ECTS	3	ECTS	4	ECTS
1	Principles and Application of InSAR and GIS in mining 20300E W06GIG-SM0037	5	Spatial Planning 10000Z W06GIG-SM0080W	2	Environmental Aspects of Mineral Extraction 21000E W06GIG-SM0090G	3	Master Thesis 01000Z W06GIG-SM0054D	28
2 3			Risk Management in Mines10100E W06GIG-SM0081G	3				
4 5			Deposit Modelling and Associated Software 10100E W06GIG-SM0082G	2	Rock Mechanics 20200E W06GIG-SM0091G	5		
6 7 8	Computer Aided Geological Modelling & Geostatistics 10300Z W06GIG-SM0038	5	Underground Mining 21000E W06GIG-SM0083G	4				
9 10 11	Project Management, Appraisal and Risk Evaluation 10210E W06GIG-SM0039G	4	Mining Subsidence Engineering 10200E W06GIG-SM0084G	3	Applied Geodesy 20200E W06GIG-SM0092G	4		
12 13			Geotechnical Monitoring and Instrumentation 10100Z W06GIG-SM0085G	1,5	Selected Aspects of Engineering Surveying in Mining and Tunneling 20300E W06GIG-SM0093G	6		
14 15	Engineering Geophysics 10010Z W06GIG-SM0040	3	CAD-Constructions in Tunneling 10100Z W06GIG-SM0086G	3				
16 17 18	Integrated Analysis of Deformations in Geomechanical Engineering 20200E W06GIG-SM0041G	5	Mine Surveying Project Study 00030Z W06GIG-SM0087P	3	Mine Mapping 20000Z W06GIG-SM0094W	3	Diploma Seminar 00002Z W06GIG-SM0070S	2
19			Regulation of Mining Damages and Ensuring Land Use 10000Z W06GIG-SM0088W	1,5	Compulsory Internship 02000Z W06GIG-SM0095C	5		
20 21	Occupational Health and Safety 100100Z W06GIG-SM0042	2	Automatic Surface Inspection 10100E W06GIG-SM0089G	3				
22	Foreign language I 03000Z SJO-SM0003	2	Free elective 20000Z GIG-SM3111AN	2	Free elective 20000Z GIG-SM3111AN	2		
23 24			Free elective 20000Z GIG-SM3111AN	2	Free elective 20000Z GIG-SM3111AN	2		
25	Foreign language II 01000Z SJO-SM0004	1						
26 27	Free elective 20000Z GIG-SM1111AN	3						
sum		**30**		**30**		**30**		**30**

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[2]Traditional – enter T, remote – enter Z
[3]Exam – enter E, crediting – enter Z. For the group of courses – after the letter E or Z - enter in brackets the final course form (lec, cl, lab, pr, sem)
[4]University-wide course /group of courses – enter O
[5]DN - number of ECTS points assigned to the classes related to the University's academic activity in the discipline/disciplines to which the main field of study is assigned
[6]Practical course / group of courses – enter P. For the group of courses – in brackets enter the number of ECTS points assigned to practical courses
[7]KO – general education courses, PD – basic sciences courses, K – main field of study courses, S – specialization courses

1. Set of obligatory and optional courses and groups of courses in semestral arrangement

Semester 1

Obligatory courses / groups of courses Number of ECTS points 24

No.	Course/ group of courses code	Name of course/group of courses (denote group of courses with symbol **GK**)	Weekly number of hours					Learning effect symbol	Number of hours		Number of ECTS points			Form[2] of course/group of courses	Way[3] of crediting	Course/group of courses			
			lec	cl	lab	pr	sem		ZZU	CNPS	Total	DN[5] classes	BU[1] classes			University -wide[4]	Concerning scientific activities[5]	Practical[6]	Type[7]
1	W06GIG -SM0037	Principles and Application of InSAR and GIS in mining	2		3			K2_GIG_W15,W16,W18 K2_GIG_U04,U07,U08	75	150	5	5	4	T/Z(w)	E(w) Z(l)		DN	P(3)	K
2	W06GIG-SM0038	Computer Aided Geological Modelling & Geostatistics	1		3			K2_GIG_W06,W08,W15 K2_GIG_U04,U08,U14	60	150	5	3	4	T /Z(w)	Z(w,l)		DN	P (4)	PD
3	W06GIG-SM0039G	Project Management, Appraisal and Risk Evaluation (GK)	1		2	1		K2_GIG_W10,W14 K2_GIG_U04,U08,U10,U15 K2_GIG_K01	60	120	4	4	3	T/Z(w)	E(w), Z(l,p)		DN	P (3)	KO
4	W06GIG-SM0040	Engineering Geophysics	1			1		K2_GIG_W02,W08,W10 K2_GIG_U04,U13	30	90	3	3	2	T /Z(w)	Z		DN	P(2)	PD
5	W06GIG-SM0041G	Integrated Analysis of Deformations in Geomechanical Engineering (GK)	2		2			K2_GIG_W07,W13,W14 K2_GIG_U07,U08,U10	60	150	5	5	4	T /Z(w)	E, Z		DN	P(3)	K
6	W06GIG-SM0042	Occupational Health and Safety	1			1		K2_GIG_W11,W12,W14, W17 K2_GIG_U11, K2_GIG_K02, K03	30	60	2	2	2	T /Z(w)	Z		DN	P(1)	K
		Total	**8**	**0**	**10**	**3**	**0**		**315**	**720**	**24**	**22**	**19**					**16**	

[1]BU – number of ECTS points assigned to hours of classes requiring direct participation of academic teachers and other persons conducting classes
[2]Traditional – enter T, remote – enter Z
[3]Exam – enter E, crediting – enter Z. For the group of courses – after the letter E or Z - enter in brackets the final course form (lec, cl, lab, pr, sem)
[4]University-wide course /group of courses – enter O
[5]DN - number of ECTS points assigned to the classes related to the University's academic activity in the discipline/disciplines to which the main field of study is assigned
[6]Practical course / group of courses – enter P. For the group of courses – in brackets enter the number of ECTS points assigned to practical courses
[7]KO – general education courses, PD – basic sciences courses, K – main field of study courses, S – specialization courses

Optional courses / groups of courses (6 ECTS points)

No.	Course/ group of courses code	Name of course/group of courses (denote group of courses with symbol **GK**)	Weekly number of hours					Learning effect symbol	Number of hours		Number of ECTS points			Form[2] of course/group of courses	Way[3] of crediting	Course/group of courses			
			lec	cl	lab	pr	sem		ZZU	CNPS	Total	DN[5] classes	BU[1] classes			University -wide[4]	Concerning scientific activities[5]	Practical[6]	Type[7]
1	SJO-SM0003	Foreign Language I		3				K2_GIG_ U03	45	60	2		1	T	Z	O		P (2)	KO
2	SJO-SM0004	Foreign Language II		1				K2_GIG_U01,U02	15	30	1		0,5	T	Z	O		P(1)	KO
3	GIG-SM1111AN	Free elctive	2					K2_GIG_W07 K2_GIG_K03	30	90	3		2	T	Z				S
		Total	**2**	**4**	**0**	**0**	**0**		**90**	**180**	**6**		**3,5**					**3**	

Altogether in semester

Total number of hours					Total number of ZZU hours	Total number of CNPS hours	Total number of ECTS points	Total number of ECTS points for DN classes[5]	Number of ECTS points for BU classes[1]
lec	cl	lab	pr	sem					
10	**4**	**10**	**3**	**0**	**405**	**900**	**30**	**22**	**22,5**

Semester 2

Obligatory courses / groups of courses Number of ECTS points 2

No.	Course/ group of courses code	Name of course/group of courses (denote group of courses with symbol **GK**)	Weekly number of hours					Learning effect symbol	Number of hours		Number of ECTS points			Form[2] of course/group of courses	Way[3] of crediting	Course/group of courses			
			lec	cl	lab	pr	sem		ZZU	CNPS	Total	DN[5] classes	BU[1] classes			University -wide[4]	Concerning scientific activities[5]	Practical[6]	Type[7]
1	W06GIG-SM0080W	Spatial planning	1					K2_GIG_W10,W14 K2_GIG_U11,U13 K2_GIG_K02, K03	15	60	2		1	T	Z				KO
		Total	**1**	**0**	**0**	**0**	**0**		**15**	**60**	**2**	**0**	**1**					**0**	

[1]BU – number of ECTS points assigned to hours of classes requiring direct participation of academic teachers and other persons conducting classes
[2]Traditional – enter T, remote – enter Z
[3]Exam – enter E, crediting – enter Z. For the group of courses – after the letter E or Z - enter in brackets the final course form (lec, cl, lab, pr, sem)
[4]University-wide course /group of courses – enter O
[5]DN - number of ECTS points assigned to the classes related to the University's academic activity in the discipline/disciplines to which the main field of study is assigned
[6]Practical course / group of courses – enter P. For the group of courses – in brackets enter the number of ECTS points assigned to practical courses
[7]KO – general education courses, PD – basic sciences courses, K – main field of study courses, S – specialization courses

Optional courses / groups of courses (28 ECTS points)

No.	Course/ group of courses code	Name of course/group of courses (denote group of courses with symbol **GK**)	Weekly number of hours					Learning effect symbol	Number of hours		Number of ECTS points			Form[2] of course/group of courses	Way[3] of crediting	Course/group of courses			
			lec	cl	lab	pr	sem		ZZU	CNPS	Total	DN[5] classes	BU[1] classes			University-wide[4]	Concerning scientific activities[5]	Practical[6]	Type[7]
1	W06GIG-SM0081G	Risk Management in Mines GK	1		1			K2_GIG_W05,W09,W11, W14,W17 K2_GIG_U11,U12	30	90	3	3	1	T	E		DN	P(1)	S
2	W06GIG-SM0082G	Deposit Modelling and Associated Software GK	1		1			K2_GIG_W06,W15 K2_GIG_U04 K2_GIG_K03	30	60	2	2	1	T	Z		DN	P(1)	S
3	W06GIG-SM0083G	Underground Mining GK	2	1				K2_GIG_W07,W09,W19 K2_GIG_U04,U07,U09	45	120	4	4	2	T	E		DN	P(4)	S
4	W06GIG-SM0084G	Mining Subsidence Engineering GK	1		2			K2_GIG_W07,W10,W16 K2_GIG_U07 K2_GIG_K03	45	90	3	5	4	T	E		DN	P(3)	S
5	W06GIG-SM0085G	Geotechnical Monitoring and Instrumentation GK	1		1			K2_GIG_W07,W10,W18 K2_GIG_U07	30	45	1,5	1	1	T	Z		DN	P(1)	S
6	W06GIG-SM0086G	CAD-Constructions in Tunneling GK	1		1			K2_GIG_W18 K2_GIG_U04,U07	30	90	3	2	1	T	Z		DN	P(2)	S
7	W06GIG-SM0087P	Mine Surveying Project Study				3		K2_GIG_U07,U10,U15	45	90	3	3	3	T	Z		DN	P(3)	S
8	W06GIG-SM0088W	Regulation of Mining Damages and Ensuring Land Use	1					K2_GIG_W05,W11,W13 K2_GIG_U05 K2_GIG_K02,K03	15	45	1,5	1	1	T	Z		DN	P(1)	S
9	W06GIG-SM0089G	Automatic Surface Inspection GK	1		1			K2_GIG_W14,W16 K2_GIG_U07,U08	30	90	3	2	1	T	Z		DN	P(2)	S
10	GIG-SM3111AN	Free Elective	2					K2_GIG_W07 K2_GIG_K03	30	60	2		2	T	Z				S
11	GIG-SM3111AN	Free Elective	2					K2_GIG_W07 K2_GIG_K03	30	60	2		2	T	Z				S
		Total	**13**	**1**	**7**	**3**	**0**		**360**	**840**	**28**	**23**	**19**					**18**	

Altogether in semester

Total number of hours					Total number of ZZU hours	Total number of CNPS hours	Total number of ECTS points	Total number of ECTS points for DN classes[5]	Number of ECTS points for BU classes[1]
lec	cl	lab	pr	sem					
14	**1**	**7**	**3**	**0**	**375**	**900**	**30**	**23**	**20**

[1]BU – number of ECTS points assigned to hours of classes requiring direct participation of academic teachers and other persons conducting classes
[2]Traditional – enter T, remote – enter Z
[3]Exam – enter E, crediting – enter Z. For the group of courses – after the letter E or Z - enter in brackets the final course form (lec, cl, lab, pr, sem)
[4]University-wide course /group of courses – enter O
[5]DN - number of ECTS points assigned to the classes related to the University's academic activity in the discipline/disciplines to which the main field of study is assigned
[6]Practical course / group of courses – enter P. For the group of courses – in brackets enter the number of ECTS points assigned to practical courses
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Semester 3

Obligatory courses / groups of courses Number of ECTS points 0

No.	Course/ group of courses code	Name of course/group of courses (denote group of courses with symbol **GK**)	Weekly number of hours					Learning effect symbol	Number of hours		Number of ECTS points			Form[2] of course/group of courses	Way[3] of crediting	Course/group of courses			
			lec	cl	lab	pr	sem		ZZU	CNPS	Total	DN[5] classes	BU[1] classes			University-wide[4]	Concerning scientific activities[5]	Practical[6]	Type[7]
		Total																	

Optional courses / groups of courses (30 ECTS points)

No.	Course/ group of courses code	Name of course/group of courses (denote group of courses with symbol **GK**)	Weekly number of hours					Learning effect symbol	Number of hours		Number of ECTS points			Form[2] of course/group of courses	Way[3] of crediting	Course/group of courses			
			lec	cl	lab	pr	sem		ZZU	CNPS	Total	DN[5] classes	BU[1] classes			University-wide[4]	Concerning scientific activities[5]	Practical[6]	Type[7]
1	W06GIG-SM0090G	Environmental Aspects of Mineral Extraction GK	2	1				K2_GIG_W04,W11,W12,W13 K2_GIG_U05,U10,U12,U15 K2_GIG_K02,K03	45	90	3	2	4	T	E		DN	P(2)	
2	W06GIG-SM0091G	Rock Mechanics GK	2		2			K2_GIG_W10,W14,W18 K2_GIG_U04,U07,U10	60	150	5	3	3	T	E		DN	P(3)	
3	W06GIG-SM0092G	Applied Geodesy GK	2		2			K2_GIG_W10 K2_GIG_U04,U07,U15	60	120	4	2	2	T	E		DN	P(2)	
4	W06GIG-SM0093G	Selected Aspects of Engineering Surveying in Mining and Tunnelling GK	2		3			K2_GIG_W07,W09 K2_GIG_U04,U07,U15	75	180	6	6	4	T	E		DN	P(4)	
5	W06GIG-SM0094W	Mine Mapping	2					K2_GIG_W18 K2_GIG_U07,U08 K2_GIG_K02	30	90	3	2	1	T	Z		DN	P(1)	
6	W06GIG-SM0095C	Compulsory Internship		2				K2_GIG_W09 K2_GIG_U09,U15 K2_GIG_K01	30	150	5	5	5		Z		DN	P(5)	S
7	GIG-SM3111AN	Free Elective	2					K2_GIG_W07 K2_GIG_K03	30	60	2		2	T	Z				S
8	GIG-SM3111AN	Free Elective	2					K2_GIG_W07 K2_GIG_K03	30	60	2		2	T	Z				S
		Total	**14**	**3**	**7**	**0**	**0**		**360**	**900**	**30**	**20**	**23**					**17**	

[1]BU – number of ECTS points assigned to hours of classes requiring direct participation of academic teachers and other persons conducting classes
[2]Traditional – enter T, remote – enter Z
[3]Exam – enter E, crediting – enter Z. For the group of courses – after the letter E or Z - enter in brackets the final course form (lec, cl, lab, pr, sem)
[4]University-wide course /group of courses – enter O
[5]DN - number of ECTS points assigned to the classes related to the University's academic activity in the discipline/disciplines to which the main field of study is assigned
[6]Practical course / group of courses – enter P. For the group of courses – in brackets enter the number of ECTS points assigned to practical courses
[7]KO – general education courses, PD – basic sciences courses, K – main field of study courses, S – specialization courses

Altogether in semester

Total number of hours					Total number of ZZU hours	Total number of CNPS hours	Total number of ECTS points	Total number of ECTS points for DN classes[5]	Number of ECTS points for BU classes[1]
lec	cl	lab	pr	sem					
14	**3**	**7**	**0**	**0**	**360**	**900**	**30**	**20**	**23**

Semester 4

Optional courses / groups of courses (30 ECTS points)

No.	Course/ group of courses code	Name of course/group of courses (denote group of courses with symbol **GK**)	Weekly number of hours					Learning effect symbol	Number of hours		Number of ECTS points			Form[2] of course/group of courses	Way[3] of crediting	Course/group of courses			
			lec	cl	lab	pr	sem		ZZU	CNPS	Total	DN[5] classes	BU[1] classes			University-wide[4]	Concerning scientific activities[5]	Practical[6]	Type[7]
1	W06GIG-SM0070S	Diploma Seminar					2	K2_GIG_W01 K2_GIG_U01,U13 K2_GIG_K03	30	60	2	2	1	T	Z		DN	P(2)	S
2	W06GIG-SM0054D	Master Thesis		1				K2_GIG_W01,W05,W10 K2_GIG_U01,U04, U08,U10,U13,U15 K2_GIG_K01,K03	15	840	28	28	5	T	Z		DN	P(28)	S
		Total	**0**	**1**	**0**	**0**	**2**		**45**	**900**	**30**	**30**	**6**					**30**	

Altogether in semester

Total number of hours					Total number of ZZU hours	Total number of CNPS hours	Total number of ECTS points	Total number of ECTS points for DN classes[5]	Number of ECTS points for BU classes[1]
lec	cl	lab	pr	sem					
0	**1**	**0**	**0**	**2**	**45**	**900**	**30**	**30**	**6**

[1]BU – number of ECTS points assigned to hours of classes requiring direct participation of academic teachers and other persons conducting classes
[2]Traditional – enter T, remote – enter Z
[3]Exam – enter E, crediting – enter Z. For the group of courses – after the letter E or Z - enter in brackets the final course form (lec, cl, lab, pr, sem)
[4]University-wide course /group of courses – enter O
[5]DN - number of ECTS points assigned to the classes related to the University's academic activity in the discipline/disciplines to which the main field of study is assigned
[6]Practical course / group of courses – enter P. For the group of courses – in brackets enter the number of ECTS points assigned to practical courses
[7]KO – general education courses, PD – basic sciences courses, K – main field of study courses, S – specialization courses

2. Set of examinations in semestral arrangement

Course / group of courses code	Names of courses / groups of courses ending with examination	Semester
W06GIG-SM0037 W06GIG-SM0039G W06GIG-SM0041G	1. Principles and Application of InSAR and GIS in mining 2. Project Management, Appraisal and Risk Evaluation 3. Integrated Analysis of Deformations in Geomechanical Engineering	1 1 1
W06GIG-SM0081G W06GIG-SM0086G W06GIG-SM0084G	1. Risk Management in Mines Underground Mine Surveying 2. Underground Mining 3. Mining Subsidence Engineering	2 2 2
W06GIG-SM0090G W06GIG-SM0091G W06GIG-SM0092G W06GIG-SM0093G	1. Environmental Aspects of Mineral Extraction 2. Rock Mechanics 3. Applied Geodesy 4. Selected Aspects of Engineering Surveying in Mining and Tunneling	3 3 3 3

3. Numbers of allowable deficit of ECTS points after particular semesters

Semester	Allowable deficit of ECTS points after semester
1	12
2	12
3	8
4	0

[1]BU – number of ECTS points assigned to hours of classes requiring direct participation of academic teachers and other persons conducting classes
[2]Traditional – enter T, remote – enter Z
[3]Exam – enter E, crediting – enter Z. For the group of courses – after the letter E or Z - enter in brackets the final course form (lec, cl, lab, pr, sem)
[4]University-wide course /group of courses – enter O
[5]DN - number of ECTS points assigned to the classes related to the University's academic activity in the discipline/disciplines to which the main field of study is assigned
[6]Practical course / group of courses – enter P. For the group of courses – in brackets enter the number of ECTS points assigned to practical courses
[7]KO – general education courses, PD – basic sciences courses, K – main field of study courses, S – specialization courses

Opinion of student government legislative body

Patrycja Haraj

Patrycja Haraj
President of the Student Government
of the Faculty of Geoengineerin, Mining and Geology

....

Date 21.10.2022 name and surname, signature of student representative

DZIEKAN

prof. dr hab. inż. Radosław Zimroz

....

Date 21.10.2022 Dean's signature

COURSE DESCRIPTIONS/
KARTY PRZEDMIOTÓW

second-level studies/ studia II stopnia
main field of study/ kierunek studiów:
Mining and Geology/ Górnictwo I Geologia

specjalność/specialisation:
MINING ENGINEERING

1-st Semester

Semestr 1

Zał. nr 5 do ZW 8/2020
Załącznik nr … do programu studiów

WYDZIAŁ **Geoinżynierii, Górnictwa i Geologii**

KARTA PRZEDMIOTU

Nazwa przedmiotu w języku polskim Wspomagane komputerowo modelowanie geologiczne i geostatystyka. ….(zajęcia są prowadzone w języku angielskim)
Nazwa przedmiotu w języku angielskim Computer Aided Geological Modelling and Geostatistics……………………………………………….
Kierunek studiów (jeśli dotyczy): Górnictwo i geologia.
Specjalność (jeśli dotyczy): Mining Engineering,
Geotechnical and Environmental Engineering,
Geomatics for Mineral Resource Management
Poziom i forma studiów: II stopień, stacjonarna
Rodzaj przedmiotu: obowiązkowy *
Kod przedmiotu W06GIG-SM0038
Grupa kursów NIE*

	Wykład	Ćwiczenia	Laboratorium	Projekt	Seminarium
Liczba godzin zajęć zorganizowanych w Uczelni (ZZU)	15		45		
Liczba godzin całkowitego nakładu pracy studenta (CNPS)	30		120		
Forma zaliczenia	~~Egzamin /~~ zaliczenie na ocenę*	Egzamin / zaliczenie na ocenę*	~~Egzamin /~~ zaliczenie na ocenę*	Egzamin / zaliczenie na ocenę*	Egzamin / zaliczenie na ocenę*
Dla grupy kursów zaznaczyć kurs końcowy (X)					
Liczba punktów ECTS	**1**		4		
w tym liczba punktów odpowiadająca zajęciom o charakterze praktycznym (P)			4		
w tym liczba punktów ECTS odpowiadająca zajęciom wymagającym bezpośredniego udziału nauczycieli lub innych osób prowadzących zajęcia (BU)	1		2		

*niepotrzebne skreślić

WYMAGANIA WSTĘPNE W ZAKRESIE WIEDZY, UMIEJĘTNOŚCI I KOMPETENCJI SPOŁECZNYCH

1. Mathematical Statistics,
2. Fundamentals of Geology and Mineral Deposits

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CELE PRZEDMIOTU

C1 Developing basic skills in computer modelling of 3-D objects.
C2 Introduction of the principles of digital modelling of typical geological structures.
C3 Introduction to the methods of deposit parameters estimation and resources evaluation.

PRZEDMIOTOWE EFEKTY UCZENIA SIĘ
Z zakresu wiedzy: PEU_W01 Estimation methods, principles of geostatistics, kriging estimators PEU_W02 Geostatistical modelling of the selected deposit parameters (domain analysis, variogram modelling, PEU_W03 Creating and validating 3-D models of various geological structures in the comprehensive dedicated software environment. Z zakresu umiejętności: PEU_U01 Application of relevant estimation methods for quality modelling of a deposit PEU_U02 Evaluating 3-D objects against structural and quality block models (volumes, tonnages, grades) PEU_U03 Describing the interpretation and applied approach, creating models, evaluation results, recommendations for possible enhancements Z zakresu kompetencji społecznych: PEK_K01 The student can think and act in a creative and enterprising way

TREŚCI PROGRAMOWE		
Forma zajęć - wykład		**Liczba godzin**
Wy1	Introduction to the course. Geological database and validation of the geological data.	2
Wy2	Geology of the seam.	2
Wy3	Structural model of the stratified deposit. Methods of the prediction of the surface layer parameters.	2
Wy4	Spatial distribution of samples values. Regionalized variable.	2
Wy5	BLUE Estimator of the mean value: Kriging.	2
Wy6	Quality model of the deposit – block model of the parameter layers. Estimation and evaluation of the block model.	2
Wy7	Reserves modelling and evaluation.	2
Wy8	Mineral resources. International reporting. The JORC Code	1
	Suma godzin	**15**

Forma zajęć - ćwiczenia		**Liczba godzin**
Ćw1		
Ćw2		
Ćw3		
Ćw4		
..		
	Suma godzin	0

Forma zajęć - laboratorium	**Liczba godzin**

La1	Determining the rules of work at the laboratory.	3
La2	Assignment of the individual dataset for the exercises and creating initial data files.	3
La3	Data validation and creating initial geological database.	3
La4	Construction of the structural wireframe model of stratigraphy layers.	3
La5	Construction of the block model of the deposit and overburden layers. Thickness and stripping ratio analysis.	3
La6	Data preparation to geostatistical analysis. Compositing of the samples.	3
La7	Domain analysis with the use of the statistical methods.	3
La8	Determination of the empirical variogram. Anisotropy analysis.	3
La9	Variogram modelling.	3
La10	Kriging Neighborhood Analysis - defining optimal parameters of the estimation procedure.	3
La11	Estimation of quality parameters in block model of the deposit layers. Validation of the estimation quality.	3
La12	Validation of the quality model and classification of the resources. Balance resources evaluation.	3
La13	Preparation of data for continuous surface mining ultimate pit design. Ultimate pit outlines generation	3
La14	Wireframe and block modelling of the ultimate pit	3
La15	Reserves evaluation, visualization and interrogation of created models	3
	Suma godzin	45

Forma zajęć - projekt		Liczba godzin
Pr1		
Pr2		
Pr3		
Pr4		
…		
	Suma godzin	0

Forma zajęć - seminarium		Liczba godzin
Se1		
Se2		
Se3		
…		
	Suma godzin	0

STOSOWANE NARZĘDZIA DYDAKTYCZNE
N1. Form of lectures - traditional, multimedia presentations using specialized software and demonstrations of its application "live", individual development of specialist topics covered during the lecture, N2. individual development of project tasks within the laboratories frames, individual development of electronic reports concerning project tasks within the laboratories frames, N3. evaluation of laboratory tasks reports with multipoint grade of student’s work, group analysis of the results obtained during laboratory tasks; preparation of conclusions concerning data dependencies and constraints of mining projects, skill control tests, duty hours in laboratory.

OCENA OSIĄGNIĘCIA PRZEDMIOTOWYCH EFEKTÓW UCZENIA SIĘ

Oceny (F – formująca (w trakcie semestru), P – podsumowująca (na koniec semestru)	Numer efektu uczenia się	Sposób oceny osiągnięcia efektu uczenia się
F1	PEU_W01, PEU_W02	Lecture grade on the basis of the written examination
F2	PEU_W03,	Laboratory task assessment: “structural modelling assessment
F3	PEU_U01	Laboratory task assessment: “geostatistical modelling”
F4	PEU_U02, PEU_U03	Laboratory task assessment: “reserves evaluation”.
P average of F1, F2, F3, F4		

LITERATURA PODSTAWOWA I UZUPEŁNIAJĄCA

LITERATURA PODSTAWOWA:

[1] M. Armstrong, Basic Linear Geostatistics, Springer Verlag, 1998.
[2] P. Goovaerts: “Geostatistics for Natural Resource Evaluation“, Oxford University Press, 1997.
[3] R. H. Grishong, Jr., 3-D Structural Geology, Springer Verlag, 2008
[4] K. Hefferan, J. O’Brien, Earth materials, Willey-Blacwell, Chichester U.K., 2010
[5] W. Hustrulid, M. Kuchta, Open pit mine planning and design. Chapter 3. Orebody description, Taylor&Francis, 2013.
[6] A. G. Journel, and C.J. Huijbregts, Mining Geostatistics, Academic Press, 1978.
[7] Ch.C. Plummer, D.H. Carlson, L. Hammersley, Physical geology, McGraw-Hill I.E. N.Y. 2010
[8] D.R. Prothero, R.H. Dott Jr., Evolution of the Earth, McGraw-Hill I.E. N.Y., 2010
[9] M.W. Rossi, C.V. Deutsch, Mineral Resources Estimation, Springer Verlag 2014.

LITERATURA UZUPEŁNIAJĄCA:

[10] Handouts, tutorials.

OPIEKUN PRZEDMIOTU (IMIĘ, NAZWISKO, ADRES E-MAIL)

Dr inż. Krzysztof Hołodnik
Dr inż. Witold Kawalec, Dr Paweł Zagożdżon

Zał. nr 5 do ZW 8/2020
Załącznik nr … do programu studiów

WYDZIAŁ GEOINŻYNIERII, GÓRNICTWA i GEOLOGII

KARTA PRZEDMIOTU

Nazwa przedmiotu w języku polskim Geofizyka inżynierska
….(zajęcia są prowadzone w języku angielskim)
Nazwa przedmiotu w języku angielskim Engineering Geophysics
Kierunek studiów (jeśli dotyczy): górnictwo i geologia
Specjalność (jeśli dotyczy): Mining Engineering,
Geotechnical and Environmental Engineering,
Geomatics for Mineral Resource Management
Poziom i forma studiów: **~~I~~ / II stopień / ~~jednolite studia magisterskie~~*, stacjonarna / ~~niestacjonarna~~***
Rodzaj przedmiotu: **~~obowiązkowy~~ / wybieralny / ~~ogólnouczelniany~~ ***
Kod przedmiotu **W06GIG-SM0040**
Grupa kursów **~~TAK~~ / NIE***

	Wykład	Ćwiczenia	Laboratorium	Projekt	Seminarium
Liczba godzin zajęć zorganizowanych w Uczelni (ZZU)	15			15	
Liczba godzin całkowitego nakładu pracy studenta (CNPS)	40			50	
Forma zaliczenia	~~Egzamin~~ / zaliczenie na ocenę*			~~Egzamin~~ / zaliczenie na ocenę*	
Dla grupy kursów zaznaczyć kurs końcowy (X)					
Liczba punktów ECTS	1			2	
w tym liczba punktów odpowiadająca zajęciom o charakterze praktycznym (P)				2	
w tym liczba punktów ECTS odpowiadająca zajęciom wymagającym bezpośredniego udziału nauczycieli lub innych osób prowadzących zajęcia (BU)				2	

*niepotrzebne skreślić

WYMAGANIA WSTĘPNE W ZAKRESIE WIEDZY, UMIEJĘTNOŚCI I KOMPETENCJI SPOŁECZNYCH

1. has knowledge of fundamentals of applied geophysics, physics and geology.
2. knows fundamentals of soil and rock mechanics.
3. is able to use MS Office software.
4. is able to work in a team.

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CELE PRZEDMIOTU

C1 familiarize with physical phenomena in geosphere of the Earth
C2 familiarize with engineering problems solved by means of geophysical surveying
C3 familiarize with various geophysical surveys.

C4 acquisition of skills to plan geophysical field surveying and to interpret its results. C5 development of skills to work in a group.

PRZEDMIOTOWE EFEKTY UCZENIA SIĘ
Z zakresu wiedzy: PEU_W01 recognizes, names and explains engineering problems in different fields. PEU_W02 identifies, describes and chooses geophysical surveying methods. PEU_W03 analyses and assesses case studies from solving the engineering problems. Z zakresu umiejętności: PEU_U01 is able to coordinate team work, create field research plans and manage the work progress. PEU_U02 is able to independently create solutions for complex practical problems in engineering and geoengineering applying knowledge about geophysical surveying, mining geophysics, utilizing modern methods in geophysical data acquisition and interpretation. PEU_U03 is able to critically assess, process and interpreted results of the geophysical surveying and provide recommendations related to engineering problems in mining, civil engineering, engineering geology, municipal waste site, archeology, engineering properties of soil and rocks, hydrogeology, monitoring seepage in river dykes or dams. PEU_U04 is able to solve geophysical problems. PEU_U05 is able to conduct auto-didactical education related to detailed handling of typical software. Z zakresu kompetencji społecznych: PEU_K02 understands the need to create and transfer to the society – among others by mass media- information and opinions related to mining engineering achievements and other activities of mining engineer; tries to transfer the information in commonly understood way, presenting different points of view; is aware of the quality and need to shape the work safety culture in mining and the responsibility for the health and life of other employees.

TREŚCI PROGRAMOWE		
Forma zajęć - wykład		**Liczba godzin**
Wy1	Physical properties of rocks. Inter-relationships between the various subdisciplines of applied geophysics. Overview of geophysical methods, their physical principles and applications. Methodology of geophysical surveying.	1
Wy2	Engineering problems solved with geophysical surveying. Case studies.	2
Wy3	Electrical resistivity methods. Tomography and VSE. IP method. Physical principles. Equipment. Methods of field surveying. Interpretation and application. Case studies.	2
Wy4	Electromagnetic methods. FDEM and TDEM methods. Magnetotelluric methods. Physical principles. Methods of field surveying. Equipment. Interpretation and application. Case studies.	2
Wy5	GPR surveying. Physical principles. Methods of field surveying.	2

	Equipment. Interpretation and application. Case studies.	
Wy6	Seismic tomography. Seismic interferometry. Physical principles. Applications. Case studies.	2
Wy7	Mine geophysics. Seismology. Seismic methods. Active and passive seismic tomography. Microgravimetry. Case studies.	2
Wy8	Gravity and magnetic surveying. Equipment. Methods of field surveying. Interpretation and application. Case studies.	2
	Suma godzin	**15**

Forma zajęć - projekt		**Liczba godzin**
Pr1	One selected geophysical technique. Fundamentals and equipment. Field surveying	4
Pr2	Processing and interpretation of field data.	3
Pr3	Solving the geophysical problems.	8
	Suma godzin	**15**

STOSOWANE NARZĘDZIA DYDAKTYCZNE
N1.Lecture aided by presentation. N2.Demonstration. N3.Discussion and consultations N3Calculations N5Practical field surveying

OCENA OSIĄGNIĘCIA PRZEDMIOTOWYCH EFEKTÓW UCZENIA SIĘ

Oceny (F – formująca (w trakcie semestru), P – podsumowująca (na koniec semestru)	Numer efektu uczenia się	Sposób oceny osiągnięcia efektu uczenia się
P1	W01-W03	Test related to lecture content. Final grade.
F1	U01-U02, U05	Test. Project 1. Report on Project 1
F2	U03, U05	Test. Project 2. Report on Project 2
F3	U04, U05	Test. Solving geophysical problems
F1-F3, P2	U01-U05 K02	Grades are given for each of three project tasks including tests and reports. The final grade P2 for the project course is the weighted average grade of F1-F3.

LITERATURA PODSTAWOWA I UZUPEŁNIAJĄCA

LITERATURA PODSTAWOWA:

[1] Aki, K., Richards P.G., 1980. Quantitative Seismology: Theory and Methods. W.H. Freeman Co.. San Francisco.
[2] Burger, H.R., Sheehan, A.F., Jones, C.H., 2006. Introduction to Applied Geophysics: Exploring the Shallow Subsurface. W.W. Norton & Company, Inc.
[3] Mendecki, A.J. (ed.), 1997. Seismic Monitoring in Mines. Chapman & Hall.
[4] Reynolds, J.M., 2011. An Introduction to Applied and Environmental Geophysics. Wiley – Blackwell. John Wiley & Sons.

[5] Sharma, Prem V., 2002. Environmental and engineering geophysics. Cambridge University Press.
[6] Torge, W., 1989. Gravimetry. Water de Gruyter. Berlin. New York.
[7] Selected Journal Publications (for example journals: Progress in Geophysics, Engineering Geophysics Journal, Environmental and Engineering Geophysics, Journal of Geophysics and Engineering, Pure and Applied Geophysics).

LITERATURA UZUPEŁNIAJĄCA:

[1] Lowrie, W., 2007. Fundamentals of Geophysics. Cambridge University Press.
[2] Milsom, J., 2003. Field Geophysics. John Wiley & Sons Ltd.
[3] Telford, W.M., Geldart, L.P., Sheriff, R.E., 1990. Applied Geophysics. Cambridge University Press.

OPIEKUN PRZEDMIOTU (IMIĘ, NAZWISKO, ADRES E-MAIL)

ANNA BARBARA GOGOLEWSKA, anna.gogolewska@pwr.edu.pl

WYDZIAŁ **Geoinżynierii, Górnictwa i Geologii**

KARTA PRZEDMIOTU

Nazwa przedmiotu w języku polskim Projektowanie wyrobisk w górnictwie odkrywkowym ….(zajęcia są prowadzone w języku angielskim)
Nazwa przedmiotu w języku angielskim Excavation Design in Open Pit Mining
Kierunek studiów (jeśli dotyczy): Górnictwo i geologia.
Specjalność (jeśli dotyczy): Mining Engineering,
Geotechnical and Environmental Engineering,
Poziom i forma studiów: II stopień, stacjonarna
Rodzaj przedmiotu: obowiązkowy *
Kod przedmiotu W06GIG-SM0068
Grupa kursów NIE*

	Wykład	Ćwiczenia	Laboratorium	Projekt	Seminarium
Liczba godzin zajęć zorganizowanych w Uczelni (ZZU)	30			15	
Liczba godzin całkowitego nakładu pracy studenta (CNPS)	120			30	
Forma zaliczenia	Egzamin / ~~zaliczenie na ocenę*~~	Egzamin / zaliczenie na ocenę*	Egzamin / zaliczenie na ocenę*	~~Egzamin~~ / zaliczenie na ocenę*	Egzamin / zaliczenie na ocenę*
Dla grupy kursów zaznaczyć kurs końcowy (X)					
Liczba punktów ECTS	**3**			2	
w tym liczba punktów odpowiadająca zajęciom o charakterze praktycznym (P)				2	
w tym liczba punktów ECTS odpowiadająca zajęciom wymagającym bezpośredniego udziału nauczycieli lub innych osób prowadzących zajęcia (BU)	2,5			1,5	

*niepotrzebne skreślić

WYMAGANIA WSTĘPNE W ZAKRESIE WIEDZY, UMIEJĘTNOŚCI I KOMPETENCJI SPOŁECZNYCH

1. Possesses fundamental knowledge of widely concerned mining, as one of the most important fields of technology and human activity, knows problems related to minerals search, sharing and mining.
2. Possesses knowledge of basic concepts of geology and systematized knowledge regarding resources and minerals mining in Poland.
3. Is able to use Microsoft Office to prepare Word documents and work with the spreadsheet Excel. Is able to use AutoCad, Microstation or similar.

CELE PRZEDMIOTU

C1 Introduction and explanation of problems related to technology of mechanized mining machines

of different types and size used in open pit mining. C2 Becoming familiar with the relationships between parameters characterizing the geometry of the workplace and the process of digging, controlling machine work process in order to achieve the proper efficiency level and forecasting the efficacy in different geological -mining conditions. C3 Preparing students to particular tasks completion in the area of work technology and the choice of technological system for the project of excavation and carrying out technological analysis of bucket-wheel excavator work.

PRZEDMIOTOWE EFEKTY UCZENIA SIĘ
Z zakresu wiedzy: K2_GIG_W07 ma wiedzę w zakresie procesów i technologii stosowanych w przemyśle wydobywczym i przetwórczym surowców mineralnych Z zakresu umiejętności: K2_GIG_U01 - dysponuje odpowiednimi dla języka specjalistycznego środkami językowymi i potrafi używać języka specjalistycznego we wszystkich działaniach językowych, aby porozumiewać się w środowisku zawodowym w zakresie studiowanego kierunku studiów K2_GIG_U07 – potrafi zaprojektować systemy technologiczne stosowane w przemyśle wydobywczym lub przetwórczym surowców mineralnych Z zakresu kompetencji społecznych: K2_GIG_K01 potrafi myśleć i działać w sposób kreatywny i przedsiębiorczy

TREŚCI PROGRAMOWE		
Forma zajęć - wykład		**Liczba godzin**
Wy1	The aim of the course, conditions of crediting, literature, contact with the teacher. Basic concepts, definitions related to open pit exploitation of deposits, basic technological systems	3
Wy2	Basic technologies of open pit exploitation (continuous, cycle, mixed), the ways off dredging and exploitation	2
Wy3	Bulldozers work technologies, the range of applications, divisions. Efficiency work forecasting of bulldozers, the resistance movement, cooperation with the base.	2
Wy4	Single and bucket-wheel excavator work technologies, the range of applications, divisions according to different criteria.	3
Wy5	Efficiency work forecasting of a bucket-wheel excavator using chosen methods, the resistance movement, cooperation with the base.	2
Wy6	Scraper work technologies, basic parameters, the range of applications, division, efficacy	2
Wy7	Ripper work technologies basic parameters, the range of applications, division, efficacy	2
Wy8	Loader spoon work technologies the range of applications, division, efficacy	2
Wy9	Multi-bucket-wheel excavator work technologies, basic parameters,	2

	the range of applications, division, and work principles	
Wy10	Multi-bucket-wheel excavator work technologies, types of shortwalls.	2
Wy11	Efficiency work forecasting of multi-bucket-wheel excavators, digging resistance, cooperation with the base	2
Wy12	Multi-bucket-chain excavators work technologies.	2
Wy13	Efficiency work forecasting of a multi-bucket-chain excavators, digging resistance, cooperation with a base.	2
Wy14	Heaping in open pit mining, types of heaps, KTZ. Heaping with the method of direct tossing.	2
	Suma godzin	**30**

	Forma zajęć - projekt	**Liczba godzin**
Pr1	Organization classes. The scope of the Project, conditions of crediting, literature. Distribution of topics among students. Discussing the guidelines for the project titled: The excavation project, bulldozer and excavator work technology. Discussing the first stage of the project task, determining mining area and also the issue of the multilevel excavation embankment design on the slope	2
Pr2	Discussing the guidelines to the choice of a bulldozer as a machine which enables an access to the deposit. Discussing issues related to an overlay indirect heaping in the excavation neighbourhood and the bulldozer work efficiency forecast	2
Pr3	Discussing the choice of excavator as a basic machine used for mineral dredging, designing the division of an excavation into floors, forecasting and its cooperation with car transport.	2
Pr4	Students hand over projects- assessment and defence. Discussing the scope of project 2. Distribution of individual topics among students. Discussing the guidelines for the project: "Technological analysis of bucket-wheel excavator…"	2
Pr5	The core of shortwall system, discussing basic parameters of a shortwall, defining the dredging radius and the angle of inclination of dredging jib in the function of dredging height and limit angles of the inclination of the side embankment of a shortwall in the function of its height. Determining maximum distance of an axis of an excavator route from internal side embankment.	2
Pr6	Discussing the outer bottom width of a shortwall. Determining the width of a shortwall.	2
Pr7	Determining two maximum values of a take: considering the slope of the forehead embankment because of the ability to drive to the forehead of shortwall and because of the possibility of the contact of a dredging jib structure with the upper edge of the second level in a shortwall. Determining the angle of inclination of the jib structure axis in the function of the height of a bucket wheel axis and also the angle describing the dimension of a lower piece of a dredging jib structure. Forecasting the SRs efficacy considering particular groups of factors, determining the individual digging resistance and digging force in given geological-mining conditions. The final calculations concerning	2

	side and forehead shortwalls, discussing the graphic form of a project.	
Pr8	Student hand over Project – assessment	1
	Suma godzin	**15**

STOSOWANE NARZĘDZIA DYDAKTYCZNE
N1. Wykład z prezentacją multimedialną N2.Dyskusja. Rozwiązywanie przykładowych zadań N3. Konsultacje i indywidualna ocena projektów

Oceny (F – formująca (w trakcie semestru), P – podsumowująca (na koniec semestru)	Numer efektu uczenia się	Sposób oceny osiągnięcia efektu uczenia się
F1, P1	K2_GIG_U07 K2_GIG_U01 K2_GIG_K01	F1.1 Ocena z wykonania i wartości merytorycznej projektu F.1.2 Ocena z obrony ustnej lub/i pisemnej projektu P1 Ocena końcowa z projektu nr 1 (średnia ważona z F1.1- 50% oraz F1.2 – 50%)
P2	K2_GIG_W07 K2_GIG_U07 K2_GIG_K01	P2 O cena końcowa z egzaminu w formie ustnej lub sprawdzianu pisemnego

LITERATURA PODSTAWOWA I UZUPEŁNIAJĄCA

LITERATURA PODSTAWOWA:

[1] Kasztelewicz, Z. (2012). Koparki wielonaczyniowe i zwałowarki taśmowe. Technologia pracy, AGH Publishing House.
[2] Hustrulid, W. A., Kuchta, M., & Martin, R. K. (2013). Open pit mine planning and design, two volume set & CD-ROM pack. CRC Press.
[3] Gogolewska, A. Surface and underground Mining Technology. Wrocław 2011
[4] Kasztelewicz, Z., Patyk, M., & Bodziony, P. (2015). Spycharki, dźwigi boczne i przesuwarki przenośników taśmowych. Budowa i technologia pracy, AW-P ART-TEKST, Kraków.
[5] Hawrylak H., Jarząbek M., Sieczyński A., Sobolski R. MASZYNY I PRACE POMOCNICZE W GÓRNICTWIE ODKRYWKOWYM
[6] Glapa W., Korzeniowski J.I., MAŁY LEKSYKON GÓRNICTWA ODKRYWKOWEGO, Wydawnictwa i Szkolenia Górnicze Burnat & Korzeniowski, Wrocław 2005
[7] Korzeniowski J.I.: GÓRNICTWO ODKRYWKOWE : RUCH ZAKŁADÓW EKSPLOATUJĄCYCH ZŁOŻA KOPALIN, 2010
[8] Bęben A.: MASZYNY I URZĄDZENIA DO WYDOBYWANIA KOPALIN POSPOLITYCH BEZ UŻYCIA MATERIAŁÓW WYBUCHOWYCH. Kraków : AGH Uczelniane Wydawnictwa Naukowo-Dydaktyczne, 2008

LITERATURA UZUPEŁNIAJĄCA:

[1] Czasopisma: Mining Science, Journal of mining science, Węgiel brunatny, Górnictwo Odkrywkowe

OPIEKUN PRZEDMIOTU (IMIĘ, NAZWISKO, ADRES E-MAIL)

Dr hab. inż. JUSTYNA WOŹNIAK , prof. uczelni
Dr inż. Anna Nowak-Szpak

Zał. nr 5 do ZW 8/2020
Załącznik nr … do programu studiów

WYDZIAŁ GEOINŻYNIERII, GÓRNICTWA I GEOLOGII

KARTA PRZEDMIOTU

Nazwa przedmiotu w języku polskim: Zintegrowana analiza deformacji w geomechanice…….(zajęcia są prowadzone w języku angielskim)
Nazwa przedmiotu w języku angielskim: Integrated Analysis of Deformations in Geomechanical Engineering
Kierunek studiów (jeśli dotyczy): górnictwo i geologia
Specjalność (jeśli dotyczy): Geomatics for Mineral Resources Management
Poziom i forma studiów: **~~I~~ / II stopień / ~~jednolite studia magisterskie~~*, stacjonarna / ~~niestacjonarna*~~**
Rodzaj przedmiotu: **~~obowiązkowy~~ / wybieralny ~~/ ogólnouczelniany~~ ***
Kod przedmiotu **W06GIG-SM0041G**
Grupa kursów **~~TAK~~ / NIE***

	Wykład	Ćwiczenia	Laboratorium	Projekt	Seminarium
Liczba godzin zajęć zorganizowanych w Uczelni (ZZU)	30		30		
Liczba godzin całkowitego nakładu pracy studenta (CNPS)	90		60		
Forma zaliczenia	Egzamin / ~~zaliczenie na ocenę*~~		~~Egzamin~~ / zaliczenie na ocenę*		
Dla grupy kursów zaznaczyć kurs końcowy (X)					
Liczba punktów ECTS	5				
w tym liczba punktów odpowiadająca zajęciom o charakterze praktycznym (P)	3		2		
w tym liczba punktów ECTS odpowiadająca zajęciom wymagającym bezpośredniego udziału nauczycieli lub innych osób prowadzących zajęcia (BU)	2,5		1,5		

*niepotrzebne skreślić

WYMAGANIA WSTĘPNE W ZAKRESIE WIEDZY, UMIEJĘTNOŚCI I KOMPETENCJI SPOŁECZNYCH

1. Podstawowa wiedza z zakresu goemechaniki
2. Podstawową wiedza dotycząca eksploatacji górniczej
3. Podstawowa wiedza monitorowania zmian górotworu

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CELE PRZEDMIOTU

C1 Przedstawienie roli monitorowania w górnictwie zrównoważonym
C2 Przygotowanie i przeprowadzenie analizy deformacji górotworu spowodowanych działalnością górniczą

C3 Przygotowanie i przeprowadzenie analizy deformacji zapór i usypisk ziemnych
C4 Nauczenie zasad modelowania MES
C5 Nabycie umiejętności wykorzystania analizy zintegrowanej wykorzystując modelowanie deterministyczne MES i wyniki pomiarów geodezyjnych i geotechnicznych

PRZEDMIOTOWE EFEKTY UCZENIA SIĘ

Z zakresu wiedzy:
PEU_W01 Potrafi rozróżnić i opisać zastosowania technik monitorowania deformacji w sPEUtrum dyscyplin inżynieryjnych takich jak górnictwo i inżynieria budowlana
PEU_W02 Potrafi scharakteryzować górotwór i metody górnicze
PEU_W03 . Posiada wiedzę z zakresu analiz: empirycznych i deterministycznych z zastosowaniem FEM deformacji górotworu,
PEU_W04 . Posiada wiedzę podstaw i zastosowań analizy zintegrowanej metody deterministycznej z wynikami pomiarów geodezyjnych
PEU_W05 . Potrafi wyznaczyć główne założenia pomiaru geodezyjnego deformacji wywołanych eksploatacja górniczą
PEU_W06 Ma znajomość przygotowania modelu MES
Z zakresu umiejętności:

Z zakresu kompetencji społecznych:
PEU_K01 Potrafi ocenić rolę monitorowania i predykcji w górnictwie zrównoważonym w całym jego cyklu

TREŚCI PROGRAMOWE		
Forma zajęć - wykład		**Liczba godzin**
Wy1	Syllabus, warunki zaliczenia, literatura,	2
Wy2	Wstęp do zintegrowanej analizy deformacji	2
Wy3	Rola monitorowania w górnictwie zrównoważonym	2
Wy4	Opis zjawisk fizycznych: statyka- dynamika , rozchodzenie się ciepła, przepływ cieczy, zmiany siły grawitacji, zastosowania	2
Wy5	Metody analizy deformacji: stosując analizę systemów i mechaniki ciała stałego	2
Wy6	Ogólna klasyfikacja metod monitorowania: absolutne i względne pomiary deformacji,	**2**
Wy7	zalety i wady metod geodezyjnych i geotechniczno-strukturalnych, koncepcja pomiarów zintegrowanych	**2**

Wy8	Mechanika ciała stałego, Problem warunków brzegowych	**2**
Wy9	Rozwiązanie systemu kratownicy - relacja do MES MES	**2**
Wy10	Empiryczne metody wyznaczania deformacji powierzchni wywołanych eksploatacją podziemną (gaz i nafta) i eksploatacją odkrywkową, zastosowanie MES, Kategoria terenu	**2**
Wy11	Przykłady zastosowania integracji : stabilności zboczy w kopalniach odkrywkowych, Chiquqimata, Chile, NevadaUSA	**2**
Wy12	Przykłady zastosowania integracji : deformacja górotworu na terenach podziemnej eksploatacji górniczej w kopalni soli w Kanadzie,	**2**
Wy13	Problemy wydobycia gazu naturalnego i nafty	**2**
Wy14	Podsumowanie	**2**
Wy15	Kolokwium	**2**
	Suma godzin	**30**

Forma zajęć - ćwiczenia		**Liczba godzin**
Ćw1		
Ćw2		
Ćw3		
Ćw4		
..		
	Suma godzin	

Forma zajęć - laboratorium		**Liczba godzin**
La1	Przedstawienie zakresu ćwiczeń, warunków zaliczenia oraz literatury.	2
La2	Analiza wpływu obciążenia na górotwór –zastosowanie programu GeoStudio 2007	2
La3	Analiza naprężeń in-situ górotworu i górotworu obciążonego	2
La4	Zaprojektowanie pomiaru geodezyjnego na terenie górniczym prowadzenia podziemnej eksploatacji na podstawie wyników MES. Dyskusja projektu pomiarów.	2
La5	Wyznaczenie kategorii terenu górniczego Dyskusja wyników projektu	2
La6	Zaprojektowanie pomiaru geodezyjnego na terenie kopalni odkrywkowej na podstawie modelu MES . Dyskusja projektu pomiarów.	2
La7	Zaprojektowanie pomiaru geodezyjnego ziemnej zapory wodnej na podstawie modelu MES. Dyskusja analizy	2
La8	Podsumowanie	1
	Suma godzin	15

Forma zajęć - projekt		Liczba godzin
Pr1	Wyznaczenie MES deformacji górotworu spowodowanych eksploatacją podziemną, wyznaczenie kategorii terenu. Analiza sprężysta i nieliniowa . Omowienie monitorowania	6
Pr2	Podsumowanie	1
Pr3	Wyznaczenie MES deformacji usypiska/zapory ziemnej w warunkach zmiennego poziomu wody. Wyznaczenie wspolczynnika bezpieczeństwa stosując oprogramowanie Geostudio. Omowienie monitorowania	6
Pr4	Podsumowanie	2
…		
	Suma godzin	**15**

Forma zajęć - seminarium		Liczba godzin
Se1		
Se2		
Se3		
…		
	Suma godzin	

STOSOWANE NARZĘDZIA DYDAKTYCZNE
N1. Wykład, film N2. N3.

OCENA OSIĄGNIĘCIA PRZEDMIOTOWYCH EFEKTÓW UCZENIA SIĘ

Oceny (F – formująca (w trakcie semestru), P – podsumowująca (na koniec semestru)	Numer efektu uczenia się	Sposób oceny osiągnięcia efektu uczenia się
F1	PEK_U01 – PEK_U06	Oceny z Lab 2-7, projekt 1 i 2.
F2		
F3		
P P PEU_W01 – PEU_W06, Kolokwium , Ocena końcowa z wykładu PEU_U01 – PEU_U06 Ocena końcowa z laboratorium . Średnia ze sprawozdań i projektu		

LITERATURA PODSTAWOWA I UZUPEŁNIAJĄCA

LITERATURA PODSTAWOWA:

[1] Szostak-Chrzanowski, A., A. Chrzanowski,(2010), „INTEGETED ANALYSIS OF DEFORMATIONS IN GEOMECHANICS “, UNB, Fredericton, N.B., 220p.

LITERATURA UZUPEŁNIAJĄCA:

1 Szostak-Chrzanowski, A., A. Chrzanowski, M. Massiera (2005) “Use of deformation monit results in solving geomechanical problems – case studies “, *Engineering Geology,* vol. 7 Issues 1-2, pp. 3-12.

2 Chrzanowski,A. (1993):"Modern Surveying Techniques for Mining and Civil Engineering 33 in: *Comprehensive Rock Engineering,* Pergamon Press,Vol.3.Chapter 33, pp.773-809.

OPIEKUN PRZEDMIOTU (IMIĘ, NAZWISKO, ADRES E-MAIL)
Anna Chrzanowska anna.chrzanowska@pwr.edu.pl

Zał. nr 5 do ZW 8/2020
Załącznik nr … do programu studiów

WYDZIAŁ **Geoinżynierii, Górnictwa i Geologii**

KARTA PRZEDMIOTU

Nazwa przedmiotu w języku polskim Bezpieczeństwo i higiena pracy ….(~~zajęcia są prowadzone w języku angielskim~~)
Nazwa przedmiotu w języku angielskim Occupational Health and Safety
Kierunek studiów (jeśli dotyczy): Górnictwo i geologia.
Specjalność (jeśli dotyczy): Mining Engineering
Geotechnical and Environmental Engineering,
Geomatics for Mineral Resource Management
Poziom i forma studiów: II stopień, stacjonarna
Rodzaj przedmiotu: obowiązkowy *
Kod przedmiotu W06GIG-SM0042
Grupa kursów NIE*

	Wykład	Ćwiczenia	Laboratorium	Projekt	Seminarium
Liczba godzin zajęć zorganizowanych w Uczelni (ZZU)	15			15	
Liczba godzin całkowitego nakładu pracy studenta (CNPS)	30			30	
Forma zaliczenia	~~Egzamin /~~ zaliczenie na ocenę*	Egzamin / zaliczenie na ocenę*	Egzamin / zaliczenie na ocenę*	~~Egzamin~~ / zaliczenie na ocenę*	Egzamin / zaliczenie na ocenę*
Dla grupy kursów zaznaczyć kurs końcowy (X)					
Liczba punktów ECTS	**1**			1	
w tym liczba punktów odpowiadająca zajęciom o charakterze praktycznym (P)				1	
w tym liczba punktów ECTS odpowiadająca zajęciom wymagającym bezpośredniego udziału nauczycieli lub innych osób prowadzących zajęcia (BU)	1			1	

*niepotrzebne skreślić

WYMAGANIA WSTĘPNE W ZAKRESIE WIEDZY, UMIEJĘTNOŚCI I KOMPETENCJI SPOŁECZNYCH

1. Possesses basic knowledge of technologies used in open-pit mines and underground mines.
2. Is able to use Microsoft Office environment to prepare documents in Word, multimedia presentations in Power Point and work with Excel spreadsheets.
3. Is able to identify harmful, dangerous and nuisance factors in the workplace environment.

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CELE PRZEDMIOTU

C1. To introduce the principles of occupational risk assessment in accordance with relevant

standards C2 To present the principles of occupational risk assessment and the determination of admissibility with the use of STER software and the RISC SCORE method.

PRZEDMIOTOWE EFEKTY UCZENIA SIĘ
Z zakresu wiedzy: PEU_W01 Possesses general knowledge of rules of occupational risk assessment formulation PEU_W02 – Possesses knowledge of evaluating and determining the admissibility of occupational risk. PEU _W0 3 – Possesses general knowledge of corrective and preventive actions regarding hazards of typical work posts in the mining industry.… Z zakresu umiejętności: PEU_U01 Is able to identify hazards of harmful, dangerous and nuisance factors of typical work posts in the mining industry PEU_U02 Is able to estimate and determine risk acceptability with methods according to STER software and the RISC SCORE method. PEU_U03 - Is able to plan corrective and preventive actions for hazards of typical work posts in the mining industry.… Z zakresu kompetencji społecznych: PEU_K01 - Is able to work in a team and together complete occupational risk assessment and develop its results and the required documentation in the form of a team report

TREŚCI PROGRAMOWE		
Forma zajęć - wykład		**Liczba godzin**
Wy1	Definition of occupational risk. Legal basics of occupational risk assessment. Risk assessment methods. Course of occupational risk assessment. Information necessary for occupational risk assessment. Identification of harmful, dangerous and nuisance factors in the work environment.	3
Wy2	Estimation of occupational risk assessment and determination of admissibility. Corrective and preventive actions. Familiarising employees with the results of occupational risk assessment. Implementation of agreed corrective and preventive actions. Monitoring the effectiveness of implemented actions. Periodic occupational risk assessment. Harmful factors – identification and assessment of risks.	3
Wy3	Dangerous factors - identification and assessment of risks.	3
Wy4	Nuisance factors in occupational risk assessment: psychological burden, static burden, monotype.	3
Wy 5	Methods of occupational risk assessment: STER software, the RISC SCORE method, written test	3
	Suma godzin	**15**

Forma zajęć - ćwiczenia		**Liczba godzin**
Ćw1		
Ćw2		
Ćw3		

Ćw4		
..		
	Suma godzin	

Forma zajęć - laboratorium		Liczba godzin
La1		
La2		
La3		
La4		
La5		
…		
	Suma godzin	

Forma zajęć - projekt		Liczba godzin
Pr1	Occupational risk assessment with the use of STER software for two work posts – description of work post, identification of hazards. Occupational risk assessment with the use of STER software for two work posts – estimation of occupational risk and determination of admissibility of harmful factors (dust, noise)	3
Pr2	Occupational risk assessment with the use of STER software for two work posts – estimation of occupational risk and determination of admissibility of harmful factors (vibration, chemical agents)	3
Pr3	Occupational risk assessment with the use of STER software for two work posts – estimation of occupational risk and determination of admissibility of dangerous factors (slippery or uneven surfaces, falling elements, moving parts, moving machinery and transported bimi items)	3
Pr4	Occupational risk assessment with the use of STER software for two work posts – estimation of occupational risk and determination of admissibility for nuisance factors (psychological burden, static burden, monotype)	3
Pr 5	Occupational risk assessment for a selected work post with the use of the RISC SCORE method, presentation of executed exercises, test	3
	Suma godzin	**15**

Forma zajęć - seminarium		Liczba godzin
Se1		
Se2		
Se3		
…		
	Suma godzin	

STOSOWANE NARZĘDZIA DYDAKTYCZNE
N1. Informative lecture with elements of problematic lectures. N2 Multimedia presentations. N3 Didactic discussions during lectures. N4 Didactic discussions during laboratory classes. N5Computer presentation of executed occupational risk assessments. N6Consultation.

OCENA OSIĄGNIĘCIA PRZEDMIOTOWYCH EFEKTÓW UCZENIA SIĘ

Oceny (F – formująca (w trakcie semestru), P – podsumowująca (na koniec semestru)	Numer efektu uczenia się	Sposób oceny osiągnięcia efektu uczenia się
F1	PEU_W01-W03	grade from a test
F2	PEU_W01-W03 PEU_U01- U03	grade from a presentation
P2	PEU_W01-W03 PEU_U01- U03	final grade from project classes (arithmetic average of F1 and F2)
P		

LITERATURA PODSTAWOWA I UZUPEŁNIAJĄCA

LITERATURA PODSTAWOWA:

[1] Iwona Romanowska Słomka, Adam Słomka Zarządzanie ryzykiem zawodowym. Wydawnictwo TARBONUS, Krakow Tarnobrzeg, 2009

[2] Iwona Romanowska Słomka, Adam Słomka Ocena ryzyka zawodowego. Wydawnictwo TARBONUS, Krakow Tarnobrzeg, 2010

[3] Wiesława Horst Ryzyko zawodowe na stanowisku pracy. Część 1, Ergonomiczne czynniki ryzyka. Wydawnictwo Politechniki Poznańskiej, Poznan, 2004

LITERATURA UZUPEŁNIAJĄCA:

[1] PN-N-18002 Systemy zarządzania bezpieczeństwem i higieną pracy - Ogólne wytyczne do oceny ryzyka zawodowego

[2]

OPIEKUN PRZEDMIOTU (IMIĘ, NAZWISKO, ADRES E-MAIL)

Dr inż. Żaklina Konopacka

Zał. nr 5 do ZW 8/2020
Załącznik nr … do programu studiów

WYDZIAŁ **Geoinżynierii, Górnictwa i Geologii**

KARTA PRZEDMIOTU

Nazwa przedmiotu w języku angielskim: Project Management, Appraisal and Risk Evaluation ….(zajęcia są prowadzone w języku angielskim)

Nazwa przedmiotu w języku polskim :Zarządzanie projektami, ocena ich opłacalności i ryzyka.
Kierunek studiów (jeśli dotyczy): Górnictwo i geologia
Specjalność (jeśli dotyczy): Mining Engineering,
Geotechnical and Environmental Engineering,
Geomatics for Mineral Resource Management
Poziom i forma studiów: II stopień , stacjonarna
Rodzaj przedmiotu: obowiązkowy
Kod przedmiotu W06GIG-SM0039G
Grupa kursów TAK

	Wykład	Ćwiczenia	Laboratorium	Projekt	Seminarium
Liczba godzin zajęć zorganizowanych w Uczelni (ZZU)	15		30	15	
Liczba godzin całkowitego nakładu pracy studenta (CNPS)	30		60	30	
Forma zaliczenia	Egzamin				
Dla grupy kursów zaznaczyć kurs końcowy (X)	X				
Liczba punktów ECTS	4				
w tym liczba punktów odpowiadająca zajęciom o charakterze praktycznym (P)	3				
w tym liczba punktów ECTS odpowiadająca zajęciom wymagającym bezpośredniego udziału nauczycieli lub innych osób prowadzących zajęcia (BU)	3				

*niepotrzebne skreślić

WYMAGANIA WSTĘPNE W ZAKRESIE WIEDZY, UMIEJĘTNOŚCI I KOMPETENCJI SPOŁECZNYCH

1. Knowledge of basic mathematical analysis, probability and statistical models
2. Skills in using Excel spreadsheets
3. Understanding of the need of lifelong learning and the importance of application of Economics, Management and Social Sciences in engineering.

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CELE PRZEDMIOTU

The course combines two groups of topics: basics of mineral economics and financial management and introduction to project management.
Part A: The purpose of the course is

C1 to introduce basic concepts of Microeconomics and financial management
C2 to introduce the concept of time value of money and present the methods used to evaluate investment projects. Different techniques are illustrated by examples and case studies. The range of application as well as the advantages and disadvantages of each method are discussed. The issues of inflation and risk analysis are included.

Part B:
C3 Introduction to project management basic concepts, methods and tools.
C4 Presentation of given project management areas: Project scope management, Project time management, Project cost management, Project risk management. Project planning, scheduling and control using Microsoft Project.
C5 Presentation of the issues of effective communication in project teams, group behaviour and leadership.

PRZEDMIOTOWE EFEKTY UCZENIA SIĘ

Z zakresu wiedzy:

PEU_W01 rozumie pojęcia podaży i popytu, elastyczności popytu i ich wpływ na rynki
PEU_W02 zna pojęcia kosztów w ekonomii i rachunkowości, rozumie różnice
PEU_W03 zna sposoby klasyfikacji kosztów w przedsiębiorstwach, zna i rozumie podstawowe pojęcia rachunku kosztów
PEU_W04 ma podstawową wiedzę o treści i wzajemnych relacjach bilansu, rachunku zysków i strat oraz rachunku przepływów pieniężnych, zna sposób prezentacji danych finansowych przedsiębiorstw w ustawowych sprawozdaniach finansowych i zna ich warianty.
PEU_W05 ma podstawową wiedzę na temat metody analizy wskaźnikowej sprawozdań finansowych
PEU_W06 zna pojęcia wartości przyszłej i wartości obecnej przepływów pieniężnych i rent rocznych
PEU_W07 zna podstawowe i zaawansowane metody oceny efektywności inwestycji (NPV, IRR, MIRR, DPBP, PBP) oraz zakresy ich stosowania
PEU_W08 ma podstawową wiedzę o metodach oceny ryzyka inwestycji

Z zakresu umiejętności:

PEU_U01 potrafi przeprowadzić analizę przyczyn i skutków zmiany popytu i podaży
PEU_U02 na podstawie krzywych kosztowych potrafi przeprowadzić optymalizację wielkości produkcji w różnych przypadkach.
PEU_U03 umie zinterpretować i korzystać z informacji zawartych w ustawowych sprawozdaniach finansowych. Umie przeprowadzić analizę wskaźnikową sprawozdań finansowych w podstawowym zakresie
PEU_U03 umie korzystać z danych kosztowych przedstawionych w różnych układach ewidencyjnych kosztów, umie stosować podstawowe metody rachunkowości zarządczej do podejmowania decyzji krótkoterminowych
PEU_U04 potrafi obliczyć wartość przyszłą i obecną pieniądza dla szeregu płatności oraz rozwiązać zadania rachunkowe z zakresu wartości pieniądza w czasie
PEU_U05 potrafi przeprowadzić ocenę opłacalności inwestycji poznanymi metodami
PEU_U06 potrafi przeprowadzić analizę wrażliwości i analizę scenariuszy z wykorzystaniem modelu finansowego inwestycji
PEU_U07 potrafi przygotować dokumentację projektową w podstawowym zakresie i

zainicjować projekt PEU_U08 potrafi zastosować podstawowe metody zarządzania projektami, monitorowania i zarządzania ryzykiem projektu PEU_U09 potrafi zastosować podstawowe metody zarządzania konfliktami w grupie PEU_U10 potrafi zastosować podstawowe metody zarządzania grupą i kreowania pozycji lidera, potrafi ocenić skuteczność zarządzania grupą Z zakresu kompetencji społecznych: PEU_K01 potrafi myśleć i działać w sposób systemowy, kreatywny i przedsiębiorczy PEU_K02 ma utrwaloną postawę ekonomicznego działania i podejmowania decyzji w oparciu o dostępne informacje finansowe i prognozy

TREŚCI PROGRAMOWE		
Forma zajęć - wykład		**Liczba godzin**
Wy1	Supply and demand, equilibrium price, changes in demand and supply. Stock and commodity markets used by mineral industries	2
Wy2	Costs in economics and in accounting. Cost and money outflow. Relevant cost, incremental cost, marginal cost, alternative cost. Short-term decision making.	2
Wy3	Costs as the subject of cost accounting, different systems of cost accounting Different methods of cost data presentation (by types, divided into direct and indirect costs). Cost allocation	2
Wy4	Variable and fixed costs. Break even point. Cost-volume –profit analysis.	1
Wy5	Basics of financial accounting. Income statement and cash flow statement. Balance sheet. Working capital. Examples of financial statements of mining companies	2
Wy6	Financial ratio analysis. Liquidity, profitability, activity and debt ratios. Financial and operating leverage.	2
Wy7	The concept of time value of money. Computation of future and present value of money by means of spreadsheet functions. Basics of capital budgeting. Evaluation of different methods.	2
Wy8	The concept of risk and return. Quantification of risk. Risk analysis in project evaluation: sensitivity analysis, scenario analysis, other methods.	2
	Suma godzin	15

Forma zajęć - projekt		**Liczba godzin**
Pr 1	Issues of understanding communication: Definitions Models (Schramm model, Berlo's SMCR (source, message, channel, receiver) model, McCroskey model, Reusch and Bateson model, Westley-MacLean model)	3
Pr 2	Conflict Sources of conflicts Kilmann and Thomas classification of conflict Kilmann and Thomas test Different styles of conflict solving Roles of conflict in group development.	3
Pr3	Team roles	3

	Team roles Belbin perspective Discussion group roles Effective managerial behaviour in the context of team roles	
Pr4	Leadership Hersey and Blanchard theory Black and Mouton approach to leadership Fiedler theory and his Least Preferred Coworker Scale Situational leadership self-assessment	3
Pr5	Summary; Effective managerial behaviour from the different contexts.	3
	Suma godzin	15

Forma zajęć - laboratorium		**Liczba godzin**
Part A		
La1	Supply and Demand curves. Elasticity of demand.	2
La2	Economic costs. Cost curves. Profit maximization cases.	2
La3	Managerial cost accounting. Decision making cases.	2
La4	Basic financial accounting. Creation of simple Balance Sheet, Profit and Loss Statement and Cash Flow Statement	2
La5	Ratio analysis based on financial statements of companies	2
La6	Time value of money and capital budgeting – calculation by means of Excel functions	2
La7	Financial model of an investment. Sensitivity and Scenario analysis.	3
Part B		
La8	Basic concepts (process, project, project management, management by projects, critical factors for project success, competences). Preparing and initiation of the project. Project analysis (project environment, stakeholders, project objectives).	3
La9	Planning and estimating of the project. Project phases and life cycle	3
La10	Project organization. Project scope management. Planning of activities, resources and costs.	3
La11	Project risk management. Project monitoring. Project management methodologies.	3
La12	Quality management. Change control. Project closing.	3
	Suma godzin	**30**

STOSOWANE NARZĘDZIA DYDAKTYCZNE

N1. Wykład interaktywny z pokazem slajdów i dyskusją
N2. Ćwiczenia laboratoryjne: indywidualne rozwiązywanie zadań z wykorzystaniem arkusza kalkulacyjnego.
N3. Ćwiczenialaboratoryjne: rozwiązywanie zadań w grupach. Prezentacja wyników. Dyskusja o otrzymanych wynikach
N4. Konsultacje
N5. Praca własna – rozwiązywanie zadań domowych
N6. Praca własna – samodzielne studia literaturowe

OCENA OSIĄGNIĘCIA PRZEDMIOTOWYCH EFEKTÓW UCZENIA SIĘ

Oceny (F – formująca (w trakcie semestru), P	Numer efektu uczenia się	Sposób oceny osiągnięcia efektu uczenia się

– podsumowująca (na koniec semestru)		
F1	PEU_W01-W08 PEU_K01-K02	Dyskusja na zajęciach, ocena aktywności studentów na zajęciach laboratoryjnych i projektowych
F2	PEU_U01-U10 PEU_K01-K02	Ocena rozwiązań zadań uzyskanych przez studentów w trakcie zajęć laboratoryjnych i projektowych
P1	PEU_W01-W08 PEU_U01-U10 PEU_K01-K02	Egzamin pisemny
P2	PEU_W01-W08 PEU_U01-U10 PEU_K01-K02	Ocena indywidualnych rozwiązań zadań nadesłanych przez studentów po zajęciach

LITERATURA PODSTAWOWA I UZUPEŁNIAJĄCA

LITERATURA PODSTAWOWA:

1. Erhardt M., Brigham E.: Financial Management Theory and Practice. South-Western Cengage Learning, USA
2. Brigham E.: Podstawy zarządzania finansami. Polskie Wydawnictwo Ekonomiczne, Warszawa 1997
3. Czekaj J., Dresler Z.: Podstawy zarządzania finansami firm. PWN Warszawa 1996
4. Jaruga A., Sobańska J., Kopczyńska L. Szychta A.: *Rachunkowość dla menedżerów*. Towarzystwo Gospodarcze RAFIB, Łódź 1996.
5. Jonson H.: Ocena projektów inwestycyjnych. Maksymalizacja wartości przedsiębiorstwa. Wyd. K.E. Liber, Warszawa 2000.
6. Nowak E.: Rachunek kosztów przedsiębiorstwa. Wydawnictwo Ekspert, Wrocław 2001
7. Sierpińska M., Jachna T.: Ocena przedsiębiorstwa według standardów światowych, PWN Warszawa 1994.
8. Świderska G. K.(red): Rachunkowość zarządcza. (praca zbiorowa) Wyd. Poltext, Warszawa 1997
9. Wysocki Robert K., McGary R., Efektywne zarządzanie projektami, OnePress, 2005
10. Lock Dennis, Podstawy zarządzania projektami, PWE, 2009

LITERATURA UZUPEŁNIAJĄCA:

1. Jajuga K., Jajuga T., 2006. Inwestycje. Instrumenty finansowe, aktywa niefinansowe, ryzyko finansowe, inżynieria finansowe, Wydawnictwo Naukowe PWN, Warszawa.
2. Jonson H.: Koszt kapitału. Klucz do wartości firmy. Wyd. K.E. Liber, Warszawa 2000
3. Turyna J., Pułaska-Turyna B.: Rachunek kosztów i wyników. Wyd. Finans-Servis, Warszawa 1997.
4. A Guide to Project Management Body of Knowledge (PMBOK®Guide Fourth Edition), Project Management Institute, 2008 (2004). wydanie polskie, MT&DC Warszawa, 2009 (2006)

OPIEKUN PRZEDMIOTU (IMIĘ, NAZWISKO, ADRES E-MAIL)

Dr inż. Gabriela Paszkowska, Gabriela.paszkowska@pwr.wroc.pl

Zał. nr 5 do ZW 8/2020
Załącznik nr … do programu studiów

WYDZIAŁ **Geoinżynierii, Górnictwa i Geologii**

KARTA PRZEDMIOTU

Nazwa przedmiotu w języku polskim Teoria i praktyka w geomechanice….(zajęcia są prowadzone w języku angielskim)
Nazwa przedmiotu w języku angielskim Theory and Practise in Geomechanics ……………………………………………….
Kierunek studiów (jeśli dotyczy): Górnictwo i geologia.
Specjalność (jeśli dotyczy): Mining Engineering,
Geotechnical and Environmental Engineering,
Poziom i forma studiów: II stopień, stacjonarna
Rodzaj przedmiotu: obowiązkowy *
Kod przedmiotu W06GIG-SM0043G
Grupa kursów NIE*

	Wykład	Ćwiczenia	Laboratorium	Projekt	Seminarium
Liczba godzin zajęć zorganizowanych w Uczelni (ZZU)	60	15			
Liczba godzin całkowitego nakładu pracy studenta (CNPS)	150	30			
Forma zaliczenia	Egzamin / ~~zaliczenie na ocenę*~~	~~Egzamin /~~ zaliczenie na ocenę*	Egzamin / zaliczenie na ocenę*	Egzamin / zaliczenie na ocenę*	Egzamin / zaliczenie na ocenę*
Dla grupy kursów zaznaczyć kurs końcowy (X)					
Liczba punktów ECTS	**4**	**2**			
w tym liczba punktów odpowiadająca zajęciom o charakterze praktycznym (P)		2			
w tym liczba punktów ECTS odpowiadająca zajęciom wymagającym bezpośredniego udziału nauczycieli lub innych osób prowadzących zajęcia (BU)	3,5	1,5			

*niepotrzebne skreślić

WYMAGANIA WSTĘPNE W ZAKRESIE WIEDZY, UMIEJĘTNOŚCI I KOMPETENCJI SPOŁECZNYCH

1. Introduction to Mathematical Analysis, Statics and Strength of Materials.

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CELE PRZEDMIOTU

C1 Presentation of foundations of Theory of Elasticity and its application in Rock and Soil Mechanics (The lecture will be delivered in index notation).
C2 Introduction of fundamental concepts of rock and soil mechanics and their application in surface and underground mining.

PRZEDMIOTOWE EFEKTY UCZENIA SIĘ
Z zakresu wiedzy: PEU_W01 Student ma ugruntowaną wiedzę w zakresie podstaw teorii sprężystości – m.in. stanu naprężeń i odkształceń w masywie skalnym. PEU_W02 Student ma wiedzę dotyczącą kryteriów wytrzymałościowych stosowanych w mechanice skał oraz gruntów. Z zakresu umiejętności: PEU_U01 Student potrafi zastosować metod obliczeniowe teorii sprężystości do określenia stanu naprężenia i odkształcenia w górotworze oraz wykorzystać te obliczenia do oceny jego stateczności. Z zakresu kompetencji społecznych: PEU_K01 Student posiada umiejętność rozwiązywania zadań oraz prezentacji otrzymanych wyników przed innymi studentami.

TREŚCI PROGRAMOWE		
Forma zajęć - wykład		**Liczba godzin**
Theory of Rock Mechanics		
Wy1	Frame of axes Cartesian coordinates. Einstein summation convention. Kroecker delta. Permutation symbol. Relationship e – δ.	2
Wy2	State of strain. Material and space coordinate. Green, Almansy and Couchy strain tensors. Gradient matrix. Geometric interpretation of infinitesimal strain components.	2
Wy3	Spherical and deviatoric tensors of state of strain. Principal strains and principal axes of strain tensor. Strain tensor invariants. Tensor of principal axes. Capability equations.	2
Wy4	State of stress. Stress vector and stress tensor. Couchy formula. Coordinate transformations for stresses. Formal definition of a tensor. Hydrostatic and stress deviation tensor.	2
Wy5	Normal and shear stresses. Principal stresses and principal axes of stress tensors and stress deviation tensors. Invariants of stress and stress deviation tensors. Octahedral stresses. Intensity of stress tensor. Mohr circle of stress components.	2
Wy6	Linear elasticity. General Hooke law. Hooke law for Isotropic materials. Stress – strain deviatoric relationship. Hydrostatic stress versus dilatation formula. Relationship between different elastic module.	2
Wy7	Elastic strain energy expressed by stress and strain tensor components. Solving theory of elasticity boundary problems using displacement approach. Navier-Stoke’s equation.	3

Wy8	Classical strength criteria. Effective stresses.	2
Wy9	Coulomb- Mohr strength criterion. Safety factor.	2
Wy10	Plane stress and plane strain problems of theory of elasticity. Solving theory of elasticity boundary problems using stress approach. Airy function. Biharmonic polynomials. Airy function In polar coordinate. General form of Airy function.	3
Wy11	Introduction to Finite Element Method.	3
Wy12	Description of Phases code interface.	2
Wy13	Simple example of FEM calculation.	3
Theory of Soil Mechanics		
Wy14	Soil classification.	2
Wy15	Modeling of soil and rock behavior.	3
Wy16	Effective stresses.	2
Wy17	Water flow.	2
Wy18	Bearing capacity of foundation.	3
Wy19	Atteberg Limits and compaction characteristic of soil.	3
Practice of Rock Mechanics		
Wy20	Rock mass properties. Rock mass classification	2
Wy21	In-situ stresses. Methods for stress analysis	2
Wy22	Rock mass discontinuities and their strength. Slope stability problems and rock fall hazard.	2
Wy23	Rock bolts and cables in rock engineering. Pillar strength and its importance in room-and-pillar mining	2
Wy24	Floor strata behavior in room-and-pillar mining. Interaction of roof, pillar and floor .	2
Wy25	. Surface subsidence due to underground mining. Structures resistance against earthquake and mining related motion	2
Wy26	Pillar strength and its importance in room-and-pillar mining. Structures resistance against earthquake and mining related motion.	2
Wy27	Application of Geomechanics in underground mining.	1
	Suma godzin	**60**

Forma zajęć - ćwiczenia		Liczba godzin
Ćw1	Examples illustrating Einstein summation convention. Kronecker delta. Permutation tensor. Formula e – δ. Calculation of spherical and deviatoric strain tensor.	2
Ćw2	Calculation of invariants of strain tensors. Finding of principal strains and principal axes. Building deviatoric strain tensor and tensor of directions.	2
Ćw3	Building hydrostatic stress tensors and stress deviation tensors. Using Couchy formula. Transformation frame of axes by rotation.	2
Ćw4	Calculation of invariants of stress tensors. Principal stresses and principal axes. Calculation of octahedral stresses. Mohr circle for stress tensor components	2
Ćw5	Examples of calculations different elastic material coefficients.	2

Ćw6	Description of Phases 2 computer code.	1
Ćw7	Finite Element Method example calculations using Phases 2 computer programme.	2
Ćw8	Comparison of close form solution of Lame problem with corresponding Finite Element Method results of calculation	2
	Suma godzin	**15**

Forma zajęć - laboratorium		**Liczba godzin**
La1		
La2		
La3		
La4		
La5		
…		
	Suma godzin	

Forma zajęć - projekt		**Liczba godzin**
Pr1		
Pr2		
Pr3		
Pr4		
…		
	Suma godzin	

Forma zajęć - seminarium		**Liczba godzin**
Se1		
Se2		
Se3		
…		
	Suma godzin	

STOSOWANE NARZĘDZIA DYDAKTYCZNE
N1. Forma wykładów i ćwiczeń – tradycyjna, treści ilustrowane prezentacjami multimedialnymi z użyciem sprzętu audio-wizualnego N2. Dyskusja w ramach wykładów i ćwiczeń N3. Konsultacje

OCENA OSIĄGNIĘCIA PRZEDMIOTOWYCH EFEKTÓW UCZENIA SIĘ

Oceny (F – formująca (w trakcie semestru), P – podsumowująca (na koniec semestru)	Numer efektu uczenia się	Sposób oceny osiągnięcia efektu uczenia się
P	PEU_W01 PEU_W02 PEU_U01	P Ocena końcowa z grupy kursów w formie sprawdzianu pisemnego

LITERATURA PODSTAWOWA I UZUPEŁNIAJĄCA
LITERATURA PODSTAWOWA: [1] Y. C. Fung, Fundations of Solid Mechanics, Prentice-Hall, Inc. U.S.A 1964 [2] Y. C. Fung, A First Course in Continuum Mechanics, Prentice-Hall, Inc. U.S.A., 1977 [3] T.J. Chung, Applied Continuum Mechanics, Cambridge University Press,, U.S.A 1996 [4] I. Kisiel, Reologia w Budownictwie, PWN, Warszawa 1962, (In Polish) [5] O. C. Zienkiewicz, The Finite Element Method In Engineering Science, McGraw-Hill, London, U. K. 1971 **LITERATURA UZUPEŁNIAJĄCA:** [1] Compilation of review articles and book chapters of various sources. Handouts.
OPIEKUN PRZEDMIOTU (IMIĘ, NAZWISKO, ADRES E-MAIL)
Dr Karolina Adach-Pawelus **Dr inż Jerzy Bauer** **Dr inż. Marek Kawa**

2-nd Semester

Semestr 2

Attachment No.5 to ZW 8/2020

FACULTY OF GEOENGINEERING, MINING AND GEAOLOGY

SUBJECT CARD

Name in Polish: AutoCAD
Name in English: AutoCAD
Main field of study (if applicable): Mining and Geology
Specialization (if applicable): Mining Engineering
Level and form of studies: 2nd, full-time
Kind of subject: elective
Subject code: W06GIG-SM0077
Group of courses: NO

	Lecture	Classes	Laboratory	Project	Seminar
Number of hours of organized classes in University (ZZU)			**30**		
Number of hours of total student workload (CNPS)			**60**		
Form of crediting			**crediting with grade**		
For group of courses mark (X) final course					
Number of ECTS points			**2**		
including number of ECTS points for practical (P) classes of practical character (P)			**2**		
including number of ECTS points for direct teacher-student contact (BK) classes			**1,5**		

*delete as applicable

PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES

1. Basic knowledge concerning technical drawing.

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SUBJECT OBJECTIVES

C1 Acquisition by the student the ability to build geometric models of designed elements, their description and preparation for printing.

SUBJECT LEARNING OUTCOMES

Subject educational effect (skills)
PEU_U01 Ability of geometric mapping concerning the designed elements.
PEU_U02 Ability of synthetic description concerning designed elements.
PEU_U03 Ability to prepare drawings for printing.

Subject educational effect (social)
PEU_K01 Understanding the importance of correct drawing mapping of the designed elements for their proper implementation.

PROGRAMME CONTENT

Form of classes - laboratory		Number of hours
L1	Familiarising with AutoCAD and preparation for work.	2
L2	Accurate drawing.	2
L3	Design of characteristical elements.	2
L4	Modification of elements.	2
L5	Modification of elements. (to be continued)	2
L6	Introducing a text.	2
L7	Adding symbols and hatches.	2
L8	Obejects drawing.	2
L9	Adding dimensions.	2
L10	Adding dimensions. (to be continued)	2
L11	Creating blocks.	2
L12	Creating dynamic blocks.	2
L13	Creating viewports and printing sheets.	2
L14	Print preparation.	2
L15	Print preparation. (to be continued)	2
	Total hours	**30**

TEACHING TOOLS USED

N1. Laboratory. Presentation and AutoCAD commend analysis while using a computer.

EVALUATION OF SUBJECT EDUCATIONAL EFFECTS ACHIEVEMENT

Evaluation (F – forming (during semester), P – concluding (at the end of semester)	Educational effect number	Way of evaluating educational effect achievement
P1	PEU_U01 – U03 PEU_K01	Drawing's printing preparation and detailed analysis.

PRIMARY AND SECONDARY LITERATURE

PRIMARY LITERATURE

[1] Pikoń A., AutoCAD 2011. Pierwsze kroki;
[2] Pikoń A., AutoCAD 2007 i 2007 PL. Practical exercises;

SECONDARY LITERATURE

[1] Jaskulski A., AutoCAD 2012/LT2012/WS+. Kurs projektowania parametrycznego i nieparametrycznego 2D i 3D

SUBJECT SUPERVISOR (NAME AND SURNAME, E-MAIL ADDRESS)

dr inż. Dariusz Woźniak
mgr inż. Natalia Suchorab, mgr inż. Maksymilian Ozdoba

MATRIX OF CORRELATION BETWEEN EDUCATIONAL EFFECTS FOR SUBJECT
AutoCAD
AND EDUCATIONAL EFFECTS FOR MAIN FIELD OF STUDY Geodesy and Cartography
AND SPECIALITY Underground and Surface Mining

SUBJECT EDUCATIONAL EFFECT	Correlation between subject educational effect and educational effects defined for main field of study and specialization	SUBJECT OBJECTIVES	PROGRAMME CONTENT	Number of educational effect
PEK_U01	K_U10	C1	L1-8, L11-12	N1
PEK_U02	K_U10	C1	L9-10	N1
PEK_U03	K_U10	C1	L13-15	N1
PEK_K01	K_K01	C1	L1-15	N1

Zał. nr 5 do ZW 8/2020
Załącznik nr … do programu studiów

WYDZIAŁ ……… / STUDIUM………………

KARTA PRZEDMIOTU

Nazwa przedmiotu w języku polskim Wspomagane komputerowo projektowanie kopalń
Nazwa przedmiotu w języku angielskim Computer Aided Mine Design
Kierunek studiów (jeśli dotyczy): Górnictwo i geologia.
Specjalność (jeśli dotyczy): Mining Engineering
Poziom i forma studiów: II stopień, stacjonarna
Rodzaj przedmiotu: wybieralny *
Kod przedmiotu W06GIG-SM0074
Grupa kursów NIE*

	Wykład	Ćwiczenia	Laboratorium	Projekt	Seminarium
Liczba godzin zajęć zorganizowanych w Uczelni (ZZU)	15		45		
Liczba godzin całkowitego nakładu pracy studenta (CNPS)	30		120		
Forma zaliczenia	~~Egzamin /~~ zaliczenie na ocenę*	Egzamin / zaliczenie na ocenę*	~~Egzamin /~~ zaliczenie na ocenę*	Egzamin / zaliczenie na ocenę*	Egzamin / zaliczenie na ocenę*
Dla grupy kursów zaznaczyć kurs końcowy (X)					
Liczba punktów ECTS	**2**		3		
w tym liczba punktów odpowiadająca zajęciom o charakterze praktycznym (P)			3		
w tym liczba punktów ECTS odpowiadająca zajęciom wymagającym bezpośredniego udziału nauczycieli lub innych osób prowadzących zajęcia (BU)	2		2		

*niepotrzebne skreślić

WYMAGANIA WSTĘPNE W ZAKRESIE WIEDZY, UMIEJĘTNOŚCI I KOMPETENCJI SPOŁECZNYCH

The student has basic knowledge of open-cast and underground deposits excavations. The student has knowledge of the occurrence, deposits, excavation, quality parameters and the use of mineral resources and the main forms of occurrence. The student can combine and interpret data describing a deposit. The student can use knowledge concerning statistics and geostatistics to produce a numerical and spatial characteristics of the selected parameters of a deposit. The student can select and verify an interpolation model of deposits parameter which is researched. The student uses specialized software concerning structuralized building and quality of digital spatial of the deposit model. The student uses specialized software concerning estimation of resources in targeted areas. The student can present the results of digital deposit modelling using a specific software environment.

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CELE PRZEDMIOTU

C1. Getting known the basics of open-cast and underground mines design.
C2 Getting known the concepts and methods of optimization of digital design and planning of mines

used in the mining world. C3 Acquisition of skills of computer-aided tools for modelling and design of mining deposits in accordance with current international standards.

PRZEDMIOTOWE EFEKTY UCZENIA SIĘ

Z zakresu wiedzy (relating to knowledge):

PEU_W01 The student can describe the basics of underground mines design. The student can describe the rules of mine dimensioning and can identify criteria for an operational system selection.

PEU_W02 The student knows the basics of open-cast mines design, can choose an excavation system for the particular type of mine and distinguish concepts of formal documents and regulations for the mine design

PEU_W03 The student can identify the target excavation area in accordance with the criteria of economic viability in three-dimensional modelling

PEU_W04 The student can explain the optimization method of the target open-cast excavation

PEU_W05 The student can formulate and choose the progress direction and different mining plan in various time horizons

Z zakresu umiejętności (relating to skills):

PEU_U01 The student can calculate the parameters of underground excavations for scheduled tasks

PEU_U02 The student can choose appropriate design methods and tools to complete the project of underground excavations according to prepared parameters

PEU_U03 The student can build a digital model of economic deposits according to the alternative criteria and can estimate the value of the mine

PEU_U04 The student can choose appropriate methods and design tools to prepare the project of open- cast excavations according to prepared parameters

PEU_U05 The student can use different software to optimize open-cast excavations and for presentation of results

PEU_U06 The student can interpret the data and develop foundations of excavation calendar plan and use specialized software environment for the implementation of the plan

PEU_U07 The student can presented, in a clear form, the results of a project using numerical summaries, maps, cross-sections, visualization and simulation

Z zakresu kompetencji społecznych (relating to social competences):

PEU_K01 The student can think and act in a creative and enterprising way

TREŚCI PROGRAMOWE

Forma zajęć - wykład		Liczba godzin
Wy1	Open Pit Economic Modelling – the general approach	1
Wy2	Lerchs-Grossmann open-pit optimization	1
Wy3	The method of evaluating lignite reserves in an integrated power engineering company	1
Wy4	Mining costs studies: transportation, costs of purchase land	1
Wy5	The influence of raw material processing efficiency and environmental costs on the profitability of mining. Case study: carbon costs	1
Wy6	Generating of the complex economic model of a chosen deposit with regard to its quality, mining technology and product pricing	1

Wy7	Integrated approach to mine planning: strategic, medium term and short term production plan	1
Wy8	Open-cast life-of-mine planning steps: an ultimate pit, pushbacks, alternative schedules, optimized mine flow with stockpiles	1
Wy9	Alternative scenarios of the continuous surface mine	1
Wy10	Short term scheduling and blending	1
Wy11	Processes of project management: Project cycle.	1
Wy12	Project time management processes. Methods /techniques to plan the activities.	1
Wy13	Resource planning & assignment. Scheduling resource work. Budgeting project costs, costs distribution over the time.	1
Wy14	Project risk management.	1
Wy15	Students' progress assessment	1
	Suma godzin	**15**

Forma zajęć - ćwiczenia		**Liczba godzin**
Ćw1		
..		
	Suma godzin	

Forma zajęć - laboratorium		**Liczba godzin**
La1	Economic modelling	3
La2	Pit development	3
La3	Life-of-mine planning. Mining levels	3
La4	Life-of-mine planning. Generating mining blocks on the levels. Evaluation of blocks and aggregating production plan results	3
La5	Detailed design of the selected elements of the open-cast mine (an initial cut, a final pit, an in-pit dump),	3
La6	Detailed design of the final pit reclamation,	3
La7	Underground mine design – the specialised design environment	3
La8	Underground mine design with the use of predefined rules and templates	3
La9	Underground mine planning – targets, constraints, dependency	3
La10	Underground mine planning – analysis of results, rescheduling	3
La11	Defining the project life cycle, scope and project long-term schedule based on developed Life-of-mine plan.	3
La12	Development of the main equipment specification and purchasing schedule of the excavators and spreaders. Development of the Outline reclamation plan.	3
La13	Cash Flows Analysis. Profitability evaluation of the mining project.	3
La14	Cash Flow Sensitivity Analyses. Outline risk assessment of the mining project.	3
La15	Supplementary - documentation and reporting (plots, evaluation)	3
	Suma godzin	45

Forma zajęć - projekt		**Liczba godzin**
Pr1		
…		
	Suma godzin	

Forma zajęć - seminarium	**Liczba godzin**

Se1		
…		
	Suma godzin	

STOSOWANE NARZĘDZIA DYDAKTYCZNE
N1. Form of lectures - traditional, multimedia presentations using specialized software and demonstrations of its application "live", individual development of specialist topics covered during the lecture, N2 discussion concerning lectures and laboratories, N3 individual development of project tasks within the laboratories frames, individual development of electronic reports concerning project tasks within the laboratories frames, N4 evaluation of laboratory tasks reports with multipoint grade of student's work, group analysis of the results obtained during laboratory tasks; preparation of conclusions concerning data dependencies and constraints of mining projects, skill control tests, duty hours in laboratory.

OCENA OSIĄGNIĘCIA PRZEDMIOTOWYCH EFEKTÓW UCZENIA SIĘ

Oceny (F – formująca (w trakcie semestru), P – podsumowująca (na koniec semestru)	Numer efektu uczenia się	Sposób oceny osiągnięcia efektu uczenia się
F1	PEU_W01,PEU_W02, PEU_W04	Lecture grade on the basis of the written examination
F2	PEU_W01, PEU_U01, PEU_U02, PEU_U07	"design of underground excavations", laboratory task assessment
F3	PEU_W02, EK_W04, PEU_U03, PEU_U04, PEU_U07	"design of open-cast excavations", laboratory task assessment
F4	PEU_W05, PEU_U05 PEU_U06, PEU_U07	"Design of open-cast mine plan", control test covering methods and skills of digital design.
P	average of F1, F2, F3, F4	

LITERATURA PODSTAWOWA I UZUPEŁNIAJĄCA

LITERATURA PODSTAWOWA:

[1] Bęben A., Maszyny i urządzenia do wydobywania kopalin pospolitych bez użycia materiałów wybuchowych, AGH Publishing, Kraków 2008
[2] Bęben A., Maszyny i urządzenia do wybranych technologii urabiania surowców skalnych, Śląsk Publishing
[3] Bęben A., Wydobywanie spod wody kruszyw naturalnych, AGH Publishing, Kraków 2006
[4] Butra J., Eksploatacja złoża rud miedzi w warunkach zagrożenia tąpaniami i zawałami, KGMH Cuprum Sp. Wrocław 2010.
[5] Hustrulid W., Kuchta M., Open Pit Mine Planning and Design, A.A.Balkema, Rotterdam 2005
[6] Kasztelewicz Z., koparki wielonaczyniowe i zwałowarki taśmowe. Technologia pracy, AGH Publishing, Kraków 2012
[7] Kołkiewicz W., Szatan M., Pomorski A., Witt A., Modelowanie i optymalizacja odkrywkowych procesów wydobywczych układami technologicznymi o pracy ciągłej, Redakcja Górnictwa Odkrywkowego, Wrocław 1996
[8] Korzeniowski J.I., Ruch zakładów eksploatujących złoża kopalin, Pub. Wikbest, Wrocław 2010
[9] Kozioł W. Uberman R., Technologia i organizacja transportu w górnictwie odkrywkowym",

AGH Publishing, Krakow 1994
[10] Piechota et al., Systemy podziemnej eksploatacji złóż węgla kamiennego, rud i soli, AGH Publishing, Kraków 2009
[11] Technologies of rock exploitation from the water - types of quarring, exploitation systems, excavators, transport of excavated material. Koncepcje i praktyki górnicze, Politechnika Wrocławska Publishing House, Wrocław 2009
[12] P.Z. pod red. K. Strzodki, J. Sajkiewicza, A. Dunikowskiego, Górnictwo Odkrywkowe Tom I, „Śląsk" Publishing, 1983

LITERATURA UZUPEŁNIAJĄCA:

[1] SME Mining Engineering Handbook Vol.1, Vol.2, SMME Inc. Littleton, Colorado, 1992
[2] Industry magazines: Górnictwo Odkrywkowe, Cuprum, Przegląd Górniczy, Gospodarka Zasobami Złóż, Mining Magazine, International Mining, Surface Mining, Braunkohle & Other Minerals Surface Mining, Braunkohle & Other Minerals
[3] Publishings of industry conferences: Mine Planning & Equipment Selection, Continuous Surface Mining, World Mining Congress, Conference of the International Association for Mathematical Geosciences (IAMG)

OPIEKUN PRZEDMIOTU (IMIĘ, NAZWISKO, ADRES E-MAIL)

Dr inż. Witold Kawalec,
Dr inż. Krzysztof Hołodnik, Dr inż. Michał Dudek

App. no 5 to ZW8/2020

FACULTY OF GEOENGINEERING, MINING AND GEOLOGY

SUBJECT CARD

Name in Polish: Geochemia
Name in English: Geochemistry
Faculty of studies (if applicable): Mining and Geology
Specialisation (if applicable): Mining Engineering
Level and form of studies: 2nd level, full-time
Subject Type: Obligatory
Subject code: W06GIG-SM0076
Group of courses: NO

	Lecture	Classes	Laboratory	Project	Seminar
Number of hours of organized classes in the University (ZZU)	**30**				
Number of hours of total student workload (CNPS)	**60**				
Form of crediting	**Crediting with grade**				
For a group of courses mark (X) for the final course					
Number of ECTS points	**2**				
including number of ECTS points for practical (P) classes					
including number of ECTS points for direct teacher-student contact (BK) classes	**2**				

*** delete as applicable**

PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES

1. Possesses basic knowledge in the area of general chemistry (inorganic and organic) and physics.
2. Possesses basic knowledge in the area of mineralogy and petrology.
3. Possesses basic knowledge and skills in the area of hydrogeology.
4. Is familiar with basic concepts of deposit and mining geology.

SUBJECT OBJECTIVES

C1 Aim of the subject is to familiarize students with fundamental physicochemical principles and processes which occur in the Earth's crust and their theoretical foundations and implications.

SUBJECT LEARNING OUTCOMES

relating to knowledge:

PEU_W01 Possesses knowledge relating to the thermodynamic and geochemical principles and processes which occur in the Earth's crust.

PEU_W02 Possesses basic knowledge in the area of rock formation and the determination of the age of rocks.

relating to skills:

PEU_ U01 Is able to search for information on geochemical processes and carry out their critical evaluation and analysis.

relating to social competencies:

PEU_K01 Is able to formulate and impart knowledge regarding processes occurring in the Earth's crust and their impact on the environment.

PROGRAMME CONTENT		
Form of classes - lecture		**Number of hours**
Lec.1	Introduction. History, present time and future of the Universe. Construction of the Earth and the structure of outer zones	3
Lec.2	The basics of thermodynamic geological processes (parameters and functions of state)	3
Lec.3	Geochemical calculations (solutions, reactions, pH, Eh, dissolution, phase diagrams, stability, rule of contradiction)	3
Lec.4	Geochemical calculations (chemical equilibria diagrams)	3
Lec.5	Global geochemical cycles	3
Lec.6	Geochemistry of elements	3
Lec.7	Geochemistry of organic compounds	3
Lec.8	Earth and life	3
Lec.9	Applied Geochemistry	3
Lec.10	Determination of the absolute age of rocks. Mineral thermometry and barometry	3
Lec.11	Mineral facies indicators	3
Lec.12	Natural non-isotope markers	3
Lec.13	Natural isotope markers	3
Lec.14	Artificial non-isotope markers	3
Lec.15	Paleomagnetism and dendrochronology	3
	Total hours	**45**

Form of classes - seminar		**Number of hours**
Se1		
Se2		
	Total hours	

Form of classes - laboratory		**Number of hours**
La1-		
La2-		
	Total hours	

TEACHING TOOLS USED
N1. Traditional lecture supplemented with multimedia presentations and discussions.

EVALUATION OF SUBJECT EDUCATIONAL OUTCOME ACHIEVEMENTS

Evaluation F – forming (during semester), P – concluding (at semester end)	Educational outcome number	Method of evaluating educational outcome achievement
P	PEU_W01-W02 PEU_U01 PEU_K01	Written test
F, P		
F, P		

PRIMARY AND SECONDARY LITERATURE

PRIMARY LITERATURE

[1] Albarède F., 2009 – Geochemistry. An introduction. Cambridge University Press, Cambridge, UK.
[2] Allègre C. J., 2008 – Isotope geology. Cambridge University Press, Cambridge, UK.
[3] Hefferan K., O'Brien J., 2010 – Earth materials. Wiley-Blackwell, Chichester, UK.
[4] Macioszczyk A., 1987, Hydrogeochemia. Wyd. Geol., Warsaw
[5] Macioszczyk A., Dobrzyński D., 2002, Hydrogeochemia strefy aktywnej wymiany wód podziemnych. Wydawnictwo Naukowe PWN, Warsaw
[6] Marshall C. P., Fairbridge R. W. (eds), 1999 – Encyklopedia of Geochemistry. Kluwer Academic Publishers, Dodrecht, Boston, London.
[7] McSween H. Y., Huss G. R., 2010 – Cosmochemistry. Cambridge University Press, Cambridge, UK
[8] Migaszewski Z. M., Gałuszka A., 2007 - Postawy geochemii środowiska, WNT.
[9] Polański A., 1988 - Podstawy geochemii. Wyd. Geol., Warsaw
[10] Polański A., 1986 - Geochemia ogólna i organiczna. Wydawnictwa U.W., Warsaw.
[11] Pazdro Z., Kozerski B., 1990 - Hydrogeologia ogólna. Wyd. Geol., Warsaw.
[12] Tolstikhin I. N., Kramers J. D., 2008 – The evolution of matter. From the Big Bang to the Present Day. Cambridge University Press, Cambridge, UK
[13] Zuber A., Różański K., Ciężkowski W., 2007 - Metody znacznikowe w badaniach hydrogeologicznych. Poradnik metodyczny. Oficyna Wyd. PWr

SECONDARY LITERATURE

[1] Appelo C.A.J., Postma D., 2005 - Geochemistry, groundwater and pollution. Balkema. Kabata-Pendias A., Pendias H., 1993 - Biogeochemia pierwiastków śladowych, PWN
[2] Merkel B. , Planer-Friedrich 8.,2005 - Groundwater geochemistry. Springer
[3] Westphal M., 1993 - Paleomagnetyzm i właściwości magnetyczne skał, Wydawnictwo Naukowe PWN, Warsaw
[4] Witczak S., Adamczyk A., 1995a - Katalog wybranych fizycznych i chemicznych wskaznik6w zanieczyszczeń wód podziemnych i metod ich oznaczania., T. I, Biblioteka Monitoringu Srodowiska, Warsaw
[5] Witczak S., Adamczyk A., 1995b - Katalog wybranych fizycznych i chemicznych wskaznik6w

zanieczyszczeń wód podziemnych i metod ich oznaczania., T. II, Biblioteka Monitoringu Środowiska, Warsaw
[6] Zielski A., Krąpiec M., 2004 - Dendrochronologia. Wyd. Naukowe PWN, Warsaw

SUBJECT SUPERVISOR (NAME AND SURNAME, E-MAIL ADDRESS)

Prof. dr hab. inż. Tadeusz Przylibski
dr inż. Danuta Szyszka, dr inż. Katarzyna Łuszczek, dr inż. Agata Kowalska

Zał. nr 5 do ZW 8/2020
Załącznik nr … do programu studiów

WYDZIAŁ **Geoinżynierii, Górnictwa i Geologii**

KARTA PRZEDMIOTU

Nazwa przedmiotu w języku polskim Systemy maszynowe
kurs prowadzony jest w języku angielskim
Nazwa przedmiotu w języku angielskim Machinery systems

Kierunek studiów (jeśli dotyczy): Górnictwo i geologia.
Specjalność (jeśli dotyczy): Mining Engineering
Poziom i forma studiów: II stopień, stacjonarna
Rodzaj przedmiotu: wybieralny
Kod przedmiotu W06GIG-SM0072
Grupa kursów NIE

	Wykład	Ćwiczenia	Laboratorium	Projekt	Seminarium
Liczba godzin zajęć zorganizowanych w Uczelni (ZZU)	30		15	15	
Liczba godzin całkowitego nakładu pracy studenta (CNPS)	60		30	30	
Forma zaliczenia	Egzamin ~~/ zaliczenie na ocenę*~~	Egzamin / zaliczenie na ocenę*	~~Egzamin /~~ zaliczenie na ocenę*	~~Egzamin~~ / zaliczenie na ocenę*	Egzamin / zaliczenie na ocenę*
Dla grupy kursów zaznaczyć kurs końcowy (X)					
Liczba punktów ECTS	**2**		2	2	
w tym liczba punktów odpowiadająca zajęciom o charakterze praktycznym (P)			2	2	
w tym liczba punktów ECTS odpowiadająca zajęciom wymagającym bezpośredniego udziału nauczycieli lub innych osób prowadzących zajęcia (BU)	2		1,5	1,5	

*niepotrzebne skreślić

WYMAGANIA WSTĘPNE W ZAKRESIE WIEDZY, UMIEJĘTNOŚCI I KOMPETENCJI SPOŁECZNYCH

1. Knowledge of mining areas where there are conducted basic operations such as dredging, crushing, transport, handling and piling.
2. Knowledge of mining machine systems backed by the expertise in the field of machinery and equipment cooperation and the selection of machines' basic parameters.
3. Ability to determine the meaning of key equipment in systems performing the excavation, transport, handling and storage of excavated material.
4. Knowledge of the risks in the use of machines in various areas of mining, and recognition of the basic safety requirements.

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CELE PRZEDMIOTU
C1. Familiarizing students with advanced methods of calculation and design of transport equipment used in mining. C2 Familiarizing students with the methods of evaluation of basic machines technical condition and transport equipment based on the vibroacoustic diagnosis. C3 Ability to make basic decisions on the selection, equipment and machinery operation

PRZEDMIOTOWE EFEKTY UCZENIA SIĘ
Z zakresu wiedzy: PEU_W01 The student has knowledge of the use and cooperation of different types of machines and transportation systems in surface and underground mining. PEU_W02 The student has basic knowledge concerning maintenance and safety use of mining equipment PEU_W03 The student has basic knowledge concerning the non-destructive and continuous diagnostics methods for elements of mining machines. Z zakresu umiejętności: PEU_U01 The student has a practical ability to measure primary resistances such as indentation rolling resistance or idler rotational resistance. PEU_U02 The student has a practical ability to detect and recognize a change of state of mining machines PEU_U03 The student has the ability to perform engineering calculations and selection of the components of belt conveyors drive. Z zakresu kompetencji społecznych: PEU_K01 The student can work in a team and together prepare and conduct a set laboratory task and to prepare the achieved results and to present the effects of the conducted research as a team paper report. PEU-K01 The student has the ability to discuss and exchange acquired information with other students.

TREŚCI PROGRAMOWE		
Forma zajęć - wykład		**Liczba godzin**
Lec 1	Scope of the course, teaching the purpose, crediting conditions, literature, contact with the teacher. Basic information, vocabulary and mining operations	2
Lec 2	Continuous transportation systems in mining. Description of the two most commonly used conveyors and their components: - belt conveyors (idlers, pulleys, belt, feed chute, cleaning equipment) - scraper chain conveyor (scraper, chain, spillplate, chute, tail and head stations) Advantages and disadvantages of both belt and chain conveyors, cooperation with appropriate operating systems. Division of motion resistance occurring during conveyor's work (concentrated, primary	2

	and lift resistances).	
Lec 3	Conveyors of special purpose; advantages and disadvantages, applications of: bucket elevator, pipe, pouch, pocket, sandwich, wire mesh belt and steel belt conveyors	2
Lec 4, 5	Machinery systems applied in surface mining. Classification of surfaced mining machines used in open cast, open pit, quarry and placer mining (and alternative methods such as auger or punch mining). Continuously operating excavating machines: bucket wheel excavator, bucket chain excavator, continuous surface miner. Single-bucket excavators: power shovel dragline. Loading, hauling dumping and transportation systems in each mining method.	4
Lec 6, 7	Machinery systems applied in underground mining. Description of machinery applied in hard rock mining and soft rock mining. Machines used in drill and blast cycle, room and pillar system, longwall mining. Description of continues miner, roadheader, shearer, plough, drilling machine, loading machine, roof bolter, shuttle car, feeder and tunnel boring machine. Different types of transportation systems in each underground mining type.	4
Lec 8	Vocabulary quiz and sum up of the machine and transportation systems information.	2
Lec 9	Proper maintenance of mining equipment and monitoring systems. Main condition monitoring techniques applied for mining equipment and factors affecting the form of the diagnostic signal.	2
Lec 10, 11	Diagnostic of conveyor belts. Types of belt damage and place of occurrence. Non-destructive diagnostic methods: magnetic, vision, thermovision and X-ray diagnostic. Failures prediction systems.	4
Lec 12	Definition of thermovision, IR thermography as a diagnostic tool. Thermography diagnostic of gears, drives, idlers and alternative applications.	2
Lec 13, 14	Basic terms in machine diagnostics and reliability. Measurements of velocity and acceleration as a base for vibration diagnostic. Spectral emitted energy technology. Vibroacoustic diagnostics of drives, gears, and bearing. Analyze the diagnostic signal.	4
Lec 15	Selected problems with conveyor belts and possible solutions or repairs. Summary of the information about condition monitoring methods. Exam.	2
	Total hours	**30**

Forma zajęć - ćwiczenia		Liczba godzin
Ćw1		
Ćw2		
Ćw3		
Ćw4		
..		
	Suma godzin	

Forma zajęć - laboratorium		Liczba godzin
Lab 1	Scope of the course, teaching the purpose, crediting conditions, safe and healthy conditions, literature, contact with the teacher. Visiting laboratories and familiarizing with devices in which the laboratory is equipped with.	2
Lab 2,3	Indentation rolling resistance measurements: - laboratory tests of the belt on idler rolling resistance according to European standard and a new test rig for measuring rolling	4

	resistance in a small scale - test rig for determining elastic and damping properties of the belt (necessary for calculations and energy efficiency rating.	
Lab 4	Laboratory tests carried on idlers: - durability test of idlers - measuring of idler rotational resistance with immobilized shaft - measuring of idler rotational resistance under additional load.	2
Lab 5	Measurements of friction force in the intermediate - drive TT linear booster drive.	2
Lab 6	Infra-Red Thermography diagnostic of gearboxes. Impact of external factors and object parameters on the results of measurements. Comparative analysis of thermograms and temperature changes of investigated objects.	2
Lab 7	Non-destructive conveyor belts diagnostics methods. Early damage detections possibilities, discussion and comparison of different methods and equipment (magnetic and X-ray diagnostics, protect and prediction systems).	2
Lab 8	Reports grade of performed laboratory research.	1
	Total hours	**15**

Forma zajęć - projekt		Liczba godzin
Pr1	Scope of project, conditions of crediting, literature Giving students individual project tasks. Discussion of the draft guidelines concerning the basic calculations of the conveyor belt.	2
Pr2,3	Calculations of multi-pulleys drive on the example of two head drive pulleys. Estimation of the load distributio drive pulleys, verification and solution if one pulley is overloaded.	4
Proj 4	Calculation of belt sliding resistance the intermediate idler drive. Force distribution on the conveyor belt's route.	2
Proj 5, 6	Calculations of the TT linear booster (intermediate) drive: - selection of the length of the TT intermediate drive - checking the condition of transverse vibrations of the TT linear booster drive	4
Proj 7	Energy efficiency solutions in belt conveyors. Definition and calculations of energy efficiency and energy consumption. Alternative solutions in conveyors, reduction of motion resistances.	2
Proj 8	Handing the readymade projects and their assessment.	1
	Total hours	**15**

Forma zajęć - seminarium		Liczba godzin
Se1		
Se2		
Se3		
…		
	Suma godzin	

STOSOWANE NARZĘDZIA DYDAKTYCZNE
N1. Informative lecture with the elements of problem solving lecture. N2. Multimedia presentations. N3. Didactic discussion during the lecture, project. N4. Projects preparation in a report form. N5. Projects presentation and test concerning issues covered by the project

N6. Preparation and a report of conducted laboratory research. N7. Duty hours

OCENA OSIĄGNIĘCIA PRZEDMIOTOWYCH EFEKTÓW UCZENIA SIĘ

Oceny (F – formująca (w trakcie semestru), P – podsumowująca (na koniec semestru)	Numer efektu uczenia się	Sposób oceny osiągnięcia efektu uczenia się
P	PEK_W01-PEK_W03	P1.Final grade of written test.
F, P	PEK_U01	F1- Grade from preparation and laboratory research performance F2 - Grade from a written report and a test from laboratory research methods and knowledge concerning equipment used for research P2 - Final grade from a laboratory (weighted average of F1 - 40% and F2 - 60%).
F, P	PEK_U02	F3 Grade from performance and merits of the project F4 - Assessment of knowledge concerning the subjects' scope of the project. P3 - Final grade from a laboratory (weighted average of F3 - 30% and F4 - 70%

LITERATURA PODSTAWOWA I UZUPEŁNIAJĄCA

LITERATURA PODSTAWOWA:

[1] Jacek Czaplicki, Janusz Sroka: Mining Engineering, 2016
[2] Matti Heiniö: Rock Excavation Handbook, 1999
[3] Walter Bartelmus: Condition monitoring of open cast mining machinery, 2006
[4] SKF – Vibration Diagnostic Guide (CM5003) www.skfreliability.com

LITERATURA UZUPEŁNIAJĄCA:

Publications in magazines:
[1] Mining Magazine: www.miningmagazine.com
[2] Mining Engineering: www.me.smenet.org
[3] Diagnostyka: www.diagnostyka.net.pl
[4] Bulk Solid Handling

OPIEKUN PRZEDMIOTU (IMIĘ, NAZWISKO, ADRES E-MAIL)

Dr inż. Martyna Konieczna – Fuławka , martyna.konieczna-fulawka@pwr.edu.pl

Zał. nr 5 do ZW 8/2020
Załącznik nr … do programu studiów

WYDZIAŁ ……… / STUDIUM………………

KARTA PRZEDMIOTU

Nazwa przedmiotu w języku polskim Projektowanie górniczych wyrobisk podziemnych i tuneli
Nazwa przedmiotu w języku angielskim Tunnel and underground excavation design
Kierunek studiów (jeśli dotyczy): Górnictwo i geologia.
Specjalność (jeśli dotyczy): Mining Engineering
Poziom i forma studiów: II stopień, stacjonarna
Rodzaj przedmiotu: obowiązkowy *
Kod przedmiotu W06GIG-SM0073
Grupa kursów NIE*

	Wykład	Ćwiczenia	Laboratorium	Projekt	Seminarium
Liczba godzin zajęć zorganizowanych w Uczelni (ZZU)	30			30	
Liczba godzin całkowitego nakładu pracy studenta (CNPS)	60			90	
Forma zaliczenia	Egzamin / ~~zaliczenie na ocenę*~~	Egzamin / zaliczenie na ocenę*	Egzamin / zaliczenie na ocenę*	~~Egzamin /~~ zaliczenie na ocenę*	Egzamin / zaliczenie na ocenę*
Dla grupy kursów zaznaczyć kurs końcowy (X)					
Liczba punktów ECTS	**2**			3	
w tym liczba punktów odpowiadająca zajęciom o charakterze praktycznym (P)				3	
w tym liczba punktów ECTS odpowiadająca zajęciom wymagającym bezpośredniego udziału nauczycieli lub innych osób prowadzących zajęcia (BU)	1,5			2,5	

*niepotrzebne skreślić

WYMAGANIA WSTĘPNE W ZAKRESIE WIEDZY, UMIEJĘTNOŚCI I KOMPETENCJI SPOŁECZNYCH

Knowledge of underground mining and rock mechanics.
Basic concepts of geology and knowledge of geomechanical parameters of rocks.
Using the Microsoft Office environment in the scope of preparing documents in Word, working with Excel spreadsheet, making presentations in PowerPoint and drawing in AutoCad.

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CELE PRZEDMIOTU

C1. Problem-solving, data-handling and evaluation skills.
C2 Opportunity for students to develop an awareness of risk assessment applied to underground excavation design.

PRZEDMIOTOWE EFEKTY UCZENIA SIĘ

Z zakresu wiedzy:

PEU_W01 Student posiada wiedzę dotyczącą systemów podziemnej eksploatacji złóż, rodzajów wyrobisk podziemnych oraz sposobów ich drążenia, a także metod drążenia tuneli w różnych rodzajach masywu skalnego.

PEU_W02 Student ma wiedzę w zakresie geomechaniki niezbędną do projektowania wyrobisk podziemnych i tuneli w różnych warunkach geologicznych.

Z zakresu umiejętności:

PEU_U01 Student potrafi ocenić stateczność podziemnych wyrobisk górniczych i tunelowych oraz zaprojektować i dobrać obudowę skutecznie je zabezpieczającą.

PEU_U02 Student umie wykorzystywać metody numeryczne do projektowania oraz oceny stateczności podziemnych wyrobisk górniczych oraz potrafi zamodelować i ustalić optymalny układ i geometrię wyrobisk kopalnianych.

Z zakresu kompetencji społecznych:

PEU_K01 Student posiada umiejętność prezentacji wyników swojej pracy oraz prowadzenia dyskusji z innymi studentami.

TREŚCI PROGRAMOWE		
Forma zajęć - wykład		**Liczba godzin**
Wy1	Use of rock engineering for the design of underground excavations.	3
Wy2	Tunneling techniques for varying rock and soil material, overview of tunnelling design/instrumentation, soft ground tunnelling methods, lining design, excavation stabilisation techniques.	3
Wy3	Introductions to mining methods, equipment and basic requirements for underground mining.	3
Wy4	Layout and design of underground mine development and equipment requirements in soft and hard rocks, equipment requirements, development workings.	3
Wy5	Underground mining methods like longwall, shortwall, sublevel caving, block caving, sublevel stopping.	3
Wy6	Drilling-and-blasting technique, mechanized extraction.	3
Wy7	Roof support, mine working support, mine backfilling, drainage systems.	3
Wy8	Natural hazards such as: methane explosion, dust explosion, coal self-ignition, gas and rock outbursts, tremors, rock-bursts and climatic conditions.	3
Wy9	Review of data for underground excavation design, design methodology.	3
Wy10	Pillar design, support dimensioning, wedge failure, rock mass support interaction	3

	Suma godzin	**30**

Forma zajęć - projekt		**Liczba godzin**
Pr1	Introduction to the project. Course scope, didactic purpose, conditions for passing, literature, contact with the teacher. Basic concepts, terms, definitions.	4
Pr2	Calculation of parameters for the mining face.	3
Pr3	Location of preparatory excavations in the mining field.	3
Pr4	Selection of parameters for the rock mass. The Hoek-Brown failure criterion and classification. The Mohr-Coulomb failure criterion.	3
Pr5	Stress field calculation. Calculation of vertical stress. Calculation of horizontal stress.	4
Pr6	Introduction to numerical methods and their application in designing underground excavations.	4
Pr7	Numerical analysis of underground excavations stability.	3
Pr8	Final choice of rock bolts.	3
Pr9	Project presentations.	3
	Suma godzin	**30**

STOSOWANE NARZĘDZIA DYDAKTYCZNE
N1. Form of lectures - traditional, multimedia presentations using specialized software and discussion concerning lectures and project classes, N2 individual development of project tasks and reports, N3 evaluation of project reports

OCENA OSIĄGNIĘCIA PRZEDMIOTOWYCH EFEKTÓW UCZENIA SIĘ

Oceny (F – formująca (w trakcie semestru), P – podsumowująca (na koniec semestru)	Numer efektu uczenia się	Sposób oceny osiągnięcia efektu uczenia się
P1	PEU_W01, PEU_W02	Lecture grade on the basis of the written examination
P2	PEU_U01, PEU_U02	Project evaluation based on project presentation

LITERATURA PODSTAWOWA I UZUPEŁNIAJĄCA

LITERATURA PODSTAWOWA:

[1] Butra J.: Eksploatacja złoża rud miedzi w warunkach zagrożenia tąpaniami i zawałami, KGHM Cuprum sp. z o.o. CBR, Wrocław 2010
[2] Butra J., Kicki J: Ewolucja technologii eksploatacji złóż rud miedzi w polskich kopalniach, Biblioteka Szkoły Eksploatacji Podziemnej, Kraków 2003
[3] Piechota S.: Technika podziemnej eksploatacji złóż, Skrypt AGH, Kraków 2003
[4] Piechota S.: Technika podziemnej eksploatacji złóż i likwidacji kopalń, Uczelniane Wydawnictwo Naukowo-Dydaktyczne AGH, Kraków 2008

[5] Pytel W.: Geomechaniczne problemy doboru obudowy kotwowej dla wyrobisk górniczych. Wyd. KGHM Cuprum sp. z o.o. CBR. Wrocław 2012.
[6] Tajduś A., Cała M., Tajduś K.: Geomechanika w budownictwie podziemnym. Projektowanie i budowa tuneli. Wyd. AGH. Kraków 2012.

LITERATURA UZUPEŁNIAJĄCA:

[1] Chudek M: Obudowa wyrobisk górniczych, Część 1: Obudowa wyrobisk korytarzowych i komorowych, Wydawnictwo „Śląsk”, Katowice 1986
[2] Goszcz A: Elementy mechaniki skał oraz tąpania w polskich kopalniach węgla i miedzi, Biblioteka Szkoły Eksploatacji Podziemnej, Kraków 1999
[3] Kidybiński A., Podstawy geotechniki kopalnianej, Wydawnictwo „Śląsk”, Katowice 1982
[4] Kłeczek Z., Geomechanika górnicza, Śląskie Wydawnictwo Techniczne, Katowice 1999

OPIEKUN PRZEDMIOTU (IMIĘ, NAZWISKO, ADRES E-MAIL)

Dr inż. Karolina Adach-Pawelus,
Dr inż. Daniel Pawelus

Zał. nr 5 do ZW 8/2020
Załącznik nr … do programu studiów

WYDZIAŁ **Geoinżynierii, Górnictwa i Geologii**

KARTA PRZEDMIOTU

Nazwa przedmiotu w języku polskim Wentylacja i Pożary
kurs prowadzony jest w języku angielskim
Nazwa przedmiotu w języku angielskim Ventilation and Mine Fires

Kierunek studiów (jeśli dotyczy): Górnictwo i geologia.
Specjalność (jeśli dotyczy): Mining Engineering
Poziom i forma studiów: II stopień, stacjonarna
Rodzaj przedmiotu: wybieralny*
Kod przedmiotu W06GIG-SM0075
Grupa kursów NIE*

	Wykład	Ćwiczenia	Laboratorium	Projekt	Seminarium
Liczba godzin zajęć zorganizowanych w Uczelni (ZZU)	15			30	
Liczba godzin całkowitego nakładu pracy studenta (CNPS)	30			120	
Forma zaliczenia	Egzamin ~~/ zaliczenie na ocenę*~~	Egzamin / zaliczenie na ocenę*	Egzamin / zaliczenie na ocenę*	~~Egzamin~~ / zaliczenie na ocenę*	Egzamin / zaliczenie na ocenę*
Dla grupy kursów zaznaczyć kurs końcowy (X)					
Liczba punktów ECTS	**2**			2	
w tym liczba punktów odpowiadająca zajęciom o charakterze praktycznym (P)				2	
w tym liczba punktów ECTS odpowiadająca zajęciom wymagającym bezpośredniego udziału nauczycieli lub innych osób prowadzących zajęcia (BU)	1,5			1,5	

*niepotrzebne skreślić

WYMAGANIA WSTĘPNE W ZAKRESIE WIEDZY, UMIEJĘTNOŚCI I KOMPETENCJI SPOŁECZNYCH

PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES

1. The student has basic knowledge concerning mathematical analysis necessary to understand mathematical issues in science of engineering character.
2. The student has basic knowledge of technical thermodynamics.
3. The student has knowledge concerning mining, mainly of provision and underground deposits excavation, and knows how to fight against natural hazards.
4. The student has basic knowledge concerning mine ventilation and fire in the air thermodynamic changes, binding rules in the mine ventilation, air distribution rules in the networks of ventilation, ventilation problems during underground fire and

conducting firefighting action.

5. The student can use word processing programs and spreadsheets (with elements of programming) in the preparation of documents, calculation and while performance of multimedia presentations.
6. The student understands the need and knows the possibilities of lifelong learning (3-rd studies, post-graduate studies, courses) improving professional, personal and social skills

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CELE PRZEDMIOTU

C1 - Familiarizing students with the aerology mining tasks concerning applicable legal requirements and directions of its development.
C2 - Preparing students to develop safe and economic analysis of the actual network ventilation with the use of computer technology.
C3 - Presenting problems concerning providing people protection during underground fire and marking escape routes for the crew in the event of fire
C4 - Getting known and understanding of the factors influencing climate conditions in the mine excavations and methods of assessment and forecast climate conditions in mine.
C5 - Understanding the theoretical cooling processes used in mines air conditioning, balance calculations of air conditioning systems and preparing students to perform air conditioning projects of mine's selected areas.
C6 - Learning local and central air conditioning solutions used in the Polish mines and abroad.

PRZEDMIOTOWE EFEKTY UCZENIA SIĘ

Z zakresu wiedzy:
PEU_W01 - The student has elementary knowledge concerning the ventilation of mines in terms of natural hazards.
PEU_W02 - The student has knowledge concerning methods used in the study of safety and economics in real ventilation networks.
PEU_W03 - The student has knowledge concerning the impact of physical-thermal rock mass properties and mining operations conducted and which has influence on climate in mine and predicting thermal conditions in the excavations.
PEU_W04 - The student has knowledge concerning the cooling processes used in mine air conditioning, used thermodynamic factors and heat dissipation capabilities, particularly from underground air-conditioning equipment.
PEU_W05 - The student has knowledge concerning used in Polish and international mining, air conditioning solutions and knows the trends in their development.

Z zakresu umiejętności:
PEU_U01 - The student is able to carry out the safety and economics analysis of ventilation network.
PEU_U02 - The student can, using computational tools, determine the escape road for crew from places which are at risk of underground fire.
PEU_U03 - The student is able to perform balance calculations of air conditioning systems.
PEU_U04 - The student is able to compile air conditioning projects of mining regions.
PEU_U05 – The student can analyse local and central air conditioning solutions used in the Polish mines and abroad taking into consideration their advantages and disadvantages.

Z zakresu kompetencji społecznych:

PEU_K01 - The student can develop and present the results of his project work as spread sheets, paper report, and multimedia presentation. PEU_K02 - The student is aware of the environmental hazards caused by the major fans noise, greenhouse gases and dust as a result of mine ventilation. PEU_K03 - The student is aware of the influence of thermodynamic factors used in mines air conditioning on the greenhouse effect and ozone hole.

TREŚCI PROGRAMOWE		
Forma zajęć - wykład		**Liczba godzin**
Le1	Rules of mines ventilation in terms of natural hazards. Safe and economic analysis of the actual network ventilation with the use of computer technology.	2
Le2	Protecting people while underground fire. Possibilities of computer generated hazardous area at a different fire location. Determination of escape routes in case of fire.	2
Le3	Factors affecting climate conditions in mine excavations: the impact of air pressure changes, operating machinery, quantities and humidity, thermal properties of rocks. Energy balance in the rock mass and mining excavation, heat conductance equation.	2
Le4	Methods for predicting air temperature in mine excavations which are ventilated separately and with the use if streamlined ventilation.	2
Le5	Cooling processes in mines air conditioning. Development trends of conditioning mines - the use of ice. Reducing pressure in air conditioning systems. Heat dissipation capabilities from the underground air conditioning installations. Refrigerants and coolants and their impact on the environment.	3
Le6	Solutions of local and central air conditioning in mines.	2
Le7	Calculations balance of air conditioning systems. Air conditioning solutions used in mines abroad.	2
	Total hours	**15**

Forma zajęć - ćwiczenia		Liczba godzin
Ćw1		
Ćw2		
Ćw3		
Ćw4		
..		
	Suma godzin	

Forma zajęć - laboratorium		Liczba godzin
La1		
La2		
La3		
La4		
	Total hours	**15**

Forma zajęć - projekt		Liczba godzin
Pr1	Scope of design exercises, crediting conditions, literature Giving students individual project tasks. Analysing tips to design exercises regarding: 1) "Determination of escape routes in case of fire. 2) Solution of air conditioning of long wall or pillar-chamber mining unit.	2
Pr2	Analysis of the danger zone for selected crew's positions (branches) through a system of "Fire".	4
Pr3	Determination of the crew escape routes depending on the place of underground fire appearance.	4
Pr4	Forecasting thermal and moisture conditions in the excavations which deliver the air to the area and in the area.	4
Pr5	Climate assessment in the region. Determining the extent of air conditioning. The adoption of the air conditioning concept.	4
Pr6	Appointment of necessary cooling capacity and its distribution in the excavations. The choice of air conditioning machine (s).	4
Pr7	Calculation of the required pipe insulation. Determination of pressure loss in pipes. The choice of a compression pump.	4
Pr8	Solution of heat dissipation from MK to air consumed currents by the means of, specified in assignment, device (evaporator refrigerator, cooling tower, or a washing chamber). Implementation of the unit's heat balance, before and after air conditioning.	4
	Total hours	**30**

Forma zajęć - seminarium		Liczba godzin
Se1		
Se2		
Se3		
…		
	Suma godzin	

STOSOWANE NARZĘDZIA DYDAKTYCZNE
N1. Type of lectures - traditional, illustrated with multimedia presentations N2. Didactic discussion during lecture and project. N3. Duty hours

OCENA OSIĄGNIĘCIA PRZEDMIOTOWYCH EFEKTÓW UCZENIA SIĘ

Oceny (F – formująca (w trakcie semestru), P – podsumowująca (na koniec semestru)	Numer efektu uczenia się	Sposób oceny osiągnięcia efektu uczenia się
P1	PEK_W01-W05	Final grade of written test.
P2	PEK_U01-U05 PEK_K01 - K03	Final grade from the project in a paper form and its defence

LITERATURA PODSTAWOWA I UZUPEŁNIAJĄCA

LITERATURA PODSTAWOWA:

[1] Wacławik J.: Wentylacja kopalń tom I i II, AGH Pub., Kraków 2010.
[2] Roszkowski J., Pawiński J., Strzemiński J.: Przewietrzanie kopalń, ŚWT Pub., Katowice 1995.
[3] Strumiński A.: Zwalczanie pożarów w kopalniach głębinowych, Śląsk Pub., Katowice 1996.
[4] Wacławik J., Cygankiewicz J., Knechtel J.: Warunki klimatyczne w kopalniach głębokich, PAN, Kraków 1998
[5] McPherson M. J.: Subsurface Ventilation and Environmental Engineering, Published by Chapman & Hall, London 1993.
[6] Gutkowski K. M.: Chłodnictwo i klimatyzacja, WNT, Warszawa 20

LITERATURA UZUPEŁNIAJĄCA:

[1] Łuska P., Nawrat S.: Klimatyzacja kopalń podziemnych: urządzenia chłodnicze. Biblioteka Szkoły Eksploatacji Podziemnej, Kraków 2002.
[2] Łuska P., Nawrat S.: Klimatyzacja kopalń podziemnych: systemy chłodnicze. AGH Uczelniane Wydawnictwa Naukowo-Dydaktyczne, Kraków 2008.
[3] Madeja-Strumińska B., Strumiński A.: Aerotermodynamika górnicza, Śląsk Pub., Katowice 1997.
[4] Chmura K., Chudek M.: Geotermomechanika górnicza, Księgarnia Nakładowa „SUPLEMENT”
[5] Frycz A.: Klimatyzacja kopalń. "Śląsk” Pub., Katowice 1981

OPIEKUN PRZEDMIOTU (IMIĘ, NAZWISKO, ADRES E-MAIL)

Dr inż. Sebastian Gola
Mgr inż. Aleksandra Banasiewicz

3-rd Semester

Semestr 3

Zał. nr 5 do ZW 8/2020
Załącznik nr … do programu studiów

FACULTY OF GEOENGINEERING, MINING AND GEOLOGY

SUBJECT CARD

Name in Polish: **Cyfrowa kopalnia**
Name in English: **Digital Mine……………………….**
Main field of study: **mining and geology**
Specialization: **Mining Engineering,**
Geotechnical and Environmental Engineering,
Level and form of studies: 2nd level, full-time
Kind of subject: **elective**
Subject code: **W06GIG-SM0069**
Group of courses: **No**

	Lecture	Classes	Laboratory	Project	Seminar
Number of hours of organized classes in University (ZZU)	15		15		
Number of hours of total student workload (CNPS)	30		30		
Form of crediting	crediting with grade		crediting with grade		
For group of courses mark (X) final course					
Number of ECTS points	**1**		1		
including number of ECTS points for practical (P) classes			1		
Including number of ECTS points for direct teacher-student contact (BK) classes	1		1		

PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES

1. Computer literacy skills
2. Basic knowledge related to Mining Engineering and Mineral Processing
3. Programming

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SUBJECT OBJECTIVES

C1. Acquisition of the ability to create utility applications in the C / C ++ and LabVIEW environment
C2. Providing students with knowledge about embedded systems, their construction, selection of components, designing, programming and their exploitation.
C3. Familiarizing with the advances of technology & methods of future mining operations.
C4. Acquisition and consolidation of social competencies including emotional intelligence skills involving the cooperation in the group of students aiming to effectively solve problems. Responsibility, honesty and fairness in the proceedings; observance force in academia and society

SUBJECT EDUCATIONAL EFFECTS
relating to knowledge: PEU_W01 A student has knowledge related to automation systems, control systems and measurement systems in various aspects of the mining industry. PEU_W02 The student has knowledge of the importance of automation and robotics systems in modern mining. **relating to skills:** PEU_U01 A student is able to select and integrate elements of a specialized measuring and control system including: control unit, executive system, measuring system as well as peripheral and communication modules PEU_U02 A student can design improvements in the existing design solutions for automation and robotics components and systems **relating to social competences:** PEU_K01 A student is aware of the need for a professional approach to technical issues, meticulous reading of documentation and knows environmental conditions in which devices and their components can function PEU_K02 The student has knowledge concerning the benefits of creation and implementation new solutions&technologies into mining industry

PROGRAMME CONTENT		
	Form of classes - lecture	**Number of hours**
Lec 1	Terminology (process, automation, robots, measurement devices, control systems). Definition of digital mine	2
Lec 2	Aims, benefits, drawbacks of automation. Industrial revolutions. Definition of industry 4.0. Overview of components of the 4th industrial revolution. Industry 4.0 and mining	2
Lec 3	Elements of technological process in mining. Automation of cyclic processes Measuring technologies in industry 4.0. Sensors systems. Data transmission and data storage technologies. Analytics in industry 4.0. Industrial BigData, Cloud Computing	2
Lec 4	Industrial Internet of Things. M2M communication, anti-collision systems, location of people underground	2
Lec 5	Virtual and augmented realities for industry. Simulators. Digital Twin. Digital models of processes and objects. Management information creation systems, reporting	2
Lec 6	Case study: Automation in open pit lignite mining (KTZ, Autonomous haulage (use case from Australia))	1
Lec 7	Case study: underground mine (Rock Vader – Sandvik project, other use cases from Sandvik, Epiroc, MineMaster, Zanam, AOT from ZGPS KGHM, KIC project on shaft inspection, …etc)	2
Lec 8	Case study: mineral processing (ConVis, FlowVis) in KGHM, OPMO project	2
	Total hours	**15**

Form of classes - laboratory		Number of hours
Lab1	Scope of the course, teaching purpose, crediting conditions, literature, data. Introduction to ARDUINO	3
Lab2	Basic sensors for physical parameters measurements	3
Lab3	Measurements in Labview	3
Lab4	Analysis and Visualization in Labview	3
Lab5	Control in labview	3
	Total hours	**15**

TEACHING TOOLS USED
N1. Type of lectures - traditional, illustrated with multimedia presentations with the usage of audio- visual equipment. N2. Discussion concerning lectures and laboratory. N3 Configuration on laboratory classes measuring systems (hardware and software), performing of measurements, teamwork N4. Projects defence - oral and written form. N5. Duty hours.

EVALUATION OF SUBJECT EDUCATIONAL EFFECTS ACHIEVEMENT

Evaluation (F – forming (during semester), P – concluding (at the end of semester)	Educational effect number	Way of evaluating educational effect achievement
F1, P1	PEK_U02-PEK_U04	F1.1 Grade from laboratory work's performance and its merits F.1.2 Grade from laboratory work's oral or written defence P1.Final grade (weighted average of F1.1 - 60% and F1.2 - 40%).
F2, P2	PEK_U02-PEK_U04	F2.1 Grade from activity during the lecture (questions, discussions etc) F.2.2 Grade from written exam P2.Final grade (weighted average of F2.1 - 20% and F2.2 - 80%).

LITERATURE
PRIMARY LITERATURE: [1] LabVIEWTM Getting Started with LabVIEW http://www.ni.com/pdf/manuals/373427j.pdf [2] Monk Simon: Arduino dla początkujących. Podstawy i szkice, Anderson R., Cervo D., Helion, 2018 [3] Monk Simon: Arduino dla początkujących. Kolejny krok, Anderson R., Cervo D., Helion, 2015 **ONLINE LITERATURE:** [1] LabVIEW Tutorial [2] ARDUINO Tutorial [3] Materials prepared by Tutor [4] Internet websites
SUBJECT SUPERVISOR (NAME AND SURNAME, E-MAIL ADDRESS)
Prof. dr hab. inż. Radosław Zimroz, radoslaw.zimroz@pwr.edu.pl **dr inż. Anna.Nowak-Szpak**

Zał. nr 5 do ZW 8/2020
Załącznik nr … do programu studiów

FACULTY OF GEOENGINEERING, MINING AND GEOLOGY

SUBJECT CARD
Name in Polish: Zarządzanie Środowiskiem
….(zajęcia są prowadzone w języku angielskim)
Name in English: Environmental Management
Faculty of studies (if applicable): Mining and Geology
Specialisation (if applicable): Mining Engineering
Level and form of studies: 2nd level, full-time
Subject Type: Obligatory
Subject code: W06GIG-SM0078
Group of courses: No

	Lecture	Classes	Laboratory	Project	Seminar
Number of hours of organized classes in the University (ZZU)	**30**				**15**
Number of hours of total student workload (CNPS)	**60**				**30**
Form of crediting	**Crediting with grade**				**Crediting with grade**
For a group of courses mark (X) for the final course					
Number of ECTS points	**1**				**1**
including number of ECTS points for practical (P) classes					
including number of ECTS points for direct teacher-student contact (BU) classes	**1,5**				**0,5**

PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES

1.Basic knowledge of issues related to ecology and environmental protection.

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SUBJECT OBJECTIVES

C1. To get students acquainted with systems of environmental management both in Poland and other EU countries.
C2. To prepare students for rational and sustainable management of environmental components.
C3. To get students acquainted with the genesis of environmental management systems in Poland, review and standardization of environmental management systems.
C4. To get students acquainted with benefits and obligations arising from the implementation of an environmental management system.
C5. To present the relationship between an environmental management system and a quality

management system.

C6. To provide an overview of informative methods of supporting the implementation of environmental management systems (possibilities and practical usage of computerised systems of environmental information management, decision support in the area of environmental protection and choice of methods and tools used to support the implementation of an environmental management system).

SUBJECT LEARNING OUTCOMES

relating to knowledge:

PEU_W01 – Possesses systematic knowledge of the origins of environmental management systems, review and standardization of environmental management systems.
PEU_W02 - Possesses knowledge of the possibilities and practical applications of tools supporting the implementation of the environmental management system.
PEU_W03 - knows basic formal and legal regulations regarding the implementation and functioning of management systems, tools and instruments of environmental management.
PEU_W04 - Possesses knowledge for rational and sustainable management of environmental components.

relating to skills:

PEU_U01 – Possesses linguistic resources appropriate for specialised language and is able to use it in linguistic activities in order to communicate in the professional environment regarding the field of studies; is able to obtain necessary information and interpret and critically evaluate it, reads and understands professional literature, is able to formulate and comprehensively justify opinions, provide presentations of problems related to a studied discipline and also participate in scientific and professional discussions.
PEU_U02 – Is able to use methods and appropriate IT tools in system management of environmental components.

relating to social competencies:

PEU_K01 - Is able to think and act in a creative and enterprising way.

PROGRAMME CONTENT		
	Form of classes - lecture	**Number of hours**
Lec.1	Basic concepts: - Environment, characteristics of individual elements of the environment - Characteristics of hazards for the natural environment which are a result of human activities - Environmental Management - The Environmental Management System	2
Lec.2	Legal aspects of environmental management	2
Lec.3	History and development of environmental management systems	2
Lec.4 Lec.5 Lec.6	Environmental management systems: - Business Charter for Sustainable Development of the International Chamber of Commerce - ICC Business Charter for Sustainable	6

	Development - EMAS – Directive of the European Community Commission regarding the approval for voluntary participation by organisations in a community eco-management and eco-audit scheme - CP - Clean Production - BS 7750 - Specification for Environmental Management Systems - ISO 9000 - ISO 14000 - ISO 14001 Characteristics of selected Environmental Management Systems. The benefits of the implementation of the EMS for a company. Experiences of Polish enterprises from the implementation of EMS. Process of implementation of the selected EMS in a company with an example of EMAS.	
Lec.7 Lec.8	Basic tools of environmental management: - Legal and administrative instruments (laws, standards, licenses and permits) - Economic instruments (fees, taxes, deposit and refund systems, transferable rights, subsidies, liens, fines) - Instruments (techniques) social impact (ecological education, ecological propaganda) Examples of basic tools of environmental management: - Procedure for an assessment of environmental impact - Integrated permits - Audits - Safety Reports - Monitoring of the Environment	4
Lec.9 Lec.10	Design of an environmental management system	4
Lec.11 Lec.12	IT systems supporting environmental management: - Decision Support Systems - Expert systems - Simulation Models - Geographical Information Systems Selected types of information systems which support environmental management, their characteristics, examples of implementation both in Poland and in the world	4
Lec.13	The benefits of an implemented and functioning environmental management system	2
Lec.14	Costs of implementation and functioning of an environmental management system	1
Lec.14 Lec.15	Environmental management systems in practice	3
	Total hours	**30**

Form of classes - seminar		Number of hours
Se1	The scope and form of an essay and presentation, terms of crediting and literature.	2

	Assignment of seminar topics for individual students.	
Se2 Se3 Se4 Se5 Se6 Se7 Se8	Student speeches with the use of multimedia presentations on the following issues: environmental management systems - specified examples, formal and legal conditions of administrative procedures (eg. receiving a decision on the environmental conditions of a project, an integrated decision etc.), life-cycle analysis of a selected company; fees, taxes, surcharges and environmental deposits; litter management systems, mineral resource management, renewable energy sources, selected monitoring systems, the institution of environmental protection in Poland and in the world and also alternative energy sources, etc. Group discussion on the content and form of speeches.	13
	Total hours	**15**

TEACHING TOOLS USED
N1. Informative lecture with elements of problematic lectures. N2. Multimedia presentations N3. Didactic discussion during lectures and seminars N4. Preparation of an essay in the form of a report N5. Presentation of the essay N6. Consultations

EVALUATION OF SUBJECT EDUCATIONAL OUTCOME ACHIEVEMENTS

Evaluation F – forming (during semester), P – concluding (at semester end)	Educational outcome number	Method of evaluating educational outcome achievement
F1- Grade from content value of an essay	PEU_U01 PEU_U02 PEU_K01	Text and graphical form of essay
F2 – Grade from presentation and issues included in an essay	PEU_U01 PEU_U02 PEU_K01	Presentation of essay
F3 – Grade from a written or oral test	PEU_W01 PEU_W02 PEU_W03 PEU_W04	Positive grade
final grade from the subject (the weighted average, respectively: 35% for the substantive content of the essay, 25% for the presentation, 40% for the lecture)		

PRIMARY AND SECONDARY LITERATURE
PRIMARY LITERATURE: [1] Ejdys J.,1998, Zarządzanie środowiskowe w przedsiębiorstwie – koszty i korzyści, Sterowanie ekorozwojem, t.2, Wyd. Politechniki Białostockiej, Bialystok, [2] Lukasheh A. F., Droste R. L., Warith M. A., 2001, Review of Expert System (ES), Geographic Information System (GIS), Decision Support System (DSS), and their applications in landfill design and management. W: Waste Management & Research nr 19, [3] Łunarski J. (red.), 2002, Zarządzanie środowiskiem", Oficyna Wydawnicza Politechniki Rzeszowskiej, Rzeszow [4] Nowak Z., 2001, Zarządzanie środowiskiem, Wyd. Politechniki Śląskiej, Gliwice, [5] Matuszak-Flejszman A., 2001: Jak skutecznie wdrożyć system zarządzania środowiskowego wg normy ISO 14001. PZIiTS, Poznan [6] Pochyluk R. i inni, 1999, Zasady wdrażania systemu zarządzania środowiskowego zgodnego z wymaganiami normy ISO 14001, Eco-Konsult, Gdansk, [7] Poskrobko B., Poskrobko T., 2012, Zarządzanie środowiskiem w Polsce, Polskie Wydawnictwo Ekonomiczne, Warsaw [8] Poskrobko B., 1998: Zarządzanie środowiskiem. Polskie Wydawnictwo Ekonomiczne, Warsaw [9] Przybyłowski P. (red.), 2005, Podstawy zarządzania środowiskowego, Wyd. Akademii Morskiej, Gdynia. **SECONDARY LITERATURE** [1] Jeżowski P. (red.), 2007: Ekonomiczne problemy ochrony środowiska i rozwoju zrównoważonego w XXI wieku. Szkoła Główna Handlowa, Warsaw [2] Lemański J. F., Matuszak-Flejszman A., Zabawa S. (red.), 2000: Efektywność funkcjonowania wdrożonego systemu zarządzania środowiskowego wg normy ISO 14001. PZIiTS, AE, Poznan – Pila [3] Websites given during lectures and seminars
SUBJECT SUPERVISOR (NAME AND SURNAME, E-MAIL ADDRESS)
Dr hab. inż. Justyna Woźniak **Dr hab. Inz. Katarzyna Pactwa,** **Dr inż. Danuta Szyszka**

Zał. nr 5 do ZW 8/2020
Załącznik nr … do programu studiów

FACULTY OF GEOIENGINEERING, MINING AND GEAOLOGY

SUBJECT CARD

Name in Polish: Systemy przeróbcze
kurs prowadzony jest w języku angielskim
Name in English: Mineral Processing Systems
Main field of study (if applicable): Mining and Geology
Specialization (if applicable): Mining Engineering,
Level and form of studies: 2nd, full-time
Kind of subject: elective
Subject code: W06GIG-SM0069
Group of courses: NO

	Lecture	Classes	Laboratory	Project	Seminar
Number of hours of organized classes in University (ZZU)	**15**			**30**	
Number of hours of total student workload (CNPS)	**30**			**60**	
Form of crediting	**crediting with grade**			**Crediting with grade**	
For group of courses mark (X) final course					
Number of ECTS points	**1**			**2**	
including number of ECTS points for practical (P) classes of practical character (P)				**2**	
including number of ECTS points for direct teacher-student contact (BU) classes	**1**			**1**	

*delete as applicable

PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES

1. Fundamentals of mineral processing and waste.
2. Basic knowledge of mathematical statics, line programming, programming in VBA.

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SUBJECT OBJECTIVES

C1 Presenting production issues in the mineral industry as an optimization problem of managing the operation of complex technological systems.
C2 Familiarising students with modern methods of off-line analysis of complex systems, mineral processing and waste.
C3 Creating skills to construct simple models and algorithms for mining operations and tailings and their implementation using a spreadsheet supported by VBA program.
C4 Creating skills to prepare and present reports of performed analyses and projects.

SUBJECT LEARNING OUTCOMES
Subject learning outcome relating to knowledge: PEU_W01 The student has general knowledge of technologies used in refining, and processing mineral resources PEU_W02 The student gets to know the principle of mathematical modelling of tailings operationsand problems of experimentation to determine model parameters of an operation. PEU_W03 The student gets to know the criteria and algorithms of optimization (off-line) of complex systems of technological operations PEU_W04 The student gets to know the examples of commercial and training functions of software for the analysis of tailings systems (JKSimMet, ModSim, WTP) PEU_W05 The student gets to know how to perform simulation calculations of systems of qualitative and quantitative operations using calculating tools available in the spreadsheet (functions,VBA) PEU_W06 The student gets to know how to perform simulation calculations of processes of qualitative and quantitative operations using calculating tools available in the spreadsheet (functions, VBA) **Subject learning outcome relating to skills:** PEU_U01 - The student can perform basic calculations of simple models tailings operations: crushing and classification and evaluating their performance PEU_U02 - The student can perform an individual/ group task to optimize a simple feedback system of mining operations and / or tailings PEU_U03 - The student can develop and present the results of his project work (paper report, multimedia presentation of sample analysis of mineral system in processing and waste **Subject learning outcome relating to social competence:** PEU_K01 - The student has created attitude of critical overview of the available knowledge on the course.

PROGRAMME CONTENT		
Form of classes - lecture		**Number of hours**
Le1	Scope of lecture, crediting conditions, literature overview. Profile characteristics of the course and the aims and methods of education. Linking the course problems with the course profile and educational programs of other courses of particular specialty and the field of study	2
Le2	The basic structures of mining, coal preparation and processing systems on the example of the construction materials industry, mining ore and coal, metallurgy, waste management	2
Le3	Types and systematics of operations, information operations model, the concept of system and process operations, performance, efficiency, reliability, productive hours.	2
Le4	Methods and tools for the analysis of complex systems operations. Spreadsheet as a calculation tool (functions, VBA)	2
Le5	Modelling crushing operations, crushing machine models, methods and problems of experimentation	2
Le6	Modelling of classification procedure (separation), classifier / separator models, methods and problems of experimentation	2
Le7	Methods of simulation of the quantitative operations processes (mass flow in systems, tanks, and machines). Knowledge control - test	3
	Total hours	**15**

Form of classes - project		Number of hours
Pr1	Introduction to the project: assumptions, aims, form, schedule	3
Pr2	Checking the initial knowledge of the students in auditorial mode.	3
Pr 3	Solving simple calculation using a spreadsheet (functions, calculus matrix).	3
Pr 4	Duty hours and exercises checking the knowledge of mathematical statistics (grain size) and the ability to operate on sets.	3
Pr 5	Handing out tasks and explanation for individual work (system analysis operations: different structures, different technologies, and different models). Variable catalogue of exercises, adjusted to current students level of knowledge and skills of).	3
Pr 6	Algorithmization and programming of tasks examples concerning the grain analysis in VBA - exercises on auxiliary examples.	3
Pr 7	Individual work: the construction of models of a given operation, individual duty hours.	3
Pr 8	Individual work: analysis (optimization) of given operation systems according to qualitative, quantitative and economics criteria, monitoring the performance, individual duty hours	3
Pr 9	Presentation/project defence of ready-made projects by students. Project settlement (course crediting). Partial crediting.	3
Pr 10	(to be continued) Presentation/project defence of ready-made projects by students, including repeats. Project settlement (course crediting). Partial crediting.	3
	Total hours	**30**

TEACHING TOOLS USED
N1. Informative lecture with the elements of problem solving lecture, multimedia presentations, N2 didactic discussion considering the lecture and the project, N3 projects preparation in a report form, written exam (knowledge test), N4 checking the progress of project, presentation and project defence, duty hours.

EVALUATION OF SUBJECT LEARNING OUTCOMES ACHIEVEMENT

Evaluation (F – forming (during semester), P – concluding (at the end of semester)	Educational effect number	Way of evaluating educational effect achievement
F1 - Assessment of problem solving skills		
F2 - Form and performance.		
P1 - Partial grade from examination which covers the content of the lecture: test of control tasks specific to the subject of the course (differentiated tasks, sorted by difficulty in %, set = 100%) the best score plus bonuses for attending the lectures determine the reference level		
P2 - Partial grade of crediting the project (weighted average of projects - 70% meritum and 30% a form)		
P3.Final grade of the group of courses: mean of constituent grades from the lecture and the project.		

PRIMARY AND SECONDARY LITERATURE
PRIMARY LITERATURE [1] Drzymała J., Podstawy przeróbki kopalin, Politechnika Wrocławska Publishing House, [2] Wrocław 2006. [3] King R.P., Modeling & simulation of mineral processing systems, Batterworth and Heinemann, [4] Oxford, 2001. [5] Lynch A.J.,Mineral crushing and grinding circuits, Elsevier Sci Publ.Company, Amsterdam, Oxford, NY, 1977. [6] 7. Wills B.A., Mineral Processing Technology. **SECONDARY LITERATURE** [1] Malewski J, Modrzejewski S., Modelowanie i optymalizacja systemów i procesów wydobycia i przeróbki kruszyw łamanych, Górnictwo Odkrywkowe Publishing, Wrocław, 2008 [2] Malewski J., Zarządzanie produkcją – kluczową technologią rozwoju przemysłu wydobywczego rud miedzi i surowców towarzyszących, Cuprum, nr 1/2008. [3] Monografia KGHM, (pod red. Piestrzyńskiego), Lubin 2007. [4]
SUBJECT SUPERVISOR (NAME AND SURNAME, E-MAIL ADDRESS)
Dr inż. Tomasz Ratajczak **Dr. inż. Danuta Szyszka**

Zał. nr 5 do ZW 8/2020

Załącznik nr … do programu studiów

FACULTY OF GEOIENGINEERING, MINING AND GEAOLOGY

SUBJECT CARD

Name in Polish: Modele Decyzyjne w Zarządzaniu
Name in English: Operations Research
Main field of study (if applicable): Mining and Geology
Specialization (if applicable): Mining Engineering,
Level and form of studies: 2nd, full-time
Kind of subject: obligatory
Subject code: W06GIG-SM0079
Group of courses: NO

	Lecture	Classes	Laboratory	Project	Seminar
Number of hours of organized classes in University (ZZU)	**15**		**15**		
Number of hours of total student workload (CNPS)	**60**		**30**		
Form of crediting	**crediting with grade**		**Crediting with grade**		
For group of courses mark (X) final course					
Number of ECTS points	**2**		**1**		
including number of ECTS points for practical (P) classes of practical character (P)			**1**		
including number of ECTS points for direct teacher-student contact (BU) classes	**1**		**1**		

*delete as applicable

PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES

1. The student has basic knowledge of mining systems, technological and organizational systems in mining
2. The student has basic knowledge concerning economics in mining
3. The student has basic knowledge concerning mathematical analysis necessary to understand mathematical issues in science having engineering and economic character.
4. The student has basic knowledge and skills of using probability theory models and mathematical statistics
5. The student can use Excel spreadsheet
6. The student understands the need and knows the possibilities of lifelong learning, improving professional, personal and social skills

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SUBJECT OBJECTIVES

C1 Acquiring basic knowledge, taking into consideration its applicational aspects concerning mathematical decision models used in management:

C1.1 Linear programming models

C1.2 Models of planning, deposits and costs of projects

C1.3 Queuing system models
C1.4 Digital simulation models

C2. Learning of qualitative understanding, interpretation and quantitative analysis with applications of selected issues concerning optimization

C2.1. Production systems:
C2.2. Transport issues
C2.3. Flows in networks.
C2.4. Project schedules
C2.5. Queuing system models

C3. Acquiring and consolidating the competencies of thinking and acting in a system way.

SUBJECT LEARNING OUTCOMES

Subject educational effect (knowledge)

PEU_W01 The student has knowledge concerning basic decision models in management
PEU_W02 The student has knowledge concerning line programming models.
PEU_W03 The student has knowledge concerning models for planning and monitoring of activities, deposits, and costs of projects
PEU_W04 The student has knowledge concerning queuing system models
PEU_W05 The student has knowledge concerning simulation models.

Subject educational effect (skills)

PEU_U01 The student has the ability to apply and interpret models using linear programming applications
PEU_U02 The student has the ability to apply and interpret models of planning and monitoring of activities, deposits, and costs of projects with the use of programming applications
PEU_U03 The student has the ability to apply and interpret queuing system models using programming applications
PEU_U04 The student has the ability to apply and interpret simulation models using programming applications

Subject educational effect (social)

PEU_K01 The student can think and act in a system, creative and enterprising way
PEU_K02 The student is able to identify and solve problems with the use of decision models and applications

PROGRAMME CONTENT

	Form of classes - lecture	Number of hours
Le1	Introduction to modelling systems	2
Le2	Linear programming issues - optimization of production	2
Le3	Linear programming issues - flow in networks optimization (optimal allocation issues, the issue of transportation, maximum flow, minimizing costs)	2
Le4	Projects scheduling using critical path	2
Le5	Planning and balancing of deposits in projects	2
Le6	Optimization issues of queuing systems	2
Le7	Monte Carlo methods and digital simulation	3
	Total hours	**15**

Form of classes - laboratory		Number of hours
La1	Defining and solving linear programming issues (Microsoft Excel-Solver)	2
La2	Production optimization (Microsoft Excel - Solver)	2
La3	Flows in networks optimization (Microsoft Excel - Solver)	2
La4	Projects scheduling (Microsoft Project)	2
La5	Planning and balancing of deposits in projects (Microsoft Project)	2
La6	Optimization issues of queuing systems (Microsoft Excel)	2
La7	Elements of Monte Carlo methods and digital simulation (Microsoft Excel)	3
	Total hours	**15**

TEACHING TOOLS USED

N1. Interactive lecture with slides and discussion
N2. Laboratory exercises with the use of IT applications - discussion concerning solutions
N3. Laboratory exercises - short written tests (calculating tasks, tests of knowledge)
N4. Duty hours
N5. Own work - preparation for laboratory classes, solving additional tasks
N6. Own work - own literature studies.

EVALUATION OF SUBJECT LEARNING OUTCOMES ACHIEVEMENT

Evaluation (F – forming (during semester), P – concluding (at the end of semester)	Educational effect number	Way of evaluating educational effect achievement
F1	PEK_U01-04	short written test.
PEU_U01-04 written test (counting exercise)		
PEU_W01-05; PEU_K01-02 Written test (knowledge test)		

PRIMARY AND SECONDARY LITERATURE

PRIMARY LITERATURE

[1] Ignasiak E., Borucki W., Badania operacyjne, PWE, 2001
[2] Krawczyk S., Badania operacyjne dla menedżerów, PWE
[3] Baranowska B, Badania operacyjne w zarządzaniu, PWSBIA, 1996

SECONDARY LITERATURE

[1] Szapiro T., Decyzje menedżerskie z Excelem, PWE 2000
[2] Trzaskalik T., Modelowanie optymalizacyjne, Absolwent
[3] Trzaskalik T., Badania operacyjne z komputerem, PWE

SUBJECT SUPERVISOR (NAME AND SURNAME, E-MAIL ADDRESS)

Dr inż. Witold Kawalec
Dr hab. inż. Leszek Jurdziak
Dr inż. Zbigniew Krysa

COURSE DESCRIPTIONS/
KARTY PRZEDMIOTÓW

second-level studies/ studia II stopnia
main field of study/ kierunek studiów:
Mining and Geology/ Górnictwo I Geologia

specjalność/specialisation:
Geotechnical and Environmental Engineering

1-st Semester

Semestr 1

Zał. nr 5 do ZW 8/2020
Załącznik nr … do programu studiów

WYDZIAŁ **Geoinżynierii, Górnictwa i Geologii**

KARTA PRZEDMIOTU

Nazwa przedmiotu w języku polskim Wspomagane komputerowo modelowanie geologiczne i geostatystyka. ….(zajęcia są prowadzone w języku angielskim)
Nazwa przedmiotu w języku angielskim Computer Aided Geological Modelling and Geostatistics…………………………………………….
Kierunek studiów (jeśli dotyczy): Górnictwo i geologia.
Specjalność (jeśli dotyczy): Mining Engineering,
Geotechnical and Environmental Engineering,
Geomatics for Mineral Resource Management
Poziom i forma studiów: II stopień, stacjonarna
Rodzaj przedmiotu: obowiązkowy *
Kod przedmiotu W06GIG-SM0038
Grupa kursów NIE*

	Wykład	Ćwiczenia	Laboratorium	Projekt	Seminarium
Liczba godzin zajęć zorganizowanych w Uczelni (ZZU)	15		45		
Liczba godzin całkowitego nakładu pracy studenta (CNPS)	30		120		
Forma zaliczenia	~~Egzamin /~~ zaliczenie na ocenę*	Egzamin / zaliczenie na ocenę*	~~Egzamin /~~ zaliczenie na ocenę*	Egzamin / zaliczenie na ocenę*	Egzamin / zaliczenie na ocenę*
Dla grupy kursów zaznaczyć kurs końcowy (X)					
Liczba punktów ECTS	**1**		4		
w tym liczba punktów odpowiadająca zajęciom o charakterze praktycznym (P)			4		
w tym liczba punktów ECTS odpowiadająca zajęciom wymagającym bezpośredniego udziału nauczycieli lub innych osób prowadzących zajęcia (BU)	1		2		

*niepotrzebne skreślić

WYMAGANIA WSTĘPNE W ZAKRESIE WIEDZY, UMIEJĘTNOŚCI I KOMPETENCJI SPOŁECZNYCH

1. Mathematical Statistics,
2. Fundamentals of Geology and Mineral Deposits

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CELE PRZEDMIOTU

C1 Developing basic skills in computer modelling of 3-D objects.
C2 Introduction of the principles of digital modelling of typical geological structures.
C3 Introduction to the methods of deposit parameters estimation and resources evaluation.

PRZEDMIOTOWE EFEKTY UCZENIA SIĘ
Z zakresu wiedzy: PEU_W01 Estimation methods, principles of geostatistics, kriging estimators PEU_W02 Geostatistical modelling of the selected deposit parameters (domain analysis, variogram modelling, PEU_W03 Creating and validating 3-D models of various geological structures in the comprehensive dedicated software environment. Z zakresu umiejętności: PEU_U01 Application of relevant estimation methods for quality modelling of a deposit PEU_U02 Evaluating 3-D objects against structural and quality block models (volumes, tonnages, grades) PEU_U03 Describing the interpretation and applied approach, creating models, evaluation results, recommendations for possible enhancements Z zakresu kompetencji społecznych: PEK_K01 The student can think and act in a creative and enterprising way

TREŚCI PROGRAMOWE		
Forma zajęć - wykład		**Liczba godzin**
Wy1	Introduction to the course. Geological database and validation of the geological data.	2
Wy2	Geology of the seam.	2
Wy3	Structural model of the stratified deposit. Methods of the prediction of the surface layer parameters.	2
Wy4	Spatial distribution of samples values. Regionalized variable.	2
Wy5	BLUE Estimator of the mean value: Kriging.	2
Wy6	Quality model of the deposit – block model of the parameter layers. Estimation and evaluation of the block model.	2
Wy7	Reserves modelling and evaluation.	2
Wy8	Mineral resources. International reporting. The JORC Code	1
	Suma godzin	**15**

Forma zajęć - ćwiczenia		**Liczba godzin**
Ćw1		
Ćw2		
Ćw3		
Ćw4		
..		
	Suma godzin	0

Forma zajęć - laboratorium	**Liczba godzin**

La1	Determining the rules of work at the laboratory.	3
La2	Assignment of the individual dataset for the exercises and creating initial data files.	3
La3	Data validation and creating initial geological database.	3
La4	Construction of the structural wireframe model of stratigraphy layers.	3
La5	Construction of the block model of the deposit and overburden layers. Thickness and stripping ratio analysis.	3
La6	Data preparation to geostatistical analysis. Compositing of the samples.	3
La7	Domain analysis with the use of the statistical methods.	3
La8	Determination of the empirical variogram. Anisotropy analysis.	3
La9	Variogram modelling.	3
La10	Kriging Neighborhood Analysis - defining optimal parameters of the estimation procedure.	3
La11	Estimation of quality parameters in block model of the deposit layers. Validation of the estimation quality.	3
La12	Validation of the quality model and classification of the resources. Balance resources evaluation.	3
La13	Preparation of data for continuous surface mining ultimate pit design. Ultimate pit outlines generation	3
La14	Wireframe and block modelling of the ultimate pit	3
La15	Reserves evaluation, visualization and interrogation of created models	3
	Suma godzin	45

Forma zajęć - projekt		Liczba godzin
Pr1		
Pr2		
Pr3		
Pr4		
…		
	Suma godzin	0

Forma zajęć - seminarium		Liczba godzin
Se1		
Se2		
Se3		
…		
	Suma godzin	0

STOSOWANE NARZĘDZIA DYDAKTYCZNE
N1. Form of lectures - traditional, multimedia presentations using specialized software and demonstrations of its application "live", individual development of specialist topics covered during the lecture, N2. individual development of project tasks within the laboratories frames, individual development of electronic reports concerning project tasks within the laboratories frames, N3. evaluation of laboratory tasks reports with multipoint grade of student's work, group analysis of the results obtained during laboratory tasks; preparation of conclusions concerning data dependencies and constraints of mining projects, skill control tests, duty hours in laboratory.

OCENA OSIĄGNIĘCIA PRZEDMIOTOWYCH EFEKTÓW UCZENIA SIĘ

Oceny (F – formująca (w trakcie semestru), P – podsumowująca (na koniec semestru)	Numer efektu uczenia się	Sposób oceny osiągnięcia efektu uczenia się
F1	PEU_W01, PEU_W02	Lecture grade on the basis of the written examination
F2	PEU_W03,	Laboratory task assessment: "structural modelling assessment
F3	PEU_U01	Laboratory task assessment: "geostatistical modelling"
F4	PEU_U02, PEU_U03	Laboratory task assessment: "reserves evaluation".
P average of F1, F2, F3, F4		

LITERATURA PODSTAWOWA I UZUPEŁNIAJĄCA

LITERATURA PODSTAWOWA:

[1] M. Armstrong, Basic Linear Geostatistics, Springer Verlag, 1998.
[2] P. Goovaerts: "Geostatistics for Natural Resource Evaluation", Oxford University Press, 1997.
[3] R. H. Grishong, Jr., 3-D Structural Geology, Springer Verlag, 2008
[4] K. Hefferan, J. O'Brien, Earth materials, Willey-Blacwell, Chichester U.K., 2010
[5] W. Hustrulid, M. Kuchta, Open pit mine planning and design. Chapter 3. Orebody description, Taylor&Francis, 2013.
[6] A. G. Journel, and C.J. Huijbregts, Mining Geostatistics, Academic Press, 1978.
[7] Ch.C. Plummer, D.H. Carlson, L. Hammersley, Physical geology, McGraw-Hill I.E. N.Y. 2010
[8] D.R. Prothero, R.H. Dott Jr., Evolution of the Earth, McGraw-Hill I.E. N.Y., 2010
[9] M.W. Rossi, C.V. Deutsch, Mineral Resources Estimation, Springer Verlag 2014.

LITERATURA UZUPEŁNIAJĄCA:

[10] Handouts, tutorials.

OPIEKUN PRZEDMIOTU (IMIĘ, NAZWISKO, ADRES E-MAIL)

Dr inż. Krzysztof Hołodnik
Dr inż. Witold Kawalec, Dr Paweł Zagożdżon

Zał. nr 5 do ZW 8/2020
Załącznik nr … do programu studiów

WYDZIAŁ GEOINŻYNIERII, GÓRNICTWA i GEOLOGII

KARTA PRZEDMIOTU

Nazwa przedmiotu w języku polskim Geofizyka inżynierska
….(zajęcia są prowadzone w języku angielskim)
Nazwa przedmiotu w języku angielskim Engineering Geophysics
Kierunek studiów (jeśli dotyczy): górnictwo i geologia
Specjalność (jeśli dotyczy): Mining Engineering,
Geotechnical and Environmental Engineering,
Geomatics for Mineral Resource Management
Poziom i forma studiów: **~~I~~ / II stopień / ~~jednolite studia magisterskie~~*, stacjonarna / ~~niestacjonarna~~***
Rodzaj przedmiotu: ~~**obowiązkowy**~~ **/ wybieralny / ~~ogólnouczelniany~~ ***
Kod przedmiotu **W06GIG-SM0040**
Grupa kursów **~~TAK~~ / NIE***

	Wykład	Ćwiczenia	Laboratorium	Projekt	Seminarium
Liczba godzin zajęć zorganizowanych w Uczelni (ZZU)	15			15	
Liczba godzin całkowitego nakładu pracy studenta (CNPS)	40			50	
Forma zaliczenia	~~Egzamin~~ / zaliczenie na ocenę*			~~Egzamin~~ / zaliczenie na ocenę*	
Dla grupy kursów zaznaczyć kurs końcowy (X)					
Liczba punktów ECTS	1			2	
w tym liczba punktów odpowiadająca zajęciom o charakterze praktycznym (P)				2	
w tym liczba punktów ECTS odpowiadająca zajęciom wymagającym bezpośredniego udziału nauczycieli lub innych osób prowadzących zajęcia (BU)				2	

*niepotrzebne skreślić

WYMAGANIA WSTĘPNE W ZAKRESIE WIEDZY, UMIEJĘTNOŚCI I KOMPETENCJI SPOŁECZNYCH

1. has knowledge of fundamentals of applied geophysics, physics and geology.
2. knows fundamentals of soil and rock mechanics.
3. is able to use MS Office software.
4. is able to work in a team.

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CELE PRZEDMIOTU

C1 familiarize with physical phenomena in geosphere of the Earth
C2 familiarize with engineering problems solved by means of geophysical surveying
C3 familiarize with various geophysical surveys.

C4 acquisition of skills to plan geophysical field surveying and to interpret its results. C5 development of skills to work in a group.

PRZEDMIOTOWE EFEKTY UCZENIA SIĘ
Z zakresu wiedzy: PEU_W01 recognizes, names and explains engineering problems in different fields. PEU_W02 identifies, describes and chooses geophysical surveying methods. PEU_W03 analyses and assesses case studies from solving the engineering problems. Z zakresu umiejętności: PEU_U01 is able to coordinate team work, create field research plans and manage the work progress. PEU_U02 is able to independently create solutions for complex practical problems in engineering and geoengineering applying knowledge about geophysical surveying, mining geophysics, utilizing modern methods in geophysical data acquisition and interpretation. PEU_U03 is able to critically assess, process and interpreted results of the geophysical surveying and provide recommendations related to engineering problems in mining, civil engineering, engineering geology, municipal waste site, archeology, engineering properties of soil and rocks, hydrogeology, monitoring seepage in river dykes or dams. PEU_U04 is able to solve geophysical problems. PEU_U05 is able to conduct auto-didactical education related to detailed handling of typical software. Z zakresu kompetencji społecznych: PEU_K02 understands the need to create and transfer to the society – among others by mass media- information and opinions related to mining engineering achievements and other activities of mining engineer; tries to transfer the information in commonly understood way, presenting different points of view; is aware of the quality and need to shape the work safety culture in mining and the responsibility for the health and life of other employees.

TREŚCI PROGRAMOWE		
Forma zajęć - wykład		**Liczba godzin**
Wy1	Physical properties of rocks. Inter-relationships between the various subdisciplines of applied geophysics. Overview of geophysical methods, their physical principles and applications. Methodology of geophysical surveying.	1
Wy2	Engineering problems solved with geophysical surveying. Case studies.	2
Wy3	Electrical resistivity methods. Tomography and VSE. IP method. Physical principles. Equipment. Methods of field surveying. Interpretation and application. Case studies.	2
Wy4	Electromagnetic methods. FDEM and TDEM methods. Magnetotelluric methods. Physical principles. Methods of field surveying. Equipment. Interpretation and application. Case studies.	2
Wy5	GPR surveying. Physical principles. Methods of field surveying.	2

	Equipment. Interpretation and application. Case studies.	
Wy6	Seismic tomography. Seismic interferometry. Physical principles. Applications. Case studies.	2
Wy7	Mine geophysics. Seismology. Seismic methods. Active and passive seismic tomography. Microgravimetry. Case studies.	2
Wy8	Gravity and magnetic surveying. Equipment. Methods of field surveying. Interpretation and application. Case studies.	2
	Suma godzin	**15**

Forma zajęć - projekt		**Liczba godzin**
Pr1	One selected geophysical technique. Fundamentals and equipment. Field surveying	4
Pr2	Processing and interpretation of field data.	3
Pr3	Solving the geophysical problems.	8
	Suma godzin	**15**

STOSOWANE NARZĘDZIA DYDAKTYCZNE
N1.Lecture aided by presentation. N2.Demonstration. N3.Discussion and consultations N3Calculations N5Practical field surveying

OCENA OSIĄGNIĘCIA PRZEDMIOTOWYCH EFEKTÓW UCZENIA SIĘ

Oceny (F – formująca (w trakcie semestru), P – podsumowująca (na koniec semestru)	Numer efektu uczenia się	Sposób oceny osiągnięcia efektu uczenia się
P1	W01-W03	Test related to lecture content. Final grade.
F1	U01-U02, U05	Test. Project 1. Report on Project 1
F2	U03, U05	Test. Project 2. Report on Project 2
F3	U04, U05	Test. Solving geophysical problems
F1-F3, P2	U01-U05 K02	Grades are given for each of three project tasks including tests and reports. The final grade P2 for the project course is the weighted average grade of F1-F3.

LITERATURA PODSTAWOWA I UZUPEŁNIAJĄCA

LITERATURA PODSTAWOWA:

[1] Aki, K., Richards P.G., 1980. Quantitative Seismology: Theory and Methods. W.H. Freeman Co.. San Francisco.
[2] Burger, H.R., Sheehan, A.F., Jones, C.H., 2006. Introduction to Applied Geophysics: Exploring the Shallow Subsurface. W.W. Norton & Company, Inc.
[3] Mendecki, A.J. (ed.), 1997. Seismic Monitoring in Mines. Chapman & Hall.
[4] Reynolds, J.M., 2011. An Introduction to Applied and Environmental Geophysics. Wiley – Blackwell. John Wiley & Sons.

[5] Sharma, Prem V., 2002. Environmental and engineering geophysics. Cambridge University Press.
[6] Torge, W., 1989. Gravimetry. Water de Gruyter. Berlin. New York.
[7] Selected Journal Publications (for example journals: Progress in Geophysics, Engineering Geophysics Journal, Environmental and Engineering Geophysics, Journal of Geophysics and Engineering, Pure and Applied Geophysics).

LITERATURA UZUPEŁNIAJĄCA:

[1] Lowrie, W., 2007. Fundamentals of Geophysics. Cambridge University Press.
[2] Milsom, J., 2003. Field Geophysics. John Wiley & Sons Ltd.
[3] Telford, W.M., Geldart, L.P., Sheriff, R.E., 1990. Applied Geophysics. Cambridge University Press.

OPIEKUN PRZEDMIOTU (IMIĘ, NAZWISKO, ADRES E-MAIL)

ANNA BARBARA GOGOLEWSKA, anna.gogolewska@pwr.edu.pl

FACULTY OF ENVIRONMENTAL ENGINEERING

SUBJECT CARD

Name in Polish: **Chemia środowiska**
Name in English: **Environmental chemistry**
Main field of study (if applicable): **Environmental Engineering**
Specialization (if applicable): **Environmental Quality Management**
Level and form of studies: **2nd level, full-time**
Kind of subject: **obligatory**
Subject code: **ISS105051**
Group of courses: **NO**

	Lecture	Classes	Laboratory	Project	Seminar
Number of hours of organized classes in University (ZZU)	30		15		
Number of hours of total student workload (CNPS)	90		60		
Form of crediting	crediting with grade		crediting with grade		
For group of courses mark (X) final course					
Number of ECTS points	**3**		2		
including number of ECTS points for practical (P) classes			2		
including number of ECTS points for direct teacher-student contact (BK) classes	1		0.5		

PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES

1. Knowledge in the field of inorganic and organic chemistry

SUBJECT OBJECTIVES

C1. Becoming familiar with the physical and chemical properties of water; chemical composition of natural waters and their contamination; water classification and water quality standards
C2. Becoming familiar with the physical and chemical processes which influence the content of the trace compounds in the air. Learning methods of mathematical description of the temporal and special variability of substances concentration in the air
C3. Gaining knowledge in the types of waste, the methods for determination of physico-chemical properties of the waste and the theoretical ways for their treatment

SUBJECT EDUCATIONAL EFFECTS	
relating to knowledge:	
PEK_W01	Student has the knowledge in the field of the physical and chemical analysis required in assessment of drinking water quality
PEK_W02	Student understands the usefulness of physicochemical analysis in assessment of water quality
PEK_W03	Student is familiar with basic notions: atmosphere, troposphere, trace compound, air contaminant, mass balance of the substance in the air
PEK_W04	Student is able to describe and explain the processes which take place in the troposphere in gaseous phase
PEK_W05	Student is able to describe and explain the processes which take place in the troposphere in liquid phase
PEK_W06	Student knows the methods of determining sieve, morphological and chemical composition of waste
PEK_W07	Student is able to specify the parameters that determine the calorific and fertilizing properties of waste
PEK_W08	Student knows the theoretical basis of waste treatment, can compare individual technologies
relating to skills:	
PEK_U01	Student has the ability to analyse physical and chemical properties of water samples
PEK_U02	Student has the ability of water quality assessment and its suitability for consumption
PEK_U03	Student has the ability to plan the experiment, its implementation and the correct interpretation of the results
PEK_U04	Student is able to apply the mathematical description of the mass-balance of species in the troposphere
PEK_U05	Student is able to analyse quantitatively selected processes taking place in gas phase and liquid phase in the troposphere.
PEK_U06	Student is able to predict and utilise the footprint of point emission source
relating to social competences:	
PEK_K01	Student is aware of the effects of pollution of natural waters
PEK_K02	Student understands the role of trace compounds in the troposphere
PEK_K03	Student is aware of risks to the environment arising from incorrect waste management

PROGRAMME CONTENT		
	Form of classes - lecture	**Number of hours**
Lec1	Physical and chemical properties of water. Minerals and natural organic compounds in water	3
Lec2	Classification and water quality standards	2
Lec3	Physical and chemical parameters of water analysis	2
Lec4	Tests for determination of organic compounds in water	2
Lec5	Crediting (part 1)	1
Lec6	Atmosphere, air and trace compounds. Mass balance of species in air and its mathematical description	3
Lec7	Chemistry of gas phase in the troposphere.	2
Lec8	Chemistry of liquid phase in the troposphere.	2
Lec9	Species removal from the troposphere: wet and dry deposition.	2
Lec10	Crediting (part 1I)	1

Lec11	Quantitative characteristics of waste. General chemistry: differences between chemical compounds and mixtures, methods of separating components from mixtures as a basis for sieve and morphological analyses	3
Lec12	Determination and evaluation of fertilizing and calorific properties of waste	2
Lec13	Organic chemistry: elements, general properties, characteristics of common compounds pointing out the connection with waste (e.g. chlorinated hydrocarbons as solvents, alkenes as raw materials for the production of polyolefins)	2
Lec14	Organic chemistry: carbohydrates, fats, proteins. Decomposition under aerobic and anaerobic conditions (chemical reactions, biocatalysis, quality of end-products)	2
Lec15	Crediting (part III)	1
	Total hours	**30**

Form of classes - laboratory		**Number of hours**
Lab1	Introduction; overview of the scope of the course. Analyses: alkalinity, hardness, calcium and magnesium	2
Lab2	Analyses: chlorides, ammonium nitrogen, nitrite nitrogen and nitrate nitrogen, sulphates and total dissolved solids	3
Lab3	Analyses: ferric, chemical oxygen demand (COD-Mn), manganese. Electrolyte balance. Assessment of water quality	3
Lab4	Temporal variability of species concentration in air as a function of the delivery and removal processes	2
Lab5	Quantitative analysis of photochemical cycle NO_2, NO, O_3	2
Lab6	Modelling of gas phase -liquid phase equilibrium for SO_2 in the tropo-sphere	2
Lab7	Emission sources identification using a receptor model	2
	Total hours	**15**

TEACHING TOOLS USED
N1 Informative lecture N2 Problematic lecture N3 Calculation of the measurement results N4 Preparing a research report N5 Computer lab

EVALUATION OF SUBJECT EDUCATIONAL EFFECTS ACHIEVEMENT

Evaluation (F – forming during semester), P – concluding (at semester end)	**Educational effect number**	**Way of evaluating educational effect achievement**
P1	PEK_W01 , PEK_W02, PEK_K01	test
P2	PEK_W03 , PEK_W04, PEK_W05, PEK_K02	test
P3	PEK_W06 , PEK_W07, PEK_W08, PEK_K03	test
P4	PEK_U04 , PEK_U05, PEK_U06	computational exercises
F1, F2	PEK_U01 , PEK_U02, PEK_U03	test
F3	PEK_U01 , PEK_U02, PEK_U03	report
P5 (lecture) = 1/3P1 + 1/3P2 +1/3P3 P6 (laboratory) = 0.5(0.4F1+0.4F2+0.2F3) + 0.5P4		

PRIMARY AND SECONDARY LITERATURE

PRIMARY LITERATURE:

[1] E. Gomółka, A. Szaynok, Chemia wody i powietrza, Oficyna Wydawnicza Politechniki Wrocławskiej, 1997.

[2] J. Dojlido, Chemia wód powierzchniowych, Wydawnictwo Ekonomia i Środowisko, 1995.

[3] B. i E. Gomółkowie, Ćwiczenia laboratoryjne z chemii wody, Oficyna Wydawnicza Politechniki Wrocławskiej, 1998

[4] J.H. Seinfeld, S.N. Pandis: Atmospheric chemistry and Physics: Prom Air Pollution to Climate Change, 2nd edition, John Wiley & Sons, USA 2006.

[5] D.J. Jacob, Introduction to Atmospheric Chemistry, Princeton University Press, USA 1999.

[6] K. Schmidt-Szałowski i inni, Podstawy technologii chemicznej, Oficyna Wydawnicza Politechniki Warszawskiej, Warszawa 2004.

[7] Bilitewski B., Hardtle G., Marek K., Podręcznik gospodarki odpadami. Wyd. Seidel-Przywecki Sp. z o.o., Warszawa, 2006.

SECONDARY LITERATURE:

[1] A. Śliwa, Obliczenia chemiczne - zbiór zadań z chemii ogólnej i analitycznej, PWN, 1973

[2] G.W. Vanloon, S.J. Duffy, Chemia środowiska, PWN, 2008

[3] Wandrasz J., Wandrasz A., Paliwa formowane. Wyd. Seidel-Przywecki Sp. z o.o., Warszawa, 2006.

[4] Materiały Konferencyjne „Paliwa z odpadów" 2001-2011

[5] R.M. Harrison: Principles of Environmental Chemistry. Royal Society of Chemistry, UK 2007

SUBJECT SUPERVISOR (NAME AND SURNAME, E-MAIL ADDRESS)

Małgorzata Szlachta, malgorzata.szlachta@pwr.edu.pl (water chemistry)
Monika Maciejewska, monika.maciejewska@pwr.edu.pl (air chemistry)
Marta Sebastian, marta.sebastian@pwr.edu.pl (waste chemistry)

Zał. nr 5 do ZW 8/2020
Załącznik nr … do programu studiów

WYDZIAŁ GEOINŻYNIERII, GÓRNICTWA I GEOLOGII

KARTA PRZEDMIOTU

Nazwa przedmiotu w języku polskim: Zintegrowana analiza deformacji w geomechanice…….(zajęcia są prowadzone w języku angielskim)
Nazwa przedmiotu w języku angielskim: Integrated Analysis of Deformations in Geomechanical Engineering
Kierunek studiów (jeśli dotyczy): górnictwo i geologia
Specjalność (jeśli dotyczy): Geomatics for Mineral Resources Management
Poziom i forma studiów: ~~I~~ / II stopień / ~~jednolite studia magisterskie~~*, stacjonarna / ~~niestacjonarna*~~
Rodzaj przedmiotu: ~~obowiązkowy~~ / wybieralny ~~/ ogólnouczelniany~~ *
Kod przedmiotu W06GIG-SM0041G
Grupa kursów ~~TAK~~ / NIE*

	Wykład	Ćwiczenia	Laboratorium	Projekt	Seminarium
Liczba godzin zajęć zorganizowanych w Uczelni (ZZU)	30		30		
Liczba godzin całkowitego nakładu pracy studenta (CNPS)	90		60		
Forma zaliczenia	Egzamin / ~~zaliczenie na ocenę*~~		~~Egzamin~~ / zaliczenie na ocenę*		
Dla grupy kursów zaznaczyć kurs końcowy (X)					
Liczba punktów ECTS	5				
w tym liczba punktów odpowiadająca zajęciom o charakterze praktycznym (P)	3		2		
w tym liczba punktów ECTS odpowiadająca zajęciom wymagającym bezpośredniego udziału nauczycieli lub innych osób prowadzących zajęcia (BU)	2,5		1,5		

*niepotrzebne skreślić

WYMAGANIA WSTĘPNE W ZAKRESIE WIEDZY, UMIEJĘTNOŚCI I KOMPETENCJI SPOŁECZNYCH

1. Podstawowa wiedza z zakresu goemechaniki
2. Podstawową wiedza dotycząca eksploatacji górniczej
3. Podstawowa wiedza monitorowania zmian górotworu

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CELE PRZEDMIOTU

C1 Przedstawienie roli monitorowania w górnictwie zrównoważonym
C2 Przygotowanie i przeprowadzenie analizy deformacji górotworu spowodowanych działalnością górniczą

C3 Przygotowanie i przeprowadzenie analizy deformacji zapór i usypisk ziemnych C4 Nauczenie zasad modelowania MES C5 Nabycie umiejętności wykorzystania analizy zintegrowanej wykorzystując modelowanie deterministyczne MES i wyniki pomiarów geodezyjnych i geotechnicznych

PRZEDMIOTOWE EFEKTY UCZENIA SIĘ
Z zakresu wiedzy: PEU_W01 Potrafi rozróżnić i opisać zastosowania technik monitorowania deformacji w sPEUtrum dyscyplin inżynieryjnych takich jak górnictwo i inżynieria budowlana PEU_W02 Potrafi scharakteryzować górotwór i metody górnicze PEU_W03 . Posiada wiedzę z zakresu analiz: empirycznych i deterministycznych z zastosowaniem FEM deformacji górotworu, PEU_W04 . Posiada wiedzę podstaw i zastosowań analizy zintegrowanej metody deterministycznej z wynikami pomiarów geodezyjnych PEU_W05 . Potrafi wyznaczyć główne założenia pomiaru geodezyjnego deformacji wywołanych eksploatacja górniczą PEU_W06 Ma znajomość przygotowania modelu MES Z zakresu umiejętności: Z zakresu kompetencji społecznych: PEU_K01 Potrafi ocenić rolę monitorowania i predykcji w górnictwie zrównoważonym w całym jego cyklu

TREŚCI PROGRAMOWE		
Forma zajęć - wykład		**Liczba godzin**
Wy1	Syllabus, warunki zaliczenia, literatura,	2
Wy2	Wstęp do zintegrowanej analizy deformacji	2
Wy3	Rola monitorowania w górnictwie zrównoważonym	2
Wy4	Opis zjawisk fizycznych: statyka- dynamika , rozchodzenie się ciepła, przepływ cieczy, zmiany siły grawitacji, zastosowania	2
Wy5	Metody analizy deformacji: stosując analizę systemów i mechaniki ciała stałego	2
Wy6	Ogólna klasyfikacja metod monitorowania: absolutne i względne pomiary deformacji,	**2**
Wy7	zalety i wady metod geodezyjnych i geotechniczno-strukturalnych, koncepcja pomiarów zintegrowanych	**2**

Wy8	Mechanika ciała stałego, Problem warunków brzegowych	**2**
Wy9	Rozwiązanie systemu kratownicy - relacja do MES MES	**2**
Wy10	Empiryczne metody wyznaczania deformacji powierzchni wywołanych eksploatacją podziemną (gaz i nafta) i eksploatacją odkrywkową, zastosowanie MES, Kategoria terenu	**2**
Wy11	Przykłady zastosowania integracji : stabilności zboczy w kopalniach odkrywkowych, Chiquqimata, Chile, NevadaUSA	**2**
Wy12	Przykłady zastosowania integracji : deformacja górotworu na terenach podziemnej eksploatacji górniczej w kopalni soli w Kanadzie,	**2**
Wy13	Problemy wydobycia gazu naturalnego i nafty	**2**
Wy14	Podsumowanie	**2**
Wy15	Kolokwium	**2**
	Suma godzin	**30**

Forma zajęć - ćwiczenia		Liczba godzin
Ćw1		
Ćw2		
Ćw3		
Ćw4		
..		
	Suma godzin	

Forma zajęć - laboratorium		Liczba godzin
La1	Przedstawienie zakresu ćwiczeń, warunków zaliczenia oraz literatury.	2
La2	Analiza wpływu obciążenia na górotwór –zastosowanie programu GeoStudio 2007	2
La3	Analiza naprężeń in-situ górotworu i górotworu obciążonego	2
La4	Zaprojektowanie pomiaru geodezyjnego na terenie górniczym prowadzenia podziemnej eksploatacji na podstawie wyników MES. Dyskusja projektu pomiarów.	2
La5	Wyznaczenie kategorii terenu górniczego Dyskusja wyników projektu	2
La6	Zaprojektowanie pomiaru geodezyjnego na terenie kopalni odkrywkowej na podstawie modelu MES . Dyskusja projektu pomiarów.	2
La7	Zaprojektowanie pomiaru geodezyjnego ziemnej zapory wodnej na podstawie modelu MES. Dyskusja analizy	2
La8	Podsumowanie	1
	Suma godzin	15

Forma zajęć - projekt		Liczba godzin
Pr1	Wyznaczenie MES deformacji górotworu spowodowanych eksploatacją podziemną, wyznaczenie kategorii terenu. Analiza sprężysta i nieliniowa . Omowienie monitorowania	6
Pr2	Podsumowanie	1
Pr3	Wyznaczenie MES deformacji usypiska/zapory ziemnej w warunkach zmiennego poziomu wody. Wyznaczenie wspolczynnika bezpieczeństwa stosując oprogramowanie Geostudio. Omowienie monitorowania	6
Pr4	Podsumowanie	2
…		
	Suma godzin	**15**

Forma zajęć - seminarium		Liczba godzin
Se1		
Se2		
Se3		
…		
	Suma godzin	

STOSOWANE NARZĘDZIA DYDAKTYCZNE
N1. Wykład, film N2. N3.

OCENA OSIĄGNIĘCIA PRZEDMIOTOWYCH EFEKTÓW UCZENIA SIĘ

Oceny (F – formująca (w trakcie semestru), P – podsumowująca (na koniec semestru)	Numer efektu uczenia się	Sposób oceny osiągnięcia efektu uczenia się
F1	PEK_U01 – PEK_U06	Oceny z Lab 2-7, projekt 1 i 2.
F2		
F3		
P P	PEU_W01 – PEU_W06, PEU_U01 – PEU_U06	Kolokwium , Ocena końcowa z wykładu Ocena końcowa z laboratorium . Średnia ze sprawozdań i projektu

LITERATURA PODSTAWOWA I UZUPEŁNIAJĄCA
<u>LITERATURA PODSTAWOWA:</u> [1] Szostak-Chrzanowski, A., A. Chrzanowski,(2010), „INTEGETED ANALYSIS OF DEFORMATIONS IN GEOMECHANICS “, UNB, Fredericton, N.B., 220p. **<u>LITERATURA UZUPEŁNIAJĄCA:</u>** 1 Szostak-Chrzanowski, A., A. Chrzanowski, M. Massiera (2005) “Use of deformation monit results in solving geomechanical problems – case studies “, *Engineering Geology,* vol. 7 Issues 1-2, pp. 3-12. 2 Chrzanowski,A. (1993):"Modern Surveying Techniques for Mining and Civil Engineering 33 in: *Comprehensive Rock Engineering,* Pergamon Press,Vol.3.Chapter 33, pp.773-809.
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Zał. nr 5 do ZW 8/2020
Załącznik nr … do programu studiów

WYDZIAŁ **Geoinżynierii, Górnictwa i Geologii**

KARTA PRZEDMIOTU

Nazwa przedmiotu w języku polskim Bezpieczeństwo i higiena pracy ….(zajęcia są prowadzone w języku angielskim)
Nazwa przedmiotu w języku angielskim Occupational Health and Safety
Kierunek studiów (jeśli dotyczy): Górnictwo i geologia.
Specjalność (jeśli dotyczy): Mining Engineering
Geotechnical and Environmental Engineering,
Geomatics for Mineral Resource Management
Poziom i forma studiów: II stopień, stacjonarna
Rodzaj przedmiotu: obowiązkowy *
Kod przedmiotu W06GIG-SM0042
Grupa kursów NIE*

	Wykład	Ćwiczenia	Laboratorium	Projekt	Seminarium
Liczba godzin zajęć zorganizowanych w Uczelni (ZZU)	15			15	
Liczba godzin całkowitego nakładu pracy studenta (CNPS)	30			30	
Forma zaliczenia	~~Egzamin /~~ zaliczenie na ocenę*	Egzamin / zaliczenie na ocenę*	Egzamin / zaliczenie na ocenę*	~~Egzamin~~ / zaliczenie na ocenę*	Egzamin / zaliczenie na ocenę*
Dla grupy kursów zaznaczyć kurs końcowy (X)					
Liczba punktów ECTS	**1**			1	
w tym liczba punktów odpowiadająca zajęciom o charakterze praktycznym (P)				1	
w tym liczba punktów ECTS odpowiadająca zajęciom wymagającym bezpośredniego udziału nauczycieli lub innych osób prowadzących zajęcia (BU)	1			1	

*niepotrzebne skreślić

WYMAGANIA WSTĘPNE W ZAKRESIE WIEDZY, UMIEJĘTNOŚCI I KOMPETENCJI SPOŁECZNYCH

1. Possesses basic knowledge of technologies used in open-pit mines and underground mines.
2. Is able to use Microsoft Office environment to prepare documents in Word, multimedia presentations in Power Point and work with Excel spreadsheets.
3. Is able to identify harmful, dangerous and nuisance factors in the workplace environment.

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CELE PRZEDMIOTU

C1. To introduce the principles of occupational risk assessment in accordance with relevant

standards C2 To present the principles of occupational risk assessment and the determination of admissibility with the use of STER software and the RISC SCORE method.

PRZEDMIOTOWE EFEKTY UCZENIA SIĘ
Z zakresu wiedzy: PEU_W01 Possesses general knowledge of rules of occupational risk assessment formulation PEU_W02 – Possesses knowledge of evaluating and determining the admissibility of occupational risk. PEU _W0 3 – Possesses general knowledge of corrective and preventive actions regarding hazards of typical work posts in the mining industry.… Z zakresu umiejętności: PEU_U01 Is able to identify hazards of harmful, dangerous and nuisance factors of typical work posts in the mining industry PEU_U02 Is able to estimate and determine risk acceptability with methods according to STER software and the RISC SCORE method. PEU_U03 - Is able to plan corrective and preventive actions for hazards of typical work posts in the mining industry.… Z zakresu kompetencji społecznych: PEU_K01 - Is able to work in a team and together complete occupational risk assessment and develop its results and the required documentation in the form of a team report

TREŚCI PROGRAMOWE		
Forma zajęć - wykład		**Liczba godzin**
Wy1	Definition of occupational risk. Legal basics of occupational risk assessment. Risk assessment methods. Course of occupational risk assessment. Information necessary for occupational risk assessment. Identification of harmful, dangerous and nuisance factors in the work environment.	3
Wy2	Estimation of occupational risk assessment and determination of admissibility. Corrective and preventive actions. Familiarising employees with the results of occupational risk assessment. Implementation of agreed corrective and preventive actions. Monitoring the effectiveness of implemented actions. Periodic occupational risk assessment. Harmful factors – identification and assessment of risks.	3
Wy3	Dangerous factors - identification and assessment of risks.	3
Wy4	Nuisance factors in occupational risk assessment: psychological burden, static burden, monotype.	3
Wy 5	Methods of occupational risk assessment: STER software, the RISC SCORE method, written test	3
	Suma godzin	**15**

Forma zajęć - ćwiczenia		**Liczba godzin**
Ćw1		
Ćw2		
Ćw3		

Ćw4		
..		
	Suma godzin	

Forma zajęć - laboratorium		Liczba godzin
La1		
La2		
La3		
La4		
La5		
…		
	Suma godzin	

Forma zajęć - projekt		Liczba godzin
Pr1	Occupational risk assessment with the use of STER software for two work posts – description of work post, identification of hazards. Occupational risk assessment with the use of STER software for two work posts – estimation of occupational risk and determination of admissibility of harmful factors (dust, noise)	3
Pr2	Occupational risk assessment with the use of STER software for two work posts – estimation of occupational risk and determination of admissibility of harmful factors (vibration, chemical agents)	3
Pr3	Occupational risk assessment with the use of STER software for two work posts – estimation of occupational risk and determination of admissibility of dangerous factors (slippery or uneven surfaces, falling elements, moving parts, moving machinery and transported bimi items)	3
Pr4	Occupational risk assessment with the use of STER software for two work posts – estimation of occupational risk and determination of admissibility for nuisance factors (psychological burden, static burden, monotype)	3
Pr 5	Occupational risk assessment for a selected work post with the use of the RISC SCORE method, presentation of executed exercises, test	3
	Suma godzin	**15**

Forma zajęć - seminarium		Liczba godzin
Se1		
Se2		
Se3		
…		
	Suma godzin	

STOSOWANE NARZĘDZIA DYDAKTYCZNE
N1. Informative lecture with elements of problematic lectures. N2 Multimedia presentations. N3 Didactic discussions during lectures. N4 Didactic discussions during laboratory classes. N5Computer presentation of executed occupational risk assessments. N6Consultation.

OCENA OSIĄGNIĘCIA PRZEDMIOTOWYCH EFEKTÓW UCZENIA SIĘ

Oceny (F – formująca (w trakcie semestru), P – podsumowująca (na koniec semestru)	Numer efektu uczenia się	Sposób oceny osiągnięcia efektu uczenia się
F1	PEU_W01-W03	grade from a test
F2	PEU_W01-W03 PEU_U01- U03	grade from a presentation
P2	PEU_W01-W03 PEU_U01- U03	final grade from project classes (arithmetic average of F1 and F2)
P		

LITERATURA PODSTAWOWA I UZUPEŁNIAJĄCA

LITERATURA PODSTAWOWA:

[1] Iwona Romanowska Słomka, Adam Słomka Zarządzanie ryzykiem zawodowym. Wydawnictwo TARBONUS, Krakow Tarnobrzeg, 2009

[2] Iwona Romanowska Słomka, Adam Słomka Ocena ryzyka zawodowego. Wydawnictwo TARBONUS, Krakow Tarnobrzeg, 2010

[3] Wiesława Horst Ryzyko zawodowe na stanowisku pracy. Część 1, Ergonomiczne czynniki ryzyka. Wydawnictwo Politechniki Poznańskiej, Poznan, 2004

LITERATURA UZUPEŁNIAJĄCA:

[1] PN-N-18002 Systemy zarządzania bezpieczeństwem i higieną pracy - Ogólne wytyczne do oceny ryzyka zawodowego

[2]

OPIEKUN PRZEDMIOTU (IMIĘ, NAZWISKO, ADRES E-MAIL)

Dr inż. Żaklina Konopacka

Zał. nr 5 do ZW 8/2020
Załącznik nr … do programu studiów

WYDZIAŁ **Geoinżynierii, Górnictwa i Geologii**

KARTA PRZEDMIOTU

Nazwa przedmiotu w języku angielskim: Project Management, Appraisal and Risk Evaluation ….(zajęcia są prowadzone w języku angielskim)

Nazwa przedmiotu w języku polskim :Zarządzanie projektami, ocena ich opłacalności i ryzyka.
Kierunek studiów (jeśli dotyczy): Górnictwo i geologia
Specjalność (jeśli dotyczy): Mining Engineering,
Geotechnical and Environmental Engineering,
Geomatics for Mineral Resource Management
Poziom i forma studiów: II stopień , stacjonarna
Rodzaj przedmiotu: obowiązkowy
Kod przedmiotu W06GIG-SM0039G
Grupa kursów TAK

	Wykład	Ćwiczenia	Laboratorium	Projekt	Seminarium
Liczba godzin zajęć zorganizowanych w Uczelni (ZZU)	15		30	15	
Liczba godzin całkowitego nakładu pracy studenta (CNPS)	30		60	30	
Forma zaliczenia	Egzamin				
Dla grupy kursów zaznaczyć kurs końcowy (X)	X				
Liczba punktów ECTS	4				
w tym liczba punktów odpowiadająca zajęciom o charakterze praktycznym (P)	3				
w tym liczba punktów ECTS odpowiadająca zajęciom wymagającym bezpośredniego udziału nauczycieli lub innych osób prowadzących zajęcia (BU)	3				

*niepotrzebne skreślić

WYMAGANIA WSTĘPNE W ZAKRESIE WIEDZY, UMIEJĘTNOŚCI I KOMPETENCJI SPOŁECZNYCH

1. Knowledge of basic mathematical analysis, probability and statistical models
2. Skills in using Excel spreadsheets
3. Understanding of the need of lifelong learning and the importance of application of Economics, Management and Social Sciences in engineering.

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CELE PRZEDMIOTU

The course combines two groups of topics: basics of mineral economics and financial management and introduction to project management.
Part A: The purpose of the course is

C1 to introduce basic concepts of Microeconomics and financial management
C2 to introduce the concept of time value of money and present the methods used to evaluate investment projects. Different techniques are illustrated by examples and case studies. The range of application as well as the advantages and disadvantages of each method are discussed. The issues of inflation and risk analysis are included.

Part B:
C3 Introduction to project management basic concepts, methods and tools.
C4 Presentation of given project management areas: Project scope management, Project time management, Project cost management, Project risk management. Project planning, scheduling and control using Microsoft Project.
C5 Presentation of the issues of effective communication in project teams, group behaviour and leadership.

PRZEDMIOTOWE EFEKTY UCZENIA SIĘ

Z zakresu wiedzy:

PEU_W01 rozumie pojęcia podaży i popytu, elastyczności popytu i ich wpływ na rynki
PEU_W02 zna pojęcia kosztów w ekonomii i rachunkowości, rozumie różnice
PEU_W03 zna sposoby klasyfikacji kosztów w przedsiębiorstwach, zna i rozumie podstawowe pojęcia rachunku kosztów
PEU_W04 ma podstawową wiedzę o treści i wzajemnych relacjach bilansu, rachunku zysków i strat oraz rachunku przepływów pieniężnych, zna sposób prezentacji danych finansowych przedsiębiorstw w ustawowych sprawozdaniach finansowych i zna ich warianty.
PEU_W05 ma podstawową wiedzę na temat metody analizy wskaźnikowej sprawozdań finansowych
PEU_W06 zna pojęcia wartości przyszłej i wartości obecnej przepływów pieniężnych i rent rocznych
PEU_W07 zna podstawowe i zaawansowane metody oceny efektywności inwestycji (NPV, IRR, MIRR, DPBP, PBP) oraz zakresy ich stosowania
PEU_W08 ma podstawową wiedzę o metodach oceny ryzyka inwestycji

Z zakresu umiejętności:

PEU_U01 potrafi przeprowadzić analizę przyczyn i skutków zmiany popytu i podaży
PEU_U02 na podstawie krzywych kosztowych potrafi przeprowadzić optymalizację wielkości produkcji w różnych przypadkach.
PEU_U03 umie zinterpretować i korzystać z informacji zawartych w ustawowych sprawozdaniach finansowych. Umie przeprowadzić analizę wskaźnikową sprawozdań finansowych w podstawowym zakresie
PEU_U03 umie korzystać z danych kosztowych przedstawionych w różnych układach ewidencyjnych kosztów, umie stosować podstawowe metody rachunkowości zarządczej do podejmowania decyzji krótkoterminowych
PEU_U04 potrafi obliczyć wartość przyszłą i obecną pieniądza dla szeregu płatności oraz rozwiązać zadania rachunkowe z zakresu wartości pieniądza w czasie
PEU_U05 potrafi przeprowadzić ocenę opłacalności inwestycji poznanymi metodami
PEU_U06 potrafi przeprowadzić analizę wrażliwości i analizę scenariuszy z wykorzystaniem modelu finansowego inwestycji
PEU_U07 potrafi przygotować dokumentację projektową w podstawowym zakresie i

zainicjować projekt PEU_U08 potrafi zastosować podstawowe metody zarządzania projektami, monitorowania i zarządzania ryzykiem projektu PEU_U09 potrafi zastosować podstawowe metody zarządzania konfliktami w grupie PEU_U10 potrafi zastosować podstawowe metody zarządzania grupą i kreowania pozycji lidera, potrafi ocenić skuteczność zarządzania grupą <u>Z zakresu kompetencji społecznych:</u> PEU_K01 potrafi myśleć i działać w sposób systemowy, kreatywny i przedsiębiorczy PEU_K02 ma utrwaloną postawę ekonomicznego działania i podejmowania decyzji w oparciu o dostępne informacje finansowe i prognozy

TREŚCI PROGRAMOWE		
Forma zajęć - wykład		**Liczba godzin**
Wy1	Supply and demand, equilibrium price, changes in demand and supply. Stock and commodity markets used by mineral industries	2
Wy2	Costs in economics and in accounting. Cost and money outflow. Relevant cost, incremental cost, marginal cost, alternative cost. Short-term decision making.	2
Wy3	Costs as the subject of cost accounting, different systems of cost accounting Different methods of cost data presentation (by types, divided into direct and indirect costs). Cost allocation	2
Wy4	Variable and fixed costs. Break even point. Cost-volume –profit analysis.	1
Wy5	Basics of financial accounting. Income statement and cash flow statement. Balance sheet. Working capital. Examples of financial statements of mining companies	2
Wy6	Financial ratio analysis. Liquidity, profitability, activity and debt ratios. Financial and operating leverage.	2
Wy7	The concept of time value of money. Computation of future and present value of money by means of spreadsheet functions. Basics of capital budgeting. Evaluation of different methods.	2
Wy8	The concept of risk and return. Quantification of risk. Risk analysis in project evaluation: sensitivity analysis, scenario analysis, other methods.	2
	Suma godzin	15

Forma zajęć - projekt		**Liczba godzin**
Pr 1	Issues of understanding communication: Definitions Models (Schramm model, Berlo's SMCR (source, message, channel, receiver) model, McCroskey model, Reusch and Bateson model, Westley-MacLean model)	3
Pr 2	Conflict Sources of conflicts Kilmann and Thomas classification of conflict Kilmann and Thomas test Different styles of conflict solving Roles of conflict in group development.	3
Pr3	Team roles	3

	Team roles Belbin perspective Discussion group roles Effective managerial behaviour in the context of team roles	
Pr4	Leadership Hersey and Blanchard theory Black and Mouton approach to leadership Fiedler theory and his Least Preferred Coworker Scale Situational leadership self-assessment	3
Pr5	Summary; Effective managerial behaviour from the different contexts.	3
	Suma godzin	15

Forma zajęć - laboratorium		**Liczba godzin**
Part A		
La1	Supply and Demand curves. Elasticity of demand.	2
La2	Economic costs. Cost curves. Profit maximization cases.	2
La3	Managerial cost accounting. Decision making cases.	2
La4	Basic financial accounting. Creation of simple Balance Sheet, Profit and Loss Statement and Cash Flow Statement	2
La5	Ratio analysis based on financial statements of companies	2
La6	Time value of money and capital budgeting – calculation by means of Excel functions	2
La7	Financial model of an investment. Sensitivity and Scenario analysis.	3
Part B		
La8	Basic concepts (process, project, project management, management by projects, critical factors for project success, competences). Preparing and initiation of the project. Project analysis (project environment, stakeholders, project objectives).	3
La9	Planning and estimating of the project. Project phases and life cycle	3
La10	Project organization. Project scope management. Planning of activities, resources and costs.	3
La11	Project risk management. Project monitoring. Project management methodologies.	3
La12	Quality management. Change control. Project closing.	3
	Suma godzin	**30**

STOSOWANE NARZĘDZIA DYDAKTYCZNE
N1. Wykład interaktywny z pokazem slajdów i dyskusją N2. Ćwiczenia laboratoryjne: indywidualne rozwiązywanie zadań z wykorzystaniem arkusza kalkulacyjnego. N3. Ćwiczenialaboratoryjne: rozwiązywanie zadań w grupach. Prezentacja wyników. Dyskusja o otrzymanych wynikach N4. Konsultacje N5. Praca własna – rozwiązywanie zadań domowych N6. Praca własna – samodzielne studia literaturowe

OCENA OSIĄGNIĘCIA PRZEDMIOTOWYCH EFEKTÓW UCZENIA SIĘ

Oceny (F – formująca (w trakcie semestru), P	Numer efektu uczenia się	Sposób oceny osiągnięcia efektu uczenia się

– podsumowująca (na koniec semestru)		
F1	PEU_W01-W08 PEU_K01-K02	Dyskusja na zajęciach, ocena aktywności studentów na zajęciach laboratoryjnych i projektowych
F2	PEU_U01-U10 PEU_K01-K02	Ocena rozwiązań zadań uzyskanych przez studentów w trakcie zajęć laboratoryjnych i projektowych
P1	PEU_W01-W08 PEU_U01-U10 PEU_K01-K02	Egzamin pisemny
P2	PEU_W01-W08 PEU_U01-U10 PEU_K01-K02	Ocena indywidualnych rozwiązań zadań nadesłanych przez studentów po zajęciach

LITERATURA PODSTAWOWA I UZUPEŁNIAJĄCA

LITERATURA PODSTAWOWA:

1. Erhardt M., Brigham E.: Financial Management Theory and Practice. South-Western Cengage Learning, USA
2. Brigham E.: Podstawy zarządzania finansami. Polskie Wydawnictwo Ekonomiczne, Warszawa 1997
3. Czekaj J., Dresler Z.: Podstawy zarządzania finansami firm. PWN Warszawa 1996
4. Jaruga A., Sobańska J., Kopczyńska L. Szychta A.: *Rachunkowość dla menedżerów*. Towarzystwo Gospodarcze RAFIB, Łódź 1996.
5. Jonson H.: Ocena projektów inwestycyjnych. Maksymalizacja wartości przedsiębiorstwa. Wyd. K.E. Liber, Warszawa 2000.
6. Nowak E.: Rachunek kosztów przedsiębiorstwa. Wydawnictwo Ekspert, Wrocław 2001
7. Sierpińska M., Jachna T.: Ocena przedsiębiorstwa według standardów światowych, PWN Warszawa 1994.
8. Świderska G. K.(red): Rachunkowość zarządcza. (praca zbiorowa) Wyd. Poltext, Warszawa 1997
9. Wysocki Robert K., McGary R., Efektywne zarządzanie projektami, OnePress, 2005
10. Lock Dennis, Podstawy zarządzania projektami, PWE, 2009

LITERATURA UZUPEŁNIAJĄCA:

1. Jajuga K., Jajuga T., 2006. Inwestycje. Instrumenty finansowe, aktywa niefinansowe, ryzyko finansowe, inżynieria finansowe, Wydawnictwo Naukowe PWN, Warszawa.
2. Jonson H.: Koszt kapitału. Klucz do wartości firmy. Wyd. K.E. Liber, Warszawa 2000
3. Turyna J., Pułaska-Turyna B.: Rachunek kosztów i wyników. Wyd. Finans-Servis, Warszawa 1997.
4. A Guide to Project Management Body of Knowledge (PMBOK®Guide Fourth Edition), Project Management Institute, 2008 (2004). wydanie polskie, MT&DC Warszawa, 2009 (2006)

OPIEKUN PRZEDMIOTU (IMIĘ, NAZWISKO, ADRES E-MAIL)

Dr inż. Gabriela Paszkowska, Gabriela.paszkowska@pwr.wroc.pl

Zał. nr 5 do ZW 8/2020
Załącznik nr … do programu studiów

WYDZIAŁ **Geoinżynierii, Górnictwa i Geologii**

KARTA PRZEDMIOTU

Nazwa przedmiotu w języku polskim Teoria i praktyka w geomechanice….(zajęcia są prowadzone w języku angielskim)
Nazwa przedmiotu w języku angielskim Theory and Practise in Geomechanics ……………………………………………….
Kierunek studiów (jeśli dotyczy): Górnictwo i geologia.
Specjalność (jeśli dotyczy): Mining Engineering,
Geotechnical and Environmental Engineering,
Poziom i forma studiów: II stopień, stacjonarna
Rodzaj przedmiotu: obowiązkowy *
Kod przedmiotu W06GIG-SM0043G
Grupa kursów NIE*

	Wykład	Ćwiczenia	Laboratorium	Projekt	Seminarium
Liczba godzin zajęć zorganizowanych w Uczelni (ZZU)	60	15			
Liczba godzin całkowitego nakładu pracy studenta (CNPS)	150	30			
Forma zaliczenia	Egzamin / ~~zaliczenie na ocenę*~~	~~Egzamin /~~ zaliczenie na ocenę*	Egzamin / zaliczenie na ocenę*	Egzamin / zaliczenie na ocenę*	Egzamin / zaliczenie na ocenę*
Dla grupy kursów zaznaczyć kurs końcowy (X)					
Liczba punktów ECTS	**4**	**2**			
w tym liczba punktów odpowiadająca zajęciom o charakterze praktycznym (P)		2			
w tym liczba punktów ECTS odpowiadająca zajęciom wymagającym bezpośredniego udziału nauczycieli lub innych osób prowadzących zajęcia (BU)	3,5	1,5			

*niepotrzebne skreślić

WYMAGANIA WSTĘPNE W ZAKRESIE WIEDZY, UMIEJĘTNOŚCI I KOMPETENCJI SPOŁECZNYCH

1. Introduction to Mathematical Analysis, Statics and Strength of Materials.

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CELE PRZEDMIOTU

C1 Presentation of foundations of Theory of Elasticity and its application in Rock and Soil Mechanics (The lecture will be delivered in index notation).
C2 Introduction of fundamental concepts of rock and soil mechanics and their application in surface and underground mining.

PRZEDMIOTOWE EFEKTY UCZENIA SIĘ
Z zakresu wiedzy: PEU_W01 Student ma ugruntowaną wiedzę w zakresie podstaw teorii sprężystości – m.in. stanu naprężeń i odkształceń w masywie skalnym. PEU_W02 Student ma wiedzę dotyczącą kryteriów wytrzymałościowych stosowanych w mechanice skał oraz gruntów. Z zakresu umiejętności: PEU_U01 Student potrafi zastosować metod obliczeniowe teorii sprężystości do określenia stanu naprężenia i odkształcenia w górotworze oraz wykorzystać te obliczenia do oceny jego stateczności. Z zakresu kompetencji społecznych: PEU_K01 Student posiada umiejętność rozwiązywania zadań oraz prezentacji otrzymanych wyników przed innymi studentami.

TREŚCI PROGRAMOWE		
Forma zajęć - wykład		Liczba godzin
Theory of Rock Mechanics		
Wy1	Frame of axes Cartesian coordinates. Einstein summation convention. Kroecker delta. Permutation symbol. Relationship e – δ.	2
Wy2	State of strain. Material and space coordinate. Green, Almansy and Couchy strain tensors. Gradient matrix. Geometric interpretation of infinitesimal strain components.	2
Wy3	Spherical and deviatoric tensors of state of strain. Principal strains and principal axes of strain tensor. Strain tensor invariants. Tensor of principal axes. Capability equations.	2
Wy4	State of stress. Stress vector and stress tensor. Couchy formula. Coordinate transformations for stresses. Formal definition of a tensor. Hydrostatic and stress deviation tensor.	2
Wy5	Normal and shear stresses. Principal stresses and principal axes of stress tensors and stress deviation tensors. Invariants of stress and stress deviation tensors. Octahedral stresses. Intensity of stress tensor. Mohr circle of stress components.	2
Wy6	Linear elasticity. General Hooke law. Hooke law for Isotropic materials. Stress – strain deviatoric relationship. Hydrostatic stress versus dilatation formula. Relationship between different elastic module.	2
Wy7	Elastic strain energy expressed by stress and strain tensor components. Solving theory of elasticity boundary problems using displacement approach. Navier-Stoke’s equation.	3

Wy8	Classical strength criteria. Effective stresses.	2
Wy9	Coulomb- Mohr strength criterion. Safety factor.	2
Wy10	Plane stress and plane strain problems of theory of elasticity. Solving theory of elasticity boundary problems using stress approach. Airy function. Biharmonic polynomials. Airy function In polar coordinate. General form of Airy function.	3
Wy11	Introduction to Finite Element Method.	3
Wy12	Description of Phases code interface.	2
Wy13	Simple example of FEM calculation.	3
	Theory of Soil Mechanics	
Wy14	Soil classification.	2
Wy15	Modeling of soil and rock behavior.	3
Wy16	Effective stresses.	2
Wy17	Water flow.	2
Wy18	Bearing capacity of foundation.	3
Wy19	Atteberg Limits and compaction characteristic of soil.	3
	Practice of Rock Mechanics	
Wy20	Rock mass properties. Rock mass classification	2
Wy21	In-situ stresses. Methods for stress analysis	2
Wy22	Rock mass discontinuities and their strength. Slope stability problems and rock fall hazard.	2
Wy23	Rock bolts and cables in rock engineering. Pillar strength and its importance in room-and-pillar mining	2
Wy24	Floor strata behavior in room-and-pillar mining. Interaction of roof, pillar and floor .	2
Wy25	. Surface subsidence due to underground mining. Structures resistance against earthquake and mining related motion	2
Wy26	Pillar strength and its importance in room-and-pillar mining. Structures resistance against earthquake and mining related motion.	2
Wy27	Application of Geomechanics in underground mining.	1
	Suma godzin	**60**

	Forma zajęć - ćwiczenia	**Liczba godzin**
Ćw1	Examples illustrating Einstein summation convention. Kronecker delta. Permutation tensor. Formula e – δ. Calculation of spherical and deviatoric strain tensor.	2
Ćw2	Calculation of invariants of strain tensors. Finding of principal strains and principal axes. Building deviatoric strain tensor and tensor of directions.	2
Ćw3	Building hydrostatic stress tensors and stress deviation tensors. Using Couchy formula. Transformation frame of axes by rotation.	2
Ćw4	Calculation of invariants of stress tensors. Principal stresses and principal axes. Calculation of octahedral stresses. Mohr circle for stress tensor components	2
Ćw5	Examples of calculations different elastic material coefficients.	2

Ćw6	Description of Phases 2 computer code.	1
Ćw7	Finite Element Method example calculations using Phases 2 computer programme.	2
Ćw8	Comparison of close form solution of Lame problem with corresponding Finite Element Method results of calculation	2
	Suma godzin	**15**

Forma zajęć - laboratorium		**Liczba godzin**
La1		
La2		
La3		
La4		
La5		
…		
	Suma godzin	

Forma zajęć - projekt		**Liczba godzin**
Pr1		
Pr2		
Pr3		
Pr4		
…		
	Suma godzin	

Forma zajęć - seminarium		**Liczba godzin**
Se1		
Se2		
Se3		
…		
	Suma godzin	

STOSOWANE NARZĘDZIA DYDAKTYCZNE
N1. Forma wykładów i ćwiczeń – tradycyjna, treści ilustrowane prezentacjami multimedialnymi z użyciem sprzętu audio-wizualnego N2. Dyskusja w ramach wykładów i ćwiczeń N3. Konsultacje

OCENA OSIĄGNIĘCIA PRZEDMIOTOWYCH EFEKTÓW UCZENIA SIĘ

Oceny (F – formująca (w trakcie semestru), P – podsumowująca (na koniec semestru)	Numer efektu uczenia się	Sposób oceny osiągnięcia efektu uczenia się
P	PEU_W01 PEU_W02 PEU_U01	P Ocena końcowa z grupy kursów w formie sprawdzianu pisemnego

LITERATURA PODSTAWOWA I UZUPEŁNIAJĄCA
LITERATURA PODSTAWOWA: [1] Y. C. Fung, Fundations of Solid Mechanics, Prentice-Hall, Inc. U.S.A 1964 [2] Y. C. Fung, A First Course in Continuum Mechanics, Prentice-Hall, Inc. U.S.A., 1977 [3] T.J. Chung, Applied Continuum Mechanics, Cambridge University Press,, U.S.A 1996 [4] I. Kisiel, Reologia w Budownictwie, PWN, Warszawa 1962, (In Polish) [5] O. C. Zienkiewicz, The Finite Element Method In Engineering Science, McGraw-Hill, London, U. K. 1971 **LITERATURA UZUPEŁNIAJĄCA:** [1] Compilation of review articles and book chapters of various sources. Handouts.
OPIEKUN PRZEDMIOTU (IMIĘ, NAZWISKO, ADRES E-MAIL)
Dr Karolina Adach-Pawelus **Dr inż Jerzy Bauer** **Dr inż. Marek Kawa**

2-nd Semester

Semestr 2

University of Miskolc

Annex 4. ESEEGEC joint courses at the University of Miskolc

Course Title: Methods of environmental assessment	**Credits: 2**
Type of course: compulsory	
Type (lec. / sem. / lab. / consult.) and Number of Contact Hours per Week: **2 sem.**	
The degree of theoretical or practical nature of the course, " course's character "[13]: 65 (kredit%)	
Type of Assessment (exam. / pr. mark. / other): **pr. mark** Students will be assessed with using the following elements. Attendance: 15 % Individual report 40 % MFinal exam 55 % Total 100% Grading scale: % value Grade 90 -100% 5 (excellent) 80 – 89% 4 (good) 70 - 79% 3 (satisfactory) 60 - 69% 2 (pass) 0 - 59% 1 (failed)	
Position in Curriculum (which semester): **3rd**	
Pre-requisites *(if any)*: -	
Course Description:	
Students awareness of the environmental assessment procedures, the methods can be used to make the study. **The short curriculum of the subject:** The history of environmental impact assessment. The legal regulation of the environmental impact assessment. Environmental assessment, environmental impact assessment, uniform environmental permit. The qualification of environmental test activities can be combined with the functionality and connectivity of the procedures. The phases of environmental testing, the method of the official method. The preliminary environmental study. The detailed requirements for environmental compatibility studies. Acting factors stakeholders, impact processes, the spread effects. The effect areas, control areas. The main aspects of recruitment procedures and environmental standards. In the effectiveness test methods and procedures. Impact Assessment. Monitoring. The impact assessment public of the hearing, public hearing. Analysis of practical examples. Preparation of an impact test, study management, presentation, public discussions. Practical work: self-made solutions of simple case-study problems.	
The 3-5 most important compulsory, or recommended **literature** (textbook, book) **resources**:	
Charles H. Eccleston: Environmental Impact Assessment: A Guide to Best Professional Practices. CRC Press, 2011 John Glasson: Methods of Environmental Impact Assessment. Routledge, 2009. M. Schmidt, J. Glasson, L. Emmelin, H. Helbron: Standards and Thresholds for Impact Assessment Springer, 2008. EU directives	

Responsible Instructor (*name, position, scientific degree):* **Balázs Zákányi Dr., assistant professor**
Other Faculty Member(s) Involved in Teaching, if any (*name, position, scientific degree*):

Course Title: Waste incineration, air quality control	**Credits: 4**
Type of course: compulsory	
Type (lec. / sem. / lab. / consult.) and Number of Contact Hours per Week: **2 lec. + 1 sem.**	
The degree of theoretical or practical nature of the course, " course's character "[13]: 60 (kredit%)	
Type of Assessment (exam. / pr. mark. / other): **exam.** Students will be assessed with using the following elements. Attendance: 15 % Individual report 10 % Midterm exam 40 % Final exam 35 % Total 100% **Grading Limits:** > 80%: excellent, 70-79%: good, 60-69%: medium, 50-59%: satisfactory, < 50%: unsatisfactory.	
Position in Curriculum (which semester): **3rd**	
Pre-requisites *(if any)*: -	
Course Description:	
1.) Flow diagram of waste processing; basic regulations for thermal treatment and disposal. 2.) Combustion parameters of wastes: physical state (solid, liquid, gaseous), particle composition, density, moisture and ash content; chemical composition (C, H. N, S, Cl), calorific value. 3.) Calculation of combustion parameters: the chemical reactions of combustion, minimum oxigen and air requirement of fules, optimal air excess necessary for complete combustion. 4.) Gaseous wastes, normal burning velocity of fuels, flame velocity, flammability and explosion limits, operating conditions for safe combustion; methods for flame stabilization. 5.) Flame and flue gas characteristics: specific volume, chemical composition, specific heat capacity; combustion temperature (theoretical and actual), dissociation and adiabatic flame temperature (definition, calculation methods); methods for increasing/reducing combustion temperature. 6.) Technical parameters of waste incineration, auto-ignition range; grid types and grid structures, combustion chamber geometry, the construction of refractory walls (design and structure). 7.) Hazardous waste disposal (by incineration), required minimum incineration temperature, the thermal treatment of halogenated waste, present-day waste incinerators, determination of post-combustion chamber ('afterburners'). 8.) Characterization of solid combustion residues: physical-chemical properties, mineral composition, thermal behaviour, sintering and ash fusion characteristics, melting temperature. Treatment and disposal of slags and fly ash. 9.) Burners: classification, geometry, sizing, fuel injection by spray nozzles (oil burners). 10.) Air pollution control: regulatory measures and provisions for waste incineration; possible allowed	

emission and immission concentrations (EU target values).
11.) Gaseous pollutants: CO, radicals, sulphur oxides, NOx formation (conditions, intensity), primary reduction methods, determination of gas emission concentrations.
12.) Characterization of gaseous pollutants; options for secondary emission reduction; flue gas cleaning methods and equipment.
13.) Definition of dust (for environmental regulations), properties of particulate matter (PM), separation and collection mechanisms, design and operation of dust collection systems (separators).
Practical work: self-made solutions of simple case-study problems.

The 3-5 most important compulsory, or recommended **literature** (textbook, book) **resources**:

- C. Baukal Jr.: Industrial Combustion Pollution and Control, Oklahoma, 2004, ISBN 0-8247-4694-5
- M. Döing: Waste to Energy, Cologne, http://www.ecoprog.com, 2014 Godfrey Boyle: Renewle Energy, Oxford, 2004, ISBN 0-19-926178-4

Responsible Instructor (*name, position, scientific degree):*
Arnold András Kállay Dr., assistant professor, PhD

Other Faculty Member(s) Involved in Teaching, if any (*name, position, scientific degree*):

Course Title: Water and waste water treatment	**Credits: 2**

Type of course: compulsory

Type (lec. / sem. / lab. / consult.) and Number of Contact Hours per Week: **1 lec. + 1 sem.**

The degree of theoretical or <u>practical</u> nature of the course, " course's character "[13]: 50 (kredit%)

Type of Assessment (exam. / pr. mark. / other): **pr. mark**
Students will be assessed with using the following elements.

Attendance:	15 %
Short quizzes	10 %
Midterm exam	40 %
Final exam	35 %
Total	100%

Grading scale:

% value	Grade
90 -100%	5 (excellent)
80 – 89%	4 (good)
70 - 79%	3 (satisfactory)
60 - 69%	2 (pass)
0 - 59%	1 (failed)

Position in Curriculum (which semester): **3rd**

Pre-requisites *(if any)*: Water quality protection

Course Description:

Acquired store of learning:
The students will be familiar with the basic elements and concepts of modern water and waste water purification technology and processes. The students will be able to choose the right purification technology concerning environmental protection aspects.

The short curriculum of the subject:
Contamination and pollution processes in water. Pollution limits in water and in groundwater. The most typical contaminants and their physical and chemical properties. Sampling, and preparations of samples. Cleaning and purification technology for municipal and industrial waste water. Technology design.

The 3-5 most important compulsory, or recommended **literature** (textbook, book) **resources**:

- Klaus Görner- Kurt Hübner: Gewaesserschutz und Abwasserbehandlung; Springer-Verlag Berlin heidelberg, 2002.
- M Henze; P Harremoes; J la C Jansen; E Arvin: Wastewater Treatment; Springer-Verlag Berlin heidelberg, 2002
- M. Sperling: Biological Wastewater Treatment Series (Volume two): Basic Principles of Wastewater Treatment, IWA 2007
- R. Ramalho: Introduction to Wastewater Treatment Processes. Academic Press, 2013

Responsible Instructor (*name, position, scientific degree):*
Sándor Nagy Dr., associate professor, PhD

Other Faculty Member(s) Involved in Teaching, if any (*name, position, scientific degree*): Valéria Üveges Dr. Mádainé, assistant lecturer

Course Title: Environmental Geotechnics	**Credits: 2**

Type of course: compulsory

Type (lec. / sem. / lab. / consult.) and Number of Contact Hours per Week: **1 lec. + 1 sem.**

The degree of <u>theoretical</u> or practical nature of the course, " course's character "[13]: **55** (kredit%)

Type of Assessment (exam. / pr. mark. / other): **exam.**
Students will be assessed with using the following elements.

Attendance:	15 %
Short quizzes	10 %
Midterm exam	40 %
Final exam	35 %
Total	100%

Grading scale:

% value	Grade
90 -100%	5 (excellent)
80 – 89%	4 (good)
70 - 79%	3 (satisfactory)
60 - 69%	2 (pass)
0 - 59%	1 (failed)

Position in Curriculum (which semester): **3rd**

Pre-requisites *(if any)*: -

Course Description:

Acquired store of learning:
The students will be familiar with the basic concepts of environmental geotechnics.

The short curriculum of the subject: Physiochemistry of soils for geoenvironmental engineering. Changing of soil parameters caused by contaminants. Determination of contaminant retention capacity of soils. Barrier systems, geological and geosynthetic barrier systems, horizontal and vertical barriers. Geotechnical aspects of landfilling. Stability and deformation of waste dumps, liner systems. Geotechnical tasks of recultivation. Investigation of contaminated sites. Geotechnical problems of remediation. Waste as constructions material. Soil improvement.
The 3-5 most important compulsory, or recommended **literature** (textbook, book) **resources**:
• Sarsby, R.: Environmental Geotechnics. Thomas Telford, 2000. • Davis, M.L.- Cornwell, D.A.: Introduction to Environmental Engineering. WCB McGraw-Hill, Boston, 1998. • Bell, F.B.: Environmental Geology. Blackwell Science Ltd, Oxford, 1998. • Rowe, K.R.: Geotechnical and Geoenvironmental Engineering Handbook. Kluwer Academic Publishers, 2000.
Responsible Instructor (*name, position, scientific degree):* **Andrea Tóth Kolencsikné Dr., assistant professor, PhD**
Other Faculty Member(s) Involved in Teaching, if any (*name, position, scientific degree*): Zsombor Fekete, PhD student

Course Title: Chemical technologies in environmental protection	**Credits: 2**
Type of course: compulsory	
Type (lec. / sem. / lab. / consult.) and Number of Contact Hours per Week: **1 lec. + 1sem.**	
The degree of theoretical or practical nature of the course, " course's character "[13]: 50 (kredit%)	
Type of Assessment (exam. / pr. mark. / other): **pr. mark** During the semester the following tasks should be completed: laboratory work and report, written test. **Grading Limits:** > 80%: excellent, 70-79%: good, 60-69%: medium, 50-59%: satisfactory, < 50%: unsatisfactory.	
Position in Curriculum (which semester): **3rd**	
Pre-requisites *(if any)*:	
Course Description:	
Acquired store of learning: Study goals: To introduce the chemical techniques on environmental pollution treatment, waste recycling and treatment, as well as on pollution control. Course content: Theory of mass transfer, laws, relationships, diffusion equations. Principles and fundamentals of design of chemical techniques and reactors. Solid-liquid extraction as a technique for the treatment of solid wastes, methods and equipment. Treatment of contaminated fluids: adsorption,	

precipitation (cementation), ion exchange, liquid-liquid separation. Thermal techniques like rectification, thermal oxidation, pyrolisys and gasification. Education method: Lectures, seminars and lab practice.
The 3-5 most important compulsory, or recommended **literature** (textbook, book) **resources**:
• Prof. Dr J. Clifford Jones Thermal Processing of Waste ISBN: 978-87-7681-590-5 • Robert Noyes Unit Operations in Environmental Engineering.
Responsible Instructor (*name, position, scientific degree):* **Ljudmilla Bokányi Dr., associate professor, PhD**
Other Faculty Member(s) Involved in Teaching, if any (*name, position, scientific degree*): Valéria Üveges Dr. Mádainé, assistan lecturer

Course Title: Environmental Risk Assessment and Remediation (Project practice)	**Credits: 3**
Type of course: compulsory/elective	
Type (lec. / sem. / lab. / consult.) and Number of Contact Hours per Week: **2 lec.**	
The degree of theoretical or practical nature of the course, " course's character "[13]: 70 (kredit%)	
Type of Assessment (exam. / pr. mark. / other): **exam.** Students will be assessed with using the following elements. Attendance: 15 % Short quizzes 10 % Midterm exam 40 % Final exam 35 % Total 100% Grading scale: % value — Grade 90 -100% — 5 (excellent) 80 – 89% — 4 (good) 70 - 79% — 3 (satisfactory) 60 - 69% — 2 (pass) 0 - 59% — 1 (failed)	
Position in Curriculum (which semester): **3rd**	
Pre-requisites *(if any)*: -	
Course Description:	
Acquired store of learning: The students will be familiarized with the basic concept and framework of Environmental and Human Health Risk assessment and its relationship to contaminated land remediation. The students shall be competent in reading and understanding risk assessment documentation and evaluating its correctness. They will be able to work together with other field specialists in a risk assessor team. They will get a brief introduction to remediation practices and their design and the European practice of remediation planning and monitoring. The short curriculum of the subject: History of Risk Assessment, principles and background of RA methodology, Overview of risk related	

terminology and definitions, Elements of HHRA methodology, Problem formulation, Exposure assessment, Toxicity assessment, Risk Characterization, Risk assessment and its role in site remediation, Risk interpretation, EU legislation and practice of RA methods, Hungarian legal background, various applications of RA methods, risk based target value and its determination, Case studies. Practical work: self-made solutions of simple case-study problems.
The 3-5 most important compulsory, or recommended **literature** (textbook, book) **resources**:
• CARACAS (1998): Risk Assessment for Contaminated Sites in Europe, Volume 1: Scientific Basis; LQM Press, Nottingham, • Vegter, J.J. (2001): A Risk-Based Land Management Approach; Land Contamination and Reclamation, Vol. 9, No. 1, Richmond, UK • Health Canada (1993): Human Health Risk Assessment of Chemicals from Contaminated Sites, Volume 1 and 2.: Risk Assessment Guidance Manual; Ottawa, ON. • Covello, V. – Mumpower, J. (1985): Risk Analysis and Management: A Historical Perspective, Risk Analysis, Vol. 5, No. 2 • CLARINET and NICOLE (2001): The Sustainable Management and Remediation of Contaminated Land, Special Edition of Land Contamination and Reclamation, Editors: Bardos, P. and Lewis, A., Richmond, UK.
Responsible Instructor (*name, position, scientific degree):* **Tamás Madarász Dr., associate professor, PhD**
Other Faculty Member(s) Involved in Teaching, if any (*name, position, scientific degree*):

Course Title: Soil chemistry	**Credits: 3**
Type of course: compulsory	
Type (lec. / sem. / lab. / consult.) and Number of Contact Hours per Week: **2 lec. + 1 sem.**	
The degree of theoretical or practical nature of the course, " course's character "[13]: 65 (kredit%)	
Type of Assessment (exam. / pr. mark. / other): **exam.** During the semester the following tasks should be completed: take part the lecture min 60%, Fulfil the laboratory practice work. One missing is allowed. Answer the minimum questions properly min. 50 %, must be correct. Writing the the test from the subject of lecture. Mark: (final test mark 2x + lab practice mark 1x)/3 **GradingLimits:** > 80%: excellent, 70-79%: good, 60-69%: medium, 50-59%: satisfactory, < 50%: unsatisfactory.	
Position in Curriculum (which semester): **1st**	
Pre-requisites *(if any)*: AKKEM 6003 equivalent	
Course Description:	

To highlight the colloidal, and chemical structure of the soil, the main equilibriums take place in the soil and which has govern the possible transformation of inorganic and organic substances are present or placed into the soil. The goal is to provide a skill to solve the environmental protection problems related to the soils. Definition and classification of soils. Characterization of the solid, solution and gas phase of the soils. Sorption, dissolution, acid-base equilibriums in the soils. Red-ox reactions. Inorganic and organic substance transformation in the soil environment. Contamination of soils and remediation possibilities. Importance of soil protection. Education method:_Oral lectures with slides, five 2 h laboratory practice focused to investigate the structure and composition of the soils (Study the soil suspensions, humidity, organic content determination of soils, investigation of acid-base character and buffer capacity of soils, preparation and investigation of soil extracts).
The 3-5 most important compulsory, or recommended **literature** (textbook, book) **resources**:
• D. L. Sparks: Environmental Soil Chemistry, Acad. Press, London (2002). Elsevier BV, ISBN: 978-0-12-656446-4 • B. Yaron, R. Calvet, R. Prost: Soil pollution, Springer, (1996). • M.R. Ashaman and G. Puri: Essential Soil science, Blackwell Publ,(2002.) • Kim H. Tan : Principles of Soil Chemitry, CRC Press, (1998) • Hinrich L. Bohn, Rick A. Myer, George A. O'Connor: Soil Chemistry, 2nd Edition, ISBN: 978-0-471-27497-1, E book, Wiley (2002).
Responsible Instructor (*name, position, scientific degree):* **János Lakatos Dr., associate professor, PhD**
Other Faculty Member(s) Involved in Teaching, if any (*name, position, scientific degree*):

Course Title: Numerical Methods and Optimization	**Credits: 2**
Type of course: compulsory	
Type (lec. / sem. / lab. / consult.) and Number of Contact Hours per Week: **1 lec. + 1 sem.**	
The degree of <u>theoretical</u> or practical nature of the course, " course's character "[13]: 50 (kredit%)	
Type of Assessment (exam. / pr. mark. / other): **exam.** During the semester the following tasks should be completed: one test and a computerized homework **Grading Limits:** > 80%: excellent, 70-79%: good, 60-69%: medium, 50-59%: satisfactory, < 50%: unsatisfactory.	
Position in Curriculum (which semester): **1st**	
Pre-requisites *(if any)*: -	
Course Description:	
Acquired store of learning:	

Study goals: Upon completing the course, students shall understand the relation between engineering and mathematics; comprehend important concept of solution methods using both analytical and numerical techniques when the problems can be formulated using differential equations, system of linear equations and system of nonlinear equations. In addition, students shall be able to apply the optimization techniques to various engineering problems. **Course content** Extrema of functions. Unconstrained and constrained optimization. Convex optimization, Minimization of functions with one variable (golden section, parabola method). Minimization of multivariable functions (Nelder-Mead, Newton, modified Newton, quasi-Newton, minimization with line search). Methods of penalty functions. Multiaided and multicriteria decision problems (Pareto effitient solutions). Linear programming. About Soft Computing (SC) methods: fuzzy systems, genetic algorithms, neural network. Numerical solutions of ordinary diffrential equations and system of equations: Runge-Kutta, predictor-corrector, finite differences.
The 3-5 most important compulsory, or recommended **literature** (textbook, book) **resources**:
• Égertné, M. É., Kálovics, F., Mészáros, G.: Numerical analysis I.-II. *(Egyetemi jegyzet)*, Miskolci Egyetemi Kiadó (1992), 1-175. • R. Fletcher: *Practical Methods of Optimization,* John Wiley &Sons, 2000. • P. E. Gill, W. Murray, M. H. Wright: *Practical Optimization***,** Academic Press, 1981. • J. Nocedal, S. J. Wright: *Numerical Optimization*, Springer, 2000.
Responsible Instructor (*name, position, scientific degree):* **Attila Körei Dr., associate professor, PhD**
Other Faculty Member(s) Involved in Teaching, if any (*name, position, scientific degree*):

Course Title: Quality Management	**Credits: 2**
Type of course: compulsory	
Type (lec. / sem. / lab. / consult.) and Number of Contact Hours per Week: **2 lec.**	
The degree of <u>theoretical</u> or practical nature of the course, " course's character "[13]**: 65** (kredit%)	
Type of Assessment (exam. / pr. mark. / other): **pr. mark** 40%: successful midterm test; 20%: presentation about a chosen quality management tool; 40%: oral exam **Grading Limits:** > 80%: excellent, 70-79%: good, 60-69%: medium, 50-59%: satisfactory, < 50%: unsatisfactory.	
Position in Curriculum (which semester): **3rd**	
Pre-requisites *(if any)*: -	
Course Description:	

The objective of the course is to prepare students to perform professional tasks on a higher level by applying the approach of quality management, including managing or participating related projects. The student will learn about principles, concept and terminology of quality management, quality-related corporate activities, requirements of the ISO 9001 standard and the specialities of project quality management. **1.** week: Terminology of quality management (principles, 5 approaches, 9 influencing factors), history of quality management. **2.** week: Quality management standardization. ISO 9000 family. Concept of quality management by ISO 9001. **3.** week: Process approach in quality management. Kaizen. **4.** week: ISO 9001 requirement: Management system. **5.** week: ISO 9001 requirement: Product and production. **6.** week: Auditing quality management system. ISO 19011:2011 standard. **7.** week: Total Quality Management. Lean approach in quality management. **8.** week: Enhancing quality management, integrated management systems. **9.** week: Quality tools: 7 old&new tools, finding the root cause, 8D **10.** week: Quality tools: FMEA, QFD **11.** week: Business excellence. Quality Awards. Tools and methods of self-evaluation. **12.** week: Project quality management: planning. **13.** week: Project quality management: risk analysis. week: Project quality management: monitoring and performance evaluation.
The 3-5 most important compulsory, or recommended **literature** (textbook, book) **resources**:
• Berényi L: Fundamentals of Quality Management. LAP, Saarbrücken, 2013. • Vivek, N.: Quality management system handbook for product development companies, CRC Press, Boca Raton, 2005. • Foster, S.T.: Managing Quality Integrating the Supply Chain, Pearson, London, 2011 • P. J. Lederer, U. S. Karmarka: The Practice of Quality Management, Springer, 1997. • Kanji, G.K., Asher, M.: 100 Methods for Total Quality Management, SAGE , London, 1996 • Griffith G.: Quality Technician's Handbook, Pearson, London, 2003.
Responsible Instructor (*name, position, scientific degree):* **László Berényi Dr., associate professor, PhD**
Other Faculty Member(s) Involved in Teaching, if any (*name, position, scientific degree*):

Course Title: Basics of waste management	**Credits: 3**
Type of course: compulsory	
Type (lec. / sem. / lab. / consult.) and Number of Contact Hours per Week: **2 lec. + 1 sem.**	
The degree of theoretical or <u>practical</u> nature of the course, " course's character "[13]: 60 (kredit%)	
Type of Assessment (exam. / pr. mark. / other): **exam.** Students will be assessed with using the following elements. Attendance: 5 % Homework: 10 % Short quizzes: 10 % Midterm exam: 40 % Final exam: 35 %	

Total: 100% Grading scale: % value Grade 90 -100% 5 (excellent) 80 – 89% 4 (good) 70 - 79% 3 (satisfactory) 60 - 69% 2 (pass) 0 - 59% 1 (failed)
Position in Curriculum (which semester): **1st**
Pre-requisites *(if any)*: -
Course Description:
Acquired store of learning: The aim of the subject for students is to learn knowledge about the waste management. History and development of waste management. Generation and types of industrial and municipal wastes. Introduction, position and aim of the subject in the course. Generation, types, composition, environmental effect of wastes. Definition and basics of sustainable development and sustainable raw material management. Determination of material characteristics (chemical and physical properties) and evaluation of the results. Material flow of production and consumption wastes. Relationship of waste management and environmental protection. Product and production integrated environmental protection. Treatment and preparation of wastes based on various utilization needs. Processes of mechanical waste preparation. General waste preparation technologies. Competences: Students will know the fundamentals of waste management and the generation of wastes. Furthermore, they will be able to characterize – from process engineering and chemical point of view – and utilize the various wastes.
The 3-5 most important compulsory, or recommended **literature** (textbook, book) **resources**:
• Bernd Bilitewski: Waste management. 1997. Springer Science & Business Media • Jacqueline Vaughn: Waste Management: A Reference Handbook. 2009 • Ramesha Chandrappa: Solid Waste Management: Principles and Practice. 2012. Springer • Lecture PowerPoint
Responsible Instructor (*name, position, scientific degree):* **Gábor Mucsi Dr., associate professor, PhD**
Other Faculty Member(s) Involved in Teaching, if any (*name, position, scientific degree*):

Course Title: Environmental Geology	**Credits: 4**
Type of course: compulsory	
Type (lec. / sem. / lab. / consult.) and Number of Contact Hours per Week: **2 lec + 1 sem**	
The degree of theoretical or practical nature of the course, " course's character "[13]: 50 (kredit%)	
Type of Assessment (exam. / pr. mark. / other): **exam.** **Assessment and grading:**	

Students will be assessed with using the following elements.

Attendance:	15 %
Individual report	10 %
Midterm exam	40 %
Final exam	35 %
Total	100%

Grading scale:

% value	Grade
90 -100%	5 (excellent)
80 – 89%	4 (good)
70 - 79%	3 (satisfactory)
60 - 69%	2 (pass)
0 - 59%	1 (failed)

Position in Curriculum (which semester): **1st**

Pre-requisites *(if any)*: -

Course Description:

The main objective of the course is to make the students familiar with the effects of geological medium on the state and changes of the environment, and prepare them for revealing the geological background of environmental problems as well as mitigating or minimizing these problems.

The short curriculum of the subject:
System approach in geology, changes in the four main systems of the Earth. The objects, methods and legal background of environmental geology. Environmental minerals, their characteristics and role in causing and mitigating of environmental problems. Geological hazards (volcanism, earthquakes, mass movements). The role of geological medium in the anthropogenic contamination and pollution (processes of environmental geochemistry, interactions between soil, rocks and contamination, geological conditions effecting on the spreading of contamination). Geological and geochemical concerns of the effects of mining on the environment. Geological background of the radioactive waste disposal. Geology in nature protection. Geological tasks in the environmental assessment.
Practical work: self-made solutions of simple case-study problems.

The 3-5 most important compulsory, or recommended **literature** (textbook, book) **resources**:

- F. G. Bell: Geological Hazards: their assessment, avoidance and mitigation. E & FN Spon, London, 1999
- L. W. Lundgren: Environmental Geology. Prentice-Hall Inernational, London, 1999.
- C. W. Montgomery: Environmental Geology. McGraw-Hill Companies, Boston, New York, San Francisco, 2005

Responsible Instructor (*name, position, scientific degree):*
Viktór Mádai Dr., associate professor, PhD

Semestr 3

Zał. nr 5 do ZW 8/2020
Załącznik nr … do programu studiów

WYDZIAŁ **Geoinżynierii, Górnictwa i Geologii**

KARTA PRZEDMIOTU

Nazwa przedmiotu w języku polskim Projektowanie wyrobisk w górnictwie odkrywkowym ….(zajęcia są prowadzone w języku angielskim)
Nazwa przedmiotu w języku angielskim Excavation Design in Open Pit Mining
Kierunek studiów (jeśli dotyczy): Górnictwo i geologia.
Specjalność (jeśli dotyczy): Mining Engineering,
Geotechnical and Environmental Engineering,
Poziom i forma studiów: II stopień, stacjonarna
Rodzaj przedmiotu: obowiązkowy *
Kod przedmiotu W06GIG-SM0068
Grupa kursów NIE*

	Wykład	Ćwiczenia	Laboratorium	Projekt	Seminarium
Liczba godzin zajęć zorganizowanych w Uczelni (ZZU)	30			15	
Liczba godzin całkowitego nakładu pracy studenta (CNPS)	120			30	
Forma zaliczenia	Egzamin / ~~zaliczenie na ocenę*~~	Egzamin / zaliczenie na ocenę*	Egzamin / zaliczenie na ocenę*	~~Egzamin~~ / zaliczenie na ocenę*	Egzamin / zaliczenie na ocenę*
Dla grupy kursów zaznaczyć kurs końcowy (X)					
Liczba punktów ECTS	**3**			2	
w tym liczba punktów odpowiadająca zajęciom o charakterze praktycznym (P)				2	
w tym liczba punktów ECTS odpowiadająca zajęciom wymagającym bezpośredniego udziału nauczycieli lub innych osób prowadzących zajęcia (BU)	2,5			1,5	

*niepotrzebne skreślić

WYMAGANIA WSTĘPNE W ZAKRESIE WIEDZY, UMIEJĘTNOŚCI I KOMPETENCJI SPOŁECZNYCH

1. Possesses fundamental knowledge of widely concerned mining, as one of the most important fields of technology and human activity, knows problems related to minerals search, sharing and mining.
2. Possesses knowledge of basic concepts of geology and systematized knowledge regarding resources and minerals mining in Poland.
3. Is able to use Microsoft Office to prepare Word documents and work with the spreadsheet Excel. Is able to use AutoCad, Microstation or similar.

CELE PRZEDMIOTU

C1 Introduction and explanation of problems related to technology of mechanized mining machines

of different types and size used in open pit mining. C2 Becoming familiar with the relationships between parameters characterizing the geometry of the workplace and the process of digging, controlling machine work process in order to achieve the proper efficiency level and forecasting the efficacy in different geological -mining conditions. C3 Preparing students to particular tasks completion in the area of work technology and the choice of technological system for the project of excavation and carrying out technological analysis of bucket-wheel excavator work.

PRZEDMIOTOWE EFEKTY UCZENIA SIĘ
Z zakresu wiedzy: K2_GIG_W07 ma wiedzę w zakresie procesów i technologii stosowanych w przemyśle wydobywczym i przetwórczym surowców mineralnych Z zakresu umiejętności: K2_GIG_U01 - dysponuje odpowiednimi dla języka specjalistycznego środkami językowymi i potrafi używać języka specjalistycznego we wszystkich działaniach językowych, aby porozumiewać się w środowisku zawodowym w zakresie studiowanego kierunku studiów K2_GIG_U07 – potrafi zaprojektować systemy technologiczne stosowane w przemyśle wydobywczym lub przetwórczym surowców mineralnych Z zakresu kompetencji społecznych: K2_GIG_K01 potrafi myśleć i działać w sposób kreatywny i przedsiębiorczy

TREŚCI PROGRAMOWE		
Forma zajęć - wykład		**Liczba godzin**
Wy1	The aim of the course, conditions of crediting, literature, contact with the teacher. Basic concepts, definitions related to open pit exploitation of deposits, basic technological systems	3
Wy2	Basic technologies of open pit exploitation (continuous, cycle, mixed), the ways off dredging and exploitation	2
Wy3	Bulldozers work technologies, the range of applications, divisions. Efficiency work forecasting of bulldozers, the resistance movement, cooperation with the base.	2
Wy4	Single and bucket-wheel excavator work technologies, the range of applications, divisions according to different criteria.	3
Wy5	Efficiency work forecasting of a bucket-wheel excavator using chosen methods, the resistance movement, cooperation with the base.	2
Wy6	Scraper work technologies, basic parameters, the range of applications, division, efficacy	2
Wy7	Ripper work technologies basic parameters, the range of applications, division, efficacy	2
Wy8	Loader spoon work technologies the range of applications, division, efficacy	2
Wy9	Multi-bucket-wheel excavator work technologies, basic parameters,	2

	the range of applications, division, and work principles	
Wy10	Multi-bucket-wheel excavator work technologies, types of shortwalls.	2
Wy11	Efficiency work forecasting of multi-bucket-wheel excavators, digging resistance, cooperation with the base	2
Wy12	Multi-bucket-chain excavators work technologies.	2
Wy13	Efficiency work forecasting of a multi-bucket-chain excavators, digging resistance, cooperation with a base.	2
Wy14	Heaping in open pit mining, types of heaps, KTZ. Heaping with the method of direct tossing.	2
	Suma godzin	**30**

Forma zajęć - projekt		Liczba godzin
Pr1	Organization classes. The scope of the Project, conditions of crediting, literature. Distribution of topics among students. Discussing the guidelines for the project titled: The excavation project, bulldozer and excavator work technology. Discussing the first stage of the project task, determining mining area and also the issue of the multilevel excavation embankment design on the slope	2
Pr2	Discussing the guidelines to the choice of a bulldozer as a machine which enables an access to the deposit. Discussing issues related to an overlay indirect heaping in the excavation neighbourhood and the bulldozer work efficiency forecast	2
Pr3	Discussing the choice of excavator as a basic machine used for mineral dredging, designing the division of an excavation into floors, forecasting and its cooperation with car transport.	2
Pr4	Students hand over projects- assessment and defence. Discussing the scope of project 2. Distribution of individual topics among students. Discussing the guidelines for the project: “Technological analysis of bucket-wheel excavator…”	2
Pr5	The core of shortwall system, discussing basic parameters of a shortwall, defining the dredging radius and the angle of inclination of dredging jib in the function of dredging height and limit angles of the inclination of the side embankment of a shortwall in the function of its height. Determining maximum distance of an axis of an excavator route from internal side embankment.	2
Pr6	Discussing the outer bottom width of a shortwall. Determining the width of a shortwall.	2
Pr7	Determining two maximum values of a take: considering the slope of the forehead embankment because of the ability to drive to the forehead of shortwall and because of the possibility of the contact of a dredging jib structure with the upper edge of the second level in a shortwall. Determining the angle of inclination of the jib structure axis in the function of the height of a bucket wheel axis and also the angle describing the dimension of a lower piece of a dredging jib structure. Forecasting the SRs efficacy considering particular groups of factors, determining the individual digging resistance and digging force in given geological-mining conditions. The final calculations concerning	2

	side and forehead shortwalls, discussing the graphic form of a project.	
Pr8	Student hand over Project – assessment	1
	Suma godzin	**15**

STOSOWANE NARZĘDZIA DYDAKTYCZNE
N1. Wykład z prezentacją multimedialną N2.Dyskusja. Rozwiązywanie przykładowych zadań N3. Konsultacje i indywidualna ocena projektów

Oceny (F – formująca (w trakcie semestru), P – podsumowująca (na koniec semestru)	Numer efektu uczenia się	Sposób oceny osiągnięcia efektu uczenia się
F1, P1	K2_GIG_U07 K2_GIG_U01 K2_GIG_K01	F1.1 Ocena z wykonania i wartości merytorycznej projektu F.1.2 Ocena z obrony ustnej lub/i pisemnej projektu P1 Ocena końcowa z projektu nr 1 (średnia ważona z F1.1- 50% oraz F1.2 – 50%)
P2	K2_GIG_W07 K2_GIG_U07 K2_GIG_K01	P2 O cena końcowa z egzaminu w formie ustnej lub sprawdzianu pisemnego

LITERATURA PODSTAWOWA I UZUPEŁNIAJĄCA

LITERATURA PODSTAWOWA:

[1] Kasztelewicz, Z. (2012). Koparki wielonaczyniowe i zwałowarki taśmowe. Technologia pracy, AGH Publishing House.
[2] Hustrulid, W. A., Kuchta, M., & Martin, R. K. (2013). Open pit mine planning and design, two volume set & CD-ROM pack. CRC Press.
[3] Gogolewska, A. Surface and underground Mining Technology. Wrocław 2011
[4] Kasztelewicz, Z., Patyk, M., & Bodziony, P. (2015). Spycharki, dźwigi boczne i przesuwarki przenośników taśmowych. Budowa i technologia pracy, AW-P ART-TEKST, Kraków.
[5] Hawrylak H., Jarząbek M., Sieczyński A., Sobolski R. MASZYNY I PRACE POMOCNICZE W GÓRNICTWIE ODKRYWKOWYM
[6] Glapa W., Korzeniowski J.I., MAŁY LEKSYKON GÓRNICTWA ODKRYWKOWEGO, Wydawnictwa i Szkolenia Górnicze Burnat & Korzeniowski, Wrocław 2005
[7] Korzeniowski J.I.: GÓRNICTWO ODKRYWKOWE : RUCH ZAKŁADÓW EKSPLOATUJĄCYCH ZŁOŻA KOPALIN, 2010
[8] Bęben A.: MASZYNY I URZĄDZENIA DO WYDOBYWANIA KOPALIN POSPOLITYCH BEZ UŻYCIA MATERIAŁÓW WYBUCHOWYCH. Kraków : AGH Uczelniane Wydawnictwa Naukowo-Dydaktyczne, 2008

LITERATURA UZUPEŁNIAJĄCA:

[1] Czasopisma: Mining Science, Journal of mining science, Węgiel brunatny, Górnictwo Odkrywkowe

OPIEKUN PRZEDMIOTU (IMIĘ, NAZWISKO, ADRES E-MAIL)

Dr hab. inż. JUSTYNA WOŹNIAK , prof. uczelni
Dr inż. Anna Nowak-Szpak

Zał. nr 5 do ZW 8/2020
Załącznik nr … do programu studiów

FACULTY OF GEOENGINEERING, MINING AND GEOLOGY

SUBJECT CARD

Name in Polish: Cyfrowa kopalnia
Name in English: Digital Mine……………………….
Main field of study: mining and geology
Specialization: Mining Engineering,
Geotechnical and Environmental Engineering,
Level and form of studies: 2nd level, full-time
Kind of subject: elective
Subject code: W06GIG-SM0069
Group of courses: No

	Lecture	Classes	Laboratory	Project	Seminar
Number of hours of organized classes in University (ZZU)	15		15		
Number of hours of total student workload (CNPS)	30		30		
Form of crediting	crediting with grade		crediting with grade		
For group of courses mark (X) final course					
Number of ECTS points	**1**		1		
including number of ECTS points for practical (P) classes			1		
Including number of ECTS points for direct teacher-student contact (BK) classes	1		1		

PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES

1. Computer literacy skills
2. Basic knowledge related to Mining Engineering and Mineral Processing
3. Programming

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SUBJECT OBJECTIVES

C1. Acquisition of the ability to create utility applications in the C / C ++ and LabVIEW environment
C2. Providing students with knowledge about embedded systems, their construction, selection of components, designing, programming and their exploitation.
C3. Familiarizing with the advances of technology & methods of future mining operations.
C4. Acquisition and consolidation of social competencies including emotional intelligence skills involving the cooperation in the group of students aiming to effectively solve problems. Responsibility, honesty and fairness in the proceedings; observance force in academia and society

SUBJECT EDUCATIONAL EFFECTS

relating to knowledge:

PEU_W01 A student has knowledge related to automation systems, control systems and measurement systems in various aspects of the mining industry.

PEU_W02 The student has knowledge of the importance of automation and robotics systems in modern mining.

relating to skills:

PEU_U01 A student is able to select and integrate elements of a specialized measuring and control system including: control unit, executive system, measuring system as well as peripheral and communication modules

PEU_U02 A student can design improvements in the existing design solutions for automation and robotics components and systems

relating to social competences:

PEU_K01 A student is aware of the need for a professional approach to technical issues, meticulous reading of documentation and knows environmental conditions in which devices and their components can function

PEU_K02 The student has knowledge concerning the benefits of creation and implementation new solutions&technologies into mining industry

PROGRAMME CONTENT		
	Form of classes - lecture	**Number of hours**
Lec 1	Terminology (process, automation, robots, measurement devices, control systems). Definition of digital mine	2
Lec 2	Aims, benefits, drawbacks of automation. Industrial revolutions. Definition of industry 4.0. Overview of components of the 4th industrial revolution. Industry 4.0 and mining	2
Lec 3	Elements of technological process in mining. Automation of cyclic processes Measuring technologies in industry 4.0. Sensors systems. Data transmission and data storage technologies. Analytics in industry 4.0. Industrial BigData, Cloud Computing	2
Lec 4	Industrial Internet of Things. M2M communication, anti-collision systems, location of people underground	2
Lec 5	Virtual and augmented realities for industry. Simulators. Digital Twin. Digital models of processes and objects. Management information creation systems, reporting	2
Lec 6	Case study: Automation in open pit lignite mining (KTZ, Autonomous haulage (use case from Australia))	1
Lec 7	Case study: underground mine (Rock Vader – Sandvik project, other use cases from Sandvik, Epiroc, MineMaster, Zanam, AOT from ZGPS KGHM, KIC project on shaft inspection, …etc)	2
Lec 8	Case study: mineral processing (ConVis, FlowVis) in KGHM, OPMO project	2
	Total hours	**15**

Form of classes - laboratory		Number of hours
Lab1	Scope of the course, teaching purpose, crediting conditions, literature, data. Introduction to ARDUINO	3
Lab2	Basic sensors for physical parameters measurements	3
Lab3	Measurements in Labview	3
Lab4	Analysis and Visualization in Labview	3
Lab5	Control in labview	3
	Total hours	**15**

TEACHING TOOLS USED
N1. Type of lectures - traditional, illustrated with multimedia presentations with the usage of audio- visual equipment. N2. Discussion concerning lectures and laboratory. N3 Configuration on laboratory classes measuring systems (hardware and software), performing of measurements, teamwork N4. Projects defence - oral and written form. N5. Duty hours.

EVALUATION OF SUBJECT EDUCATIONAL EFFECTS ACHIEVEMENT

Evaluation (F – forming (during semester), P – concluding (at the end of semester)	Educational effect number	Way of evaluating educational effect achievement
F1, P1	PEK_U02-PEK_U04	F1.1 Grade from laboratory work's performance and its merits F.1.2 Grade from laboratory work's oral or written defence P1.Final grade (weighted average of F1.1 - 60% and F1.2 - 40%).
F2, P2	PEK_U02-PEK_U04	F2.1 Grade from activity during the lecture (questions, discussions etc) F.2.2 Grade from written exam P2.Final grade (weighted average of F2.1 - 20% and F2.2 - 80%).

LITERATURE
PRIMARY LITERATURE: [1] LabVIEWTM Getting Started with LabVIEW http://www.ni.com/pdf/manuals/373427j.pdf [2] Monk Simon: Arduino dla początkujących. Podstawy i szkice, Anderson R., Cervo D., Helion, 2018 [3] Monk Simon: Arduino dla początkujących. Kolejny krok, Anderson R., Cervo D., Helion, 2015 **ONLINE LITERATURE:** [1] LabVIEW Tutorial [2] ARDUINO Tutorial [3] Materials prepared by Tutor [4] Internet websites
SUBJECT SUPERVISOR (NAME AND SURNAME, E-MAIL ADDRESS)
Prof. dr hab. inż. Radosław Zimroz, radoslaw.zimroz@pwr.edu.pl **dr inż. Anna.Nowak-Szpak**

Zał. nr 5 do ZW 8/2020
Załącznik nr … do programu studiów

FACULTY OF GEOIENGINEERING, MINING AND GEAOLOGY

SUBJECT CARD

Name in Polish: Systemy przeróbcze
kurs prowadzony jest w języku angielskim
Name in English: Mineral Processing Systems
Main field of study (if applicable): Mining and Geology
Specialization (if applicable): Mining Engineering,
Level and form of studies: 2nd, full-time
Kind of subject: elective
Subject code: W06GIG-SM0069
Group of courses: NO

	Lecture	Classes	Laboratory	Project	Seminar
Number of hours of organized classes in University (ZZU)	**15**			**30**	
Number of hours of total student workload (CNPS)	**30**			**60**	
Form of crediting	**crediting with grade**			**Crediting with grade**	
For group of courses mark (X) final course					
Number of ECTS points	**1**			**2**	
including number of ECTS points for practical (P) classes of practical character (P)				**2**	
including number of ECTS points for direct teacher-student contact (BU) classes	**1**			**1**	

*delete as applicable

PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES
1. Fundamentals of mineral processing and waste.
2. Basic knowledge of mathematical statics, line programming, programming in VBA.

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SUBJECT OBJECTIVES

C1 Presenting production issues in the mineral industry as an optimization problem of managing the operation of complex technological systems.
C2 Familiarising students with modern methods of off-line analysis of complex systems, mineral processing and waste.
C3 Creating skills to construct simple models and algorithms for mining operations and tailings and their implementation using a spreadsheet supported by VBA program.
C4 Creating skills to prepare and present reports of performed analyses and projects.

SUBJECT LEARNING OUTCOMES
Subject learning outcome relating to knowledge: PEU_W01 The student has general knowledge of technologies used in refining, and processing mineral resources PEU_W02 The student gets to know the principle of mathematical modelling of tailings operationsand problems of experimentation to determine model parameters of an operation. PEU_W03 The student gets to know the criteria and algorithms of optimization (off-line) of complex systems of technological operations PEU_W04 The student gets to know the examples of commercial and training functions of software for the analysis of tailings systems (JKSimMet, ModSim, WTP) PEU_W05 The student gets to know how to perform simulation calculations of systems of qualitative and quantitative operations using calculating tools available in the spreadsheet (functions,VBA) PEU_W06 The student gets to know how to perform simulation calculations of processes of qualitative and quantitative operations using calculating tools available in the spreadsheet (functions, VBA) **Subject learning outcome relating to skills:** PEU_U01 - The student can perform basic calculations of simple models tailings operations: crushing and classification and evaluating their performance PEU_U02 - The student can perform an individual/ group task to optimize a simple feedback system of mining operations and / or tailings PEU_U03 - The student can develop and present the results of his project work (paper report, multimedia presentation of sample analysis of mineral system in processing and waste **Subject learning outcome relating to social competence:** PEU_K01 - The student has created attitude of critical overview of the available knowledge on the course.

PROGRAMME CONTENT		
	Form of classes - lecture	**Number of hours**
Le1	Scope of lecture, crediting conditions, literature overview. Profile characteristics of the course and the aims and methods of education. Linking the course problems with the course profile and educational programs of other courses of particular specialty and the field of study	2
Le2	The basic structures of mining, coal preparation and processing systems on the example of the construction materials industry, mining ore and coal, metallurgy, waste management	2
Le3	Types and systematics of operations, information operations model, the concept of system and process operations, performance, efficiency, reliability, productive hours.	2
Le4	Methods and tools for the analysis of complex systems operations. Spreadsheet as a calculation tool (functions, VBA)	2
Le5	Modelling crushing operations, crushing machine models, methods and problems of experimentation	2
Le6	Modelling of classification procedure (separation), classifier / separator models, methods and problems of experimentation	2
Le7	Methods of simulation of the quantitative operations processes (mass flow in systems, tanks, and machines). Knowledge control - test	3
	Total hours	**15**

Form of classes - project		Number of hours
Pr1	Introduction to the project: assumptions, aims, form, schedule	3
Pr2	Checking the initial knowledge of the students in auditorial mode.	3
Pr 3	Solving simple calculation using a spreadsheet (functions, calculus matrix).	3
Pr 4	Duty hours and exercises checking the knowledge of mathematical statistics (grain size) and the ability to operate on sets.	3
Pr 5	Handing out tasks and explanation for individual work (system analysis operations: different structures, different technologies, and different models). Variable catalogue of exercises, adjusted to current students level of knowledge and skills of).	3
Pr 6	Algorithmization and programming of tasks examples concerning the grain analysis in VBA - exercises on auxiliary examples.	3
Pr 7	Individual work: the construction of models of a given operation, individual duty hours.	3
Pr 8	Individual work: analysis (optimization) of given operation systems according to qualitative, quantitative and economics criteria, monitoring the performance, individual duty hours	3
Pr 9	Presentation/project defence of ready-made projects by students. Project settlement (course crediting). Partial crediting.	3
Pr 10	(to be continued) Presentation/project defence of ready-made projects by students, including repeats. Project settlement (course crediting). Partial crediting.	3
	Total hours	**30**

TEACHING TOOLS USED
N1. Informative lecture with the elements of problem solving lecture, multimedia presentations, N2 didactic discussion considering the lecture and the project, N3 projects preparation in a report form, written exam (knowledge test), N4 checking the progress of project, presentation and project defence, duty hours.

EVALUATION OF SUBJECT LEARNING OUTCOMES ACHIEVEMENT

Evaluation (F – forming (during semester), P – concluding (at the end of semester)	Educational effect number	Way of evaluating educational effect achievement
F1 - Assessment of problem solving skills		
F2 - Form and performance.		
P1 - Partial grade from examination which covers the content of the lecture: test of control tasks specific to the subject of the course (differentiated tasks, sorted by difficulty in %, set = 100%) the best score plus bonuses for attending the lectures determine the reference level		
P2 - Partial grade of crediting the project (weighted average of projects - 70% meritum and 30% a form)		
P3.Final grade of the group of courses: mean of constituent grades from the lecture and the project.		

PRIMARY AND SECONDARY LITERATURE
PRIMARY LITERATURE [1] Drzymała J., Podstawy przeróbki kopalin, Politechnika Wrocławska Publishing House, [2] Wrocław 2006. [3] King R.P., Modeling & simulation of mineral processing systems, Batterworth and Heinemann, [4] Oxford, 2001. [5] Lynch A.J.,Mineral crushing and grinding circuits, Elsevier Sci Publ.Company, Amsterdam, Oxford, NY, 1977. [6] 7. Wills B.A., Mineral Processing Technology. **SECONDARY LITERATURE** [1] Malewski J, Modrzejewski S., Modelowanie i optymalizacja systemów i procesów wydobycia i przeróbki kruszyw łamanych, Górnictwo Odkrywkowe Publishing, Wrocław, 2008 [2] Malewski J., Zarządzanie produkcją – kluczową technologią rozwoju przemysłu wydobywczego rud miedzi i surowców towarzyszących, Cuprum, nr 1/2008. [3] Monografia KGHM, (pod red. Piestrzyńskiego), Lubin 2007. [4]
SUBJECT SUPERVISOR (NAME AND SURNAME, E-MAIL ADDRESS)
Dr inż. Tomasz Ratajczak **Dr. inż. Danuta Szyszka**

COURSE DESCRIPTIONS/
KARTY PRZEDMIOTÓW

second-level studies/ studia II stopnia
main field of study/ kierunek studiów:
Mining and Geology/ Górnictwo I Geologia

specialisation/specjalność:
GEOMATICS FOR MINERAL RESOURCE MANAGEMENT

ścieżka studiów/study track: FREIBERG

1-st Semester

Semestr 1

Zał. nr 5 do ZW 8/2020
Załącznik nr … do programu studiów

WYDZIAŁ **Geoinżynierii, Górnictwa i Geologii**

KARTA PRZEDMIOTU

Nazwa przedmiotu w języku polskim Wspomagane komputerowo modelowanie geologiczne i geostatystyka. ….(zajęcia są prowadzone w języku angielskim)
Nazwa przedmiotu w języku angielskim Computer Aided Geological Modelling and Geostatistics……………………………………………….
Kierunek studiów (jeśli dotyczy): Górnictwo i geologia.
Specjalność (jeśli dotyczy): Mining Engineering,
Geotechnical and Environmental Engineering,
Geomatics for Mineral Resource Management
Poziom i forma studiów: II stopień, stacjonarna
Rodzaj przedmiotu: obowiązkowy *
Kod przedmiotu W06GIG-SM0038
Grupa kursów NIE*

	Wykład	Ćwiczenia	Laboratorium	Projekt	Seminarium
Liczba godzin zajęć zorganizowanych w Uczelni (ZZU)	15		45		
Liczba godzin całkowitego nakładu pracy studenta (CNPS)	30		120		
Forma zaliczenia	~~Egzamin /~~ zaliczenie na ocenę*	Egzamin / zaliczenie na ocenę*	~~Egzamin /~~ zaliczenie na ocenę*	Egzamin / zaliczenie na ocenę*	Egzamin / zaliczenie na ocenę*
Dla grupy kursów zaznaczyć kurs końcowy (X)					
Liczba punktów ECTS	**1**		4		
w tym liczba punktów odpowiadająca zajęciom o charakterze praktycznym (P)			4		
w tym liczba punktów ECTS odpowiadająca zajęciom wymagającym bezpośredniego udziału nauczycieli lub innych osób prowadzących zajęcia (BU)	1		2		

*niepotrzebne skreślić

WYMAGANIA WSTĘPNE W ZAKRESIE WIEDZY, UMIEJĘTNOŚCI I KOMPETENCJI SPOŁECZNYCH

1. Mathematical Statistics,
2. Fundamentals of Geology and Mineral Deposits

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CELE PRZEDMIOTU

C1 Developing basic skills in computer modelling of 3-D objects.
C2 Introduction of the principles of digital modelling of typical geological structures.
C3 Introduction to the methods of deposit parameters estimation and resources evaluation.

PRZEDMIOTOWE EFEKTY UCZENIA SIĘ
Z zakresu wiedzy: PEU_W01 Estimation methods, principles of geostatistics, kriging estimators PEU_W02 Geostatistical modelling of the selected deposit parameters (domain analysis, variogram modelling, PEU_W03 Creating and validating 3-D models of various geological structures in the comprehensive dedicated software environment. Z zakresu umiejętności: PEU_U01 Application of relevant estimation methods for quality modelling of a deposit PEU_U02 Evaluating 3-D objects against structural and quality block models (volumes, tonnages, grades) PEU_U03 Describing the interpretation and applied approach, creating models, evaluation results, recommendations for possible enhancements Z zakresu kompetencji społecznych: PEK_K01 The student can think and act in a creative and enterprising way

TREŚCI PROGRAMOWE		
Forma zajęć - wykład		**Liczba godzin**
Wy1	Introduction to the course. Geological database and validation of the geological data.	2
Wy2	Geology of the seam.	2
Wy3	Structural model of the stratified deposit. Methods of the prediction of the surface layer parameters.	2
Wy4	Spatial distribution of samples values. Regionalized variable.	2
Wy5	BLUE Estimator of the mean value: Kriging.	2
Wy6	Quality model of the deposit – block model of the parameter layers. Estimation and evaluation of the block model.	2
Wy7	Reserves modelling and evaluation.	2
Wy8	Mineral resources. International reporting. The JORC Code	1
	Suma godzin	**15**

Forma zajęć - ćwiczenia		**Liczba godzin**
Ćw1		
Ćw2		
Ćw3		
Ćw4		
..		
	Suma godzin	0

Forma zajęć - laboratorium	**Liczba godzin**

La1	Determining the rules of work at the laboratory.	3
La2	Assignment of the individual dataset for the exercises and creating initial data files.	3
La3	Data validation and creating initial geological database.	3
La4	Construction of the structural wireframe model of stratigraphy layers.	3
La5	Construction of the block model of the deposit and overburden layers. Thickness and stripping ratio analysis.	3
La6	Data preparation to geostatistical analysis. Compositing of the samples.	3
La7	Domain analysis with the use of the statistical methods.	3
La8	Determination of the empirical variogram. Anisotropy analysis.	3
La9	Variogram modelling.	3
La10	Kriging Neighborhood Analysis - defining optimal parameters of the estimation procedure.	3
La11	Estimation of quality parameters in block model of the deposit layers. Validation of the estimation quality.	3
La12	Validation of the quality model and classification of the resources. Balance resources evaluation.	3
La13	Preparation of data for continuous surface mining ultimate pit design. Ultimate pit outlines generation	3
La14	Wireframe and block modelling of the ultimate pit	3
La15	Reserves evaluation, visualization and interrogation of created models	3
	Suma godzin	45

Forma zajęć - projekt		Liczba godzin
Pr1		
Pr2		
Pr3		
Pr4		
…		
	Suma godzin	0

Forma zajęć - seminarium		Liczba godzin
Se1		
Se2		
Se3		
…		
	Suma godzin	0

STOSOWANE NARZĘDZIA DYDAKTYCZNE
N1. Form of lectures - traditional, multimedia presentations using specialized software and demonstrations of its application "live", individual development of specialist topics covered during the lecture, N2. individual development of project tasks within the laboratories frames, individual development of electronic reports concerning project tasks within the laboratories frames, N3. evaluation of laboratory tasks reports with multipoint grade of student’s work, group analysis of the results obtained during laboratory tasks; preparation of conclusions concerning data dependencies and constraints of mining projects, skill control tests, duty hours in laboratory.

OCENA OSIĄGNIĘCIA PRZEDMIOTOWYCH EFEKTÓW UCZENIA SIĘ

Oceny (F – formująca (w trakcie semestru), P – podsumowująca (na koniec semestru)	Numer efektu uczenia się	Sposób oceny osiągnięcia efektu uczenia się
F1	PEU_W01, PEU_W02	Lecture grade on the basis of the written examination
F2	PEU_W03,	Laboratory task assessment: “structural modelling assessment
F3	PEU_U01	Laboratory task assessment: “geostatistical modelling”
F4	PEU_U02, PEU_U03	Laboratory task assessment: “reserves evaluation”.
P average of F1, F2, F3, F4		

LITERATURA PODSTAWOWA I UZUPEŁNIAJĄCA

LITERATURA PODSTAWOWA:

[1] M. Armstrong, Basic Linear Geostatistics, Springer Verlag, 1998.
[2] P. Goovaerts: “Geostatistics for Natural Resource Evaluation“, Oxford University Press, 1997.
[3] R. H. Grishong, Jr., 3-D Structural Geology, Springer Verlag, 2008
[4] K. Hefferan, J. O’Brien, Earth materials, Willey-Blacwell, Chichester U.K., 2010
[5] W. Hustrulid, M. Kuchta, Open pit mine planning and design. Chapter 3. Orebody description, Taylor&Francis, 2013.
[6] A. G. Journel, and C.J. Huijbregts, Mining Geostatistics, Academic Press, 1978.
[7] Ch.C. Plummer, D.H. Carlson, L. Hammersley, Physical geology, McGraw-Hill I.E. N.Y. 2010
[8] D.R. Prothero, R.H. Dott Jr., Evolution of the Earth, McGraw-Hill I.E. N.Y., 2010
[9] M.W. Rossi, C.V. Deutsch, Mineral Resources Estimation, Springer Verlag 2014.

LITERATURA UZUPEŁNIAJĄCA:

[10] Handouts, tutorials.

OPIEKUN PRZEDMIOTU (IMIĘ, NAZWISKO, ADRES E-MAIL)

Dr inż. Krzysztof Hołodnik
Dr inż. Witold Kawalec, Dr Paweł Zagożdżon

Zał. nr 5 do ZW 8/2020
Załącznik nr … do programu studiów

WYDZIAŁ GEOINŻYNIERII, GÓRNICTWA i GEOLOGII

KARTA PRZEDMIOTU

Nazwa przedmiotu w języku polskim Geofizyka inżynierska
….(zajęcia są prowadzone w języku angielskim)
Nazwa przedmiotu w języku angielskim Engineering Geophysics
Kierunek studiów (jeśli dotyczy): górnictwo i geologia
Specjalność (jeśli dotyczy): Mining Engineering,
Geotechnical and Environmental Engineering,
Geomatics for Mineral Resource Management
Poziom i forma studiów: ~~I~~ **/ II stopień /** ~~jednolite studia magisterskie~~***, stacjonarna /** ~~niestacjonarna~~*****
Rodzaj przedmiotu: ~~obowiązkowy~~ / wybieralny / ~~ogólnouczelniany~~ *****
Kod przedmiotu W06GIG-SM0040
Grupa kursów ~~TAK~~ **/ NIE***

	Wykład	Ćwiczenia	Laboratorium	Projekt	Seminarium
Liczba godzin zajęć zorganizowanych w Uczelni (ZZU)	15			15	
Liczba godzin całkowitego nakładu pracy studenta (CNPS)	40			50	
Forma zaliczenia	~~Egzamin~~ / zaliczenie na ocenę*			~~Egzamin~~ / zaliczenie na ocenę*	
Dla grupy kursów zaznaczyć kurs końcowy (X)					
Liczba punktów ECTS	1			2	
w tym liczba punktów odpowiadająca zajęciom o charakterze praktycznym (P)				2	
w tym liczba punktów ECTS odpowiadająca zajęciom wymagającym bezpośredniego udziału nauczycieli lub innych osób prowadzących zajęcia (BU)				2	

*niepotrzebne skreślić

WYMAGANIA WSTĘPNE W ZAKRESIE WIEDZY, UMIEJĘTNOŚCI I KOMPETENCJI SPOŁECZNYCH

1. has knowledge of fundamentals of applied geophysics, physics and geology.
2. knows fundamentals of soil and rock mechanics.
3. is able to use MS Office software.
4. is able to work in a team.

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CELE PRZEDMIOTU

C1 familiarize with physical phenomena in geosphere of the Earth
C2 familiarize with engineering problems solved by means of geophysical surveying
C3 familiarize with various geophysical surveys.

C4 acquisition of skills to plan geophysical field surveying and to interpret its results. C5 development of skills to work in a group.

PRZEDMIOTOWE EFEKTY UCZENIA SIĘ
Z zakresu wiedzy: PEU_W01 recognizes, names and explains engineering problems in different fields. PEU_W02 identifies, describes and chooses geophysical surveying methods. PEU_W03 analyses and assesses case studies from solving the engineering problems. Z zakresu umiejętności: PEU_U01 is able to coordinate team work, create field research plans and manage the work progress. PEU_U02 is able to independently create solutions for complex practical problems in engineering and geoengineering applying knowledge about geophysical surveying, mining geophysics, utilizing modern methods in geophysical data acquisition and interpretation. PEU_U03 is able to critically assess, process and interpreted results of the geophysical surveying and provide recommendations related to engineering problems in mining, civil engineering, engineering geology, municipal waste site, archeology, engineering properties of soil and rocks, hydrogeology, monitoring seepage in river dykes or dams. PEU_U04 is able to solve geophysical problems. PEU_U05 is able to conduct auto-didactical education related to detailed handling of typical software. Z zakresu kompetencji społecznych: PEU_K02 understands the need to create and transfer to the society – among others by mass media- information and opinions related to mining engineering achievements and other activities of mining engineer; tries to transfer the information in commonly understood way, presenting different points of view; is aware of the quality and need to shape the work safety culture in mining and the responsibility for the health and life of other employees.

TREŚCI PROGRAMOWE		
Forma zajęć - wykład		**Liczba godzin**
Wy1	Physical properties of rocks. Inter-relationships between the various subdisciplines of applied geophysics. Overview of geophysical methods, their physical principles and applications. Methodology of geophysical surveying.	1
Wy2	Engineering problems solved with geophysical surveying. Case studies.	2
Wy3	Electrical resistivity methods. Tomography and VSE. IP method. Physical principles. Equipment. Methods of field surveying. Interpretation and application. Case studies.	2
Wy4	Electromagnetic methods. FDEM and TDEM methods. Magnetotelluric methods. Physical principles. Methods of field surveying. Equipment. Interpretation and application. Case studies.	2
Wy5	GPR surveying. Physical principles. Methods of field surveying.	2

	Equipment. Interpretation and application. Case studies.	
Wy6	Seismic tomography. Seismic interferometry. Physical principles. Applications. Case studies.	2
Wy7	Mine geophysics. Seismology. Seismic methods. Active and passive seismic tomography. Microgravimetry. Case studies.	2
Wy8	Gravity and magnetic surveying. Equipment. Methods of field surveying. Interpretation and application. Case studies.	2
	Suma godzin	**15**

Forma zajęć - projekt		**Liczba godzin**
Pr1	One selected geophysical technique. Fundamentals and equipment. Field surveying	4
Pr2	Processing and interpretation of field data.	3
Pr3	Solving the geophysical problems.	8
	Suma godzin	**15**

STOSOWANE NARZĘDZIA DYDAKTYCZNE
N1.Lecture aided by presentation. N2.Demonstration. N3.Discussion and consultations N3Calculations N5Practical field surveying

OCENA OSIĄGNIĘCIA PRZEDMIOTOWYCH EFEKTÓW UCZENIA SIĘ

Oceny (F – formująca (w trakcie semestru), P – podsumowująca (na koniec semestru)	Numer efektu uczenia się	Sposób oceny osiągnięcia efektu uczenia się
P1	W01-W03	Test related to lecture content. Final grade.
F1	U01-U02, U05	Test. Project 1. Report on Project 1
F2	U03, U05	Test. Project 2. Report on Project 2
F3	U04, U05	Test. Solving geophysical problems
F1-F3, P2	U01-U05 K02	Grades are given for each of three project tasks including tests and reports. The final grade P2 for the project course is the weighted average grade of F1-F3.

LITERATURA PODSTAWOWA I UZUPEŁNIAJĄCA

LITERATURA PODSTAWOWA:

[1] Aki, K., Richards P.G., 1980. Quantitative Seismology: Theory and Methods. W.H. Freeman Co.. San Francisco.
[2] Burger, H.R., Sheehan, A.F., Jones, C.H., 2006. Introduction to Applied Geophysics: Exploring the Shallow Subsurface. W.W. Norton & Company, Inc.
[3] Mendecki, A.J. (ed.), 1997. Seismic Monitoring in Mines. Chapman & Hall.
[4] Reynolds, J.M., 2011. An Introduction to Applied and Environmental Geophysics. Wiley – Blackwell. John Wiley & Sons.

[5] Sharma, Prem V., 2002. Environmental and engineering geophysics. Cambridge University Press.
[6] Torge, W., 1989. Gravimetry. Water de Gruyter. Berlin. New York.
[7] Selected Journal Publications (for example journals: Progress in Geophysics, Engineering Geophysics Journal, Environmental and Engineering Geophysics, Journal of Geophysics and Engineering, Pure and Applied Geophysics).

LITERATURA UZUPEŁNIAJĄCA:

[1] Lowrie, W., 2007. Fundamentals of Geophysics. Cambridge University Press.
[2] Milsom, J., 2003. Field Geophysics. John Wiley & Sons Ltd.
[3] Telford, W.M., Geldart, L.P., Sheriff, R.E., 1990. Applied Geophysics. Cambridge University Press.

OPIEKUN PRZEDMIOTU (IMIĘ, NAZWISKO, ADRES E-MAIL)

ANNA BARBARA GOGOLEWSKA, anna.gogolewska@pwr.edu.pl

Zał. nr 5 do ZW 8/2020
Załącznik nr … do programu studiów

WYDZIAŁ GEOINŻYNIERII, GÓRNICTWA I GEOLOGII

KARTA PRZEDMIOTU

Nazwa przedmiotu w języku polskim: Zintegrowana analiza deformacji w geomechanice…….(zajęcia są prowadzone w języku angielskim)
Nazwa przedmiotu w języku angielskim: Integrated Analysis of Deformations in Geomechanical Engineering
Kierunek studiów (jeśli dotyczy): górnictwo i geologia
Specjalność (jeśli dotyczy): Geomatics for Mineral Resources Management
Poziom i forma studiów: ~~I~~ / II stopień / ~~jednolite studia magisterskie~~*, stacjonarna / ~~niestacjonarna*~~
Rodzaj przedmiotu: ~~obowiązkowy~~ / wybieralny / ~~ogólnouczelniany~~ *
Kod przedmiotu W06GIG-SM0041G
Grupa kursów ~~TAK~~ / NIE*

	Wykład	Ćwiczenia	Laboratorium	Projekt	Seminarium
Liczba godzin zajęć zorganizowanych w Uczelni (ZZU)	30		30		
Liczba godzin całkowitego nakładu pracy studenta (CNPS)	90		60		
Forma zaliczenia	Egzamin / ~~zaliczenie na ocenę*~~		~~Egzamin~~ / zaliczenie na ocenę*		
Dla grupy kursów zaznaczyć kurs końcowy (X)					
Liczba punktów ECTS	5				
w tym liczba punktów odpowiadająca zajęciom o charakterze praktycznym (P)	3		2		
w tym liczba punktów ECTS odpowiadająca zajęciom wymagającym bezpośredniego udziału nauczycieli lub innych osób prowadzących zajęcia (BU)	2,5		1,5		

*niepotrzebne skreślić

WYMAGANIA WSTĘPNE W ZAKRESIE WIEDZY, UMIEJĘTNOŚCI I KOMPETENCJI SPOŁECZNYCH

1. Podstawowa wiedza z zakresu goemechaniki
2. Podstawową wiedza dotycząca eksploatacji górniczej
3. Podstawowa wiedza monitorowania zmian górotworu

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CELE PRZEDMIOTU

C1 Przedstawienie roli monitorowania w górnictwie zrównoważonym
C2 Przygotowanie i przeprowadzenie analizy deformacji górotworu spowodowanych działalnością górniczą

C3 Przygotowanie i przeprowadzenie analizy deformacji zapór i usypisk ziemnych C4 Nauczenie zasad modelowania MES C5 Nabycie umiejętności wykorzystania analizy zintegrowanej wykorzystując modelowanie deterministyczne MES i wyniki pomiarów geodezyjnych i geotechnicznych

PRZEDMIOTOWE EFEKTY UCZENIA SIĘ
Z zakresu wiedzy: PEU_W01 Potrafi rozróżnić i opisać zastosowania technik monitorowania deformacji w sPEUtrum dyscyplin inżynieryjnych takich jak górnictwo i inżynieria budowlana PEU_W02 Potrafi scharakteryzować górotwór i metody górnicze PEU_W03 . Posiada wiedzę z zakresu analiz: empirycznych i deterministycznych z zastosowaniem FEM deformacji górotworu, PEU_W04 . Posiada wiedzę podstaw i zastosowań analizy zintegrowanej metody deterministycznej z wynikami pomiarów geodezyjnych PEU_W05 . Potrafi wyznaczyć główne założenia pomiaru geodezyjnego deformacji wywołanych eksploatacja górniczą PEU_W06 Ma znajomość przygotowania modelu MES Z zakresu umiejętności: Z zakresu kompetencji społecznych: PEU_K01 Potrafi ocenić rolę monitorowania i predykcji w górnictwie zrównoważonym w całym jego cyklu

TREŚCI PROGRAMOWE		
Forma zajęć - wykład		**Liczba godzin**
Wy1	Syllabus, warunki zaliczenia, literatura,	2
Wy2	Wstęp do zintegrowanej analizy deformacji	2
Wy3	Rola monitorowania w górnictwie zrównoważonym	2
Wy4	Opis zjawisk fizycznych: statyka- dynamika , rozchodzenie się ciepła, przepływ cieczy, zmiany siły grawitacji, zastosowania	2
Wy5	Metody analizy deformacji: stosując analizę systemów i mechaniki ciała stałego	2
Wy6	Ogólna klasyfikacja metod monitorowania: absolutne i względne pomiary deformacji,	**2**
Wy7	zalety i wady metod geodezyjnych i geotechniczno-strukturalnych, koncepcja pomiarów zintegrowanych	**2**

Wy8	Mechanika ciała stałego, Problem warunków brzegowych	**2**
Wy9	Rozwiązanie systemu kratownicy - relacja do MES MES	**2**
Wy10	Empiryczne metody wyznaczania deformacji powierzchni wywołanych eksploatacją podziemną (gaz i nafta) i eksploatacją odkrywkową, zastosowanie MES, Kategoria terenu	**2**
Wy11	Przykłady zastosowania integracji : stabilności zboczy w kopalniach odkrywkowych, Chiquqimata, Chile, NevadaUSA	**2**
Wy12	Przykłady zastosowania integracji : deformacja górotworu na terenach podziemnej eksploatacji górniczej w kopalni soli w Kanadzie,	**2**
Wy13	Problemy wydobycia gazu naturalnego i nafty	**2**
Wy14	Podsumowanie	**2**
Wy15	Kolokwium	**2**
	Suma godzin	**30**

Forma zajęć - ćwiczenia		**Liczba godzin**
Ćw1		
Ćw2		
Ćw3		
Ćw4		
..		
	Suma godzin	

Forma zajęć - laboratorium		**Liczba godzin**
La1	Przedstawienie zakresu ćwiczeń, warunków zaliczenia oraz literatury.	2
La2	Analiza wpływu obciążenia na górotwór –zastosowanie programu GeoStudio 2007	2
La3	Analiza naprężeń in-situ górotworu i górotworu obciążonego	2
La4	Zaprojektowanie pomiaru geodezyjnego na terenie górniczym prowadzenia podziemnej eksploatacji na podstawie wyników MES. Dyskusja projektu pomiarów.	2
La5	Wyznaczenie kategorii terenu górniczego Dyskusja wyników projektu	2
La6	Zaprojektowanie pomiaru geodezyjnego na terenie kopalni odkrywkowej na podstawie modelu MES . Dyskusja projektu pomiarów.	2
La7	Zaprojektowanie pomiaru geodezyjnego ziemnej zapory wodnej na podstawie modelu MES. Dyskusja analizy	2
La8	Podsumowanie	1
	Suma godzin	15

Forma zajęć - projekt		Liczba godzin
Pr1	Wyznaczenie MES deformacji górotworu spowodowanych eksploatacją podziemną, wyznaczenie kategorii terenu. Analiza sprężysta i nieliniowa . Omowienie monitorowania	6
Pr2	Podsumowanie	1
Pr3	Wyznaczenie MES deformacji usypiska/zapory ziemnej w warunkach zmiennego poziomu wody. Wyznaczenie wspolczynnika bezpieczeństwa stosując oprogramowanie Geostudio. Omowienie monitorowania	6
Pr4	Podsumowanie	2
…		
	Suma godzin	**15**

Forma zajęć - seminarium		Liczba godzin
Se1		
Se2		
Se3		
…		
	Suma godzin	

STOSOWANE NARZĘDZIA DYDAKTYCZNE
N1. Wykład, film N2. N3.

OCENA OSIĄGNIĘCIA PRZEDMIOTOWYCH EFEKTÓW UCZENIA SIĘ

Oceny (F – formująca (w trakcie semestru), P – podsumowująca (na koniec semestru)	Numer efektu uczenia się	Sposób oceny osiągnięcia efektu uczenia się
F1	PEK_U01 – PEK_U06	Oceny z Lab 2-7, projekt 1 i 2.
F2		
F3		
P P PEU_W01 – PEU_W06, Kolokwium , Ocena końcowa z wykładu PEU_U01 – PEU_U06 Ocena końcowa z laboratorium . Średnia ze sprawozdań i projektu		

LITERATURA PODSTAWOWA I UZUPEŁNIAJĄCA
LITERATURA PODSTAWOWA: [1] Szostak-Chrzanowski, A., A. Chrzanowski,(2010), „INTEGETED ANALYSIS OF DEFORMATIONS IN GEOMECHANICS “, UNB, Fredericton, N.B., 220p. **LITERATURA UZUPEŁNIAJĄCA:** 1 Szostak-Chrzanowski, A., A. Chrzanowski, M. Massiera (2005) “Use of deformation monit results in solving geomechanical problems – case studies “, *Engineering Geology,* vol. 7 Issues 1-2, pp. 3-12. 2 Chrzanowski,A. (1993):"Modern Surveying Techniques for Mining and Civil Engineering 33 in: *Comprehensive Rock Engineering,* Pergamon Press,Vol.3.Chapter 33, pp.773-809.
OPIEKUN PRZEDMIOTU (IMIĘ, NAZWISKO, ADRES E-MAIL)
Anna Chrzanowska anna.chrzanowska@pwr.edu.pl

Zał. nr 5 do ZW 8/2020
Załącznik nr … do programu studiów

WYDZIAŁ **Geoinżynierii, Górnictwa i Geologii**

KARTA PRZEDMIOTU

Nazwa przedmiotu w języku polskim Bezpieczeństwo i higiena pracy ….(zajęcia są prowadzone w języku angielskim)
Nazwa przedmiotu w języku angielskim Occupational Health and Safety
Kierunek studiów (jeśli dotyczy): Górnictwo i geologia.
Specjalność (jeśli dotyczy): Mining Engineering
Geotechnical and Environmental Engineering,
Geomatics for Mineral Resource Management
Poziom i forma studiów: II stopień, stacjonarna
Rodzaj przedmiotu: obowiązkowy *
Kod przedmiotu W06GIG-SM0042
Grupa kursów NIE*

	Wykład	Ćwiczenia	Laboratorium	Projekt	Seminarium
Liczba godzin zajęć zorganizowanych w Uczelni (ZZU)	15			15	
Liczba godzin całkowitego nakładu pracy studenta (CNPS)	30			30	
Forma zaliczenia	~~Egzamin /~~ zaliczenie na ocenę*	Egzamin / zaliczenie na ocenę*	Egzamin / zaliczenie na ocenę*	~~Egzamin~~ / zaliczenie na ocenę*	Egzamin / zaliczenie na ocenę*
Dla grupy kursów zaznaczyć kurs końcowy (X)					
Liczba punktów ECTS	**1**			1	
w tym liczba punktów odpowiadająca zajęciom o charakterze praktycznym (P)				1	
w tym liczba punktów ECTS odpowiadająca zajęciom wymagającym bezpośredniego udziału nauczycieli lub innych osób prowadzących zajęcia (BU)	1			1	

*niepotrzebne skreślić

WYMAGANIA WSTĘPNE W ZAKRESIE WIEDZY, UMIEJĘTNOŚCI I KOMPETENCJI SPOŁECZNYCH

1. Possesses basic knowledge of technologies used in open-pit mines and underground mines.
2. Is able to use Microsoft Office environment to prepare documents in Word, multimedia presentations in Power Point and work with Excel spreadsheets.
3. Is able to identify harmful, dangerous and nuisance factors in the workplace environment.

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CELE PRZEDMIOTU

C1. To introduce the principles of occupational risk assessment in accordance with relevant

standards C2 To present the principles of occupational risk assessment and the determination of admissibility with the use of STER software and the RISC SCORE method.

PRZEDMIOTOWE EFEKTY UCZENIA SIĘ

Z zakresu wiedzy:

PEU_W01 Possesses general knowledge of rules of occupational risk assessment formulation

PEU_W02 – Possesses knowledge of evaluating and determining the admissibility of occupational risk.

PEU _W0 3 – Possesses general knowledge of corrective and preventive actions regarding hazards of typical work posts in the mining industry.…

Z zakresu umiejętności:

PEU_U01 Is able to identify hazards of harmful, dangerous and nuisance factors of typical work posts in the mining industry

PEU_U02 Is able to estimate and determine risk acceptability with methods according to STER software and the RISC SCORE method.

PEU_U03 - Is able to plan corrective and preventive actions for hazards of typical work posts in the mining industry.…

Z zakresu kompetencji społecznych:

PEU_K01 - Is able to work in a team and together complete occupational risk assessment and develop its results and the required documentation in the form of a team report

TREŚCI PROGRAMOWE		
Forma zajęć - wykład		Liczba godzin
Wy1	Definition of occupational risk. Legal basics of occupational risk assessment. Risk assessment methods. Course of occupational risk assessment. Information necessary for occupational risk assessment. Identification of harmful, dangerous and nuisance factors in the work environment.	3
Wy2	Estimation of occupational risk assessment and determination of admissibility. Corrective and preventive actions. Familiarising employees with the results of occupational risk assessment. Implementation of agreed corrective and preventive actions. Monitoring the effectiveness of implemented actions. Periodic occupational risk assessment. Harmful factors – identification and assessment of risks.	3
Wy3	Dangerous factors - identification and assessment of risks.	3
Wy4	Nuisance factors in occupational risk assessment: psychological burden, static burden, monotype.	3
Wy 5	Methods of occupational risk assessment: STER software, the RISC SCORE method, written test	3
	Suma godzin	**15**

Forma zajęć - ćwiczenia		Liczba godzin
Ćw1		
Ćw2		
Ćw3		

Ćw4		
..		
	Suma godzin	

Forma zajęć - laboratorium		Liczba godzin
La1		
La2		
La3		
La4		
La5		
…		
	Suma godzin	

Forma zajęć - projekt		Liczba godzin
Pr1	Occupational risk assessment with the use of STER software for two work posts – description of work post, identification of hazards. Occupational risk assessment with the use of STER software for two work posts – estimation of occupational risk and determination of admissibility of harmful factors (dust, noise)	3
Pr2	Occupational risk assessment with the use of STER software for two work posts – estimation of occupational risk and determination of admissibility of harmful factors (vibration, chemical agents)	3
Pr3	Occupational risk assessment with the use of STER software for two work posts – estimation of occupational risk and determination of admissibility of dangerous factors (slippery or uneven surfaces, falling elements, moving parts, moving machinery and transported bimi items)	3
Pr4	Occupational risk assessment with the use of STER software for two work posts – estimation of occupational risk and determination of admissibility for nuisance factors (psychological burden, static burden, monotype)	3
Pr 5	Occupational risk assessment for a selected work post with the use of the RISC SCORE method, presentation of executed exercises, test	3
	Suma godzin	**15**

Forma zajęć - seminarium		Liczba godzin
Se1		
Se2		
Se3		
…		
	Suma godzin	

STOSOWANE NARZĘDZIA DYDAKTYCZNE
N1. Informative lecture with elements of problematic lectures. N2 Multimedia presentations. N3 Didactic discussions during lectures. N4 Didactic discussions during laboratory classes. N5Computer presentation of executed occupational risk assessments. N6Consultation.

OCENA OSIĄGNIĘCIA PRZEDMIOTOWYCH EFEKTÓW UCZENIA SIĘ

Oceny (F – formująca (w trakcie semestru), P – podsumowująca (na koniec semestru)	Numer efektu uczenia się	Sposób oceny osiągnięcia efektu uczenia się
F1	PEU_W01-W03	grade from a test
F2	PEU_W01-W03 PEU_U01- U03	grade from a presentation
P2	PEU_W01-W03 PEU_U01- U03	final grade from project classes (arithmetic average of F1 and F2)
P		

LITERATURA PODSTAWOWA I UZUPEŁNIAJĄCA

LITERATURA PODSTAWOWA:

[1] Iwona Romanowska Słomka, Adam Słomka Zarządzanie ryzykiem zawodowym. Wydawnictwo TARBONUS, Krakow Tarnobrzeg, 2009

[2] Iwona Romanowska Słomka, Adam Słomka Ocena ryzyka zawodowego. Wydawnictwo TARBONUS, Krakow Tarnobrzeg, 2010

[3] Wiesława Horst Ryzyko zawodowe na stanowisku pracy. Część 1, Ergonomiczne czynniki ryzyka. Wydawnictwo Politechniki Poznańskiej, Poznan, 2004

LITERATURA UZUPEŁNIAJĄCA:

[1] PN-N-18002 Systemy zarządzania bezpieczeństwem i higieną pracy - Ogólne wytyczne do oceny ryzyka zawodowego

[2]

OPIEKUN PRZEDMIOTU (IMIĘ, NAZWISKO, ADRES E-MAIL)

Dr inż. Żaklina Konopacka

Zał. nr 5 do ZW 8/2020
Załącznik nr … do programu studiów

WYDZIAŁ **Geoinżynierii, Górnictwa i Geologii**

KARTA PRZEDMIOTU

Nazwa przedmiotu w języku angielskim: Project Management, Appraisal and Risk Evaluation ….(zajęcia są prowadzone w języku angielskim)

Nazwa przedmiotu w języku polskim :Zarządzanie projektami, ocena ich opłacalności i ryzyka.
Kierunek studiów (jeśli dotyczy): Górnictwo i geologia
Specjalność (jeśli dotyczy): Mining Engineering,
Geotechnical and Environmental Engineering,
Geomatics for Mineral Resource Management
Poziom i forma studiów: II stopień , stacjonarna
Rodzaj przedmiotu: obowiązkowy
Kod przedmiotu W06GIG-SM0039G
Grupa kursów TAK

	Wykład	Ćwiczenia	Laboratorium	Projekt	Seminarium
Liczba godzin zajęć zorganizowanych w Uczelni (ZZU)	15		30	15	
Liczba godzin całkowitego nakładu pracy studenta (CNPS)	30		60	30	
Forma zaliczenia	Egzamin				
Dla grupy kursów zaznaczyć kurs końcowy (X)	X				
Liczba punktów ECTS	4				
w tym liczba punktów odpowiadająca zajęciom o charakterze praktycznym (P)	3				
w tym liczba punktów ECTS odpowiadająca zajęciom wymagającym bezpośredniego udziału nauczycieli lub innych osób prowadzących zajęcia (BU)	3				

*niepotrzebne skreślić

WYMAGANIA WSTĘPNE W ZAKRESIE WIEDZY, UMIEJĘTNOŚCI I KOMPETENCJI SPOŁECZNYCH

1. Knowledge of basic mathematical analysis, probability and statistical models
2. Skills in using Excel spreadsheets
3. Understanding of the need of lifelong learning and the importance of application of Economics, Management and Social Sciences in engineering.

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CELE PRZEDMIOTU

The course combines two groups of topics: basics of mineral economics and financial management and introduction to project management.
Part A: The purpose of the course is

C1 to introduce basic concepts of Microeconomics and financial management
C2 to introduce the concept of time value of money and present the methods used to evaluate investment projects. Different techniques are illustrated by examples and case studies. The range of application as well as the advantages and disadvantages of each method are discussed. The issues of inflation and risk analysis are included.

Part B:
C3 Introduction to project management basic concepts, methods and tools.
C4 Presentation of given project management areas: Project scope management, Project time management, Project cost management, Project risk management. Project planning, scheduling and control using Microsoft Project.
C5 Presentation of the issues of effective communication in project teams, group behaviour and leadership.

PRZEDMIOTOWE EFEKTY UCZENIA SIĘ

Z zakresu wiedzy:

PEU_W01 rozumie pojęcia podaży i popytu, elastyczności popytu i ich wpływ na rynki
PEU_W02 zna pojęcia kosztów w ekonomii i rachunkowości, rozumie różnice
PEU_W03 zna sposoby klasyfikacji kosztów w przedsiębiorstwach, zna i rozumie podstawowe pojęcia rachunku kosztów
PEU_W04 ma podstawową wiedzę o treści i wzajemnych relacjach bilansu, rachunku zysków i strat oraz rachunku przepływów pieniężnych, zna sposób prezentacji danych finansowych przedsiębiorstw w ustawowych sprawozdaniach finansowych i zna ich warianty.
PEU_W05 ma podstawową wiedzę na temat metody analizy wskaźnikowej sprawozdań finansowych
PEU_W06 zna pojęcia wartości przyszłej i wartości obecnej przepływów pieniężnych i rent rocznych
PEU_W07 zna podstawowe i zaawansowane metody oceny efektywności inwestycji (NPV, IRR, MIRR, DPBP, PBP) oraz zakresy ich stosowania
PEU_W08 ma podstawową wiedzę o metodach oceny ryzyka inwestycji

Z zakresu umiejętności:

PEU_U01 potrafi przeprowadzić analizę przyczyn i skutków zmiany popytu i podaży
PEU_U02 na podstawie krzywych kosztowych potrafi przeprowadzić optymalizację wielkości produkcji w różnych przypadkach.
PEU_U03 umie zinterpretować i korzystać z informacji zawartych w ustawowych sprawozdaniach finansowych. Umie przeprowadzić analizę wskaźnikową sprawozdań finansowych w podstawowym zakresie
PEU_U03 umie korzystać z danych kosztowych przedstawionych w różnych układach ewidencyjnych kosztów, umie stosować podstawowe metody rachunkowości zarządczej do podejmowania decyzji krótkoterminowych
PEU_U04 potrafi obliczyć wartość przyszłą i obecną pieniądza dla szeregu płatności oraz rozwiązać zadania rachunkowe z zakresu wartości pieniądza w czasie
PEU_U05 potrafi przeprowadzić ocenę opłacalności inwestycji poznanymi metodami
PEU_U06 potrafi przeprowadzić analizę wrażliwości i analizę scenariuszy z wykorzystaniem modelu finansowego inwestycji
PEU_U07 potrafi przygotować dokumentację projektową w podstawowym zakresie i

zainicjować projekt PEU_U08 potrafi zastosować podstawowe metody zarządzania projektami, monitorowania i zarządzania ryzykiem projektu PEU_U09 potrafi zastosować podstawowe metody zarządzania konfliktami w grupie PEU_U10 potrafi zastosować podstawowe metody zarządzania grupą i kreowania pozycji lidera, potrafi ocenić skuteczność zarządzania grupą Z zakresu kompetencji społecznych: PEU_K01 potrafi myśleć i działać w sposób systemowy, kreatywny i przedsiębiorczy PEU_K02 ma utrwaloną postawę ekonomicznego działania i podejmowania decyzji w oparciu o dostępne informacje finansowe i prognozy

TREŚCI PROGRAMOWE		
Forma zajęć - wykład		**Liczba godzin**
Wy1	Supply and demand, equilibrium price, changes in demand and supply. Stock and commodity markets used by mineral industries	2
Wy2	Costs in economics and in accounting. Cost and money outflow. Relevant cost, incremental cost, marginal cost, alternative cost. Short-term decision making.	2
Wy3	Costs as the subject of cost accounting, different systems of cost accounting Different methods of cost data presentation (by types, divided into direct and indirect costs). Cost allocation	2
Wy4	Variable and fixed costs. Break even point. Cost-volume –profit analysis.	1
Wy5	Basics of financial accounting. Income statement and cash flow statement. Balance sheet. Working capital. Examples of financial statements of mining companies	2
Wy6	Financial ratio analysis. Liquidity, profitability, activity and debt ratios. Financial and operating leverage.	2
Wy7	The concept of time value of money. Computation of future and present value of money by means of spreadsheet functions. Basics of capital budgeting. Evaluation of different methods.	2
Wy8	The concept of risk and return. Quantification of risk. Risk analysis in project evaluation: sensitivity analysis, scenario analysis, other methods.	2
	Suma godzin	15

Forma zajęć - projekt		**Liczba godzin**
Pr 1	Issues of understanding communication: Definitions Models (Schramm model, Berlo's SMCR (source, message, channel, receiver) model, McCroskey model, Reusch and Bateson model, Westley-MacLean model)	3
Pr 2	Conflict Sources of conflicts Kilmann and Thomas classification of conflict Kilmann and Thomas test Different styles of conflict solving Roles of conflict in group development.	3
Pr3	Team roles	3

	Team roles Belbin perspective Discussion group roles Effective managerial behaviour in the context of team roles	
Pr4	Leadership Hersey and Blanchard theory Black and Mouton approach to leadership Fiedler theory and his Least Preferred Coworker Scale Situational leadership self-assessment	3
Pr5	Summary; Effective managerial behaviour from the different contexts.	3
	Suma godzin	15

Forma zajęć - laboratorium		Liczba godzin
Part A		
La1	Supply and Demand curves. Elasticity of demand.	2
La2	Economic costs. Cost curves. Profit maximization cases.	2
La3	Managerial cost accounting. Decision making cases.	2
La4	Basic financial accounting. Creation of simple Balance Sheet, Profit and Loss Statement and Cash Flow Statement	2
La5	Ratio analysis based on financial statements of companies	2
La6	Time value of money and capital budgeting – calculation by means of Excel functions	2
La7	Financial model of an investment. Sensitivity and Scenario analysis.	3
Part B		
La8	Basic concepts (process, project, project management, management by projects, critical factors for project success, competences). Preparing and initiation of the project. Project analysis (project environment, stakeholders, project objectives).	3
La9	Planning and estimating of the project. Project phases and life cycle	3
La10	Project organization. Project scope management. Planning of activities, resources and costs.	3
La11	Project risk management. Project monitoring. Project management methodologies.	3
La12	Quality management. Change control. Project closing.	3
	Suma godzin	**30**

STOSOWANE NARZĘDZIA DYDAKTYCZNE

N1. Wykład interaktywny z pokazem slajdów i dyskusją
N2. Ćwiczenia laboratoryjne: indywidualne rozwiązywanie zadań z wykorzystaniem arkusza kalkulacyjnego.
N3. Ćwiczenialaboratoryjne: rozwiązywanie zadań w grupach. Prezentacja wyników. Dyskusja o otrzymanych wynikach
N4. Konsultacje
N5. Praca własna – rozwiązywanie zadań domowych
N6. Praca własna – samodzielne studia literaturowe

OCENA OSIĄGNIĘCIA PRZEDMIOTOWYCH EFEKTÓW UCZENIA SIĘ

Oceny (F – formująca (w trakcie semestru), P	Numer efektu uczenia się	Sposób oceny osiągnięcia efektu uczenia się

– podsumowująca (na koniec semestru)		
F1	PEU_W01-W08 PEU_K01-K02	Dyskusja na zajęciach, ocena aktywności studentów na zajęciach laboratoryjnych i projektowych
F2	PEU_U01-U10 PEU_K01-K02	Ocena rozwiązań zadań uzyskanych przez studentów w trakcie zajęć laboratoryjnych i projektowych
P1	PEU_W01-W08 PEU_U01-U10 PEU_K01-K02	Egzamin pisemny
P2	PEU_W01-W08 PEU_U01-U10 PEU_K01-K02	Ocena indywidualnych rozwiązań zadań nadesłanych przez studentów po zajęciach

LITERATURA PODSTAWOWA I UZUPEŁNIAJĄCA

LITERATURA PODSTAWOWA:

1. Erhardt M., Brigham E.: Financial Management Theory and Practice. South-Western Cengage Learning, USA
2. Brigham E.: Podstawy zarządzania finansami. Polskie Wydawnictwo Ekonomiczne, Warszawa 1997
3. Czekaj J., Dresler Z.: Podstawy zarządzania finansami firm. PWN Warszawa 1996
4. Jaruga A., Sobańska J., Kopczyńska L. Szychta A.: *Rachunkowość dla menedżerów*. Towarzystwo Gospodarcze RAFIB, Łódź 1996.
5. Jonson H.: Ocena projektów inwestycyjnych. Maksymalizacja wartości przedsiębiorstwa. Wyd. K.E. Liber, Warszawa 2000.
6. Nowak E.: Rachunek kosztów przedsiębiorstwa. Wydawnictwo Ekspert, Wrocław 2001
7. Sierpińska M., Jachna T.: Ocena przedsiębiorstwa według standardów światowych, PWN Warszawa 1994.
8. Świderska G. K.(red): Rachunkowość zarządcza. (praca zbiorowa) Wyd. Poltext, Warszawa 1997
9. Wysocki Robert K., McGary R., Efektywne zarządzanie projektami, OnePress, 2005
10. Lock Dennis, Podstawy zarządzania projektami, PWE, 2009

LITERATURA UZUPEŁNIAJĄCA:

1. Jajuga K., Jajuga T., 2006. Inwestycje. Instrumenty finansowe, aktywa niefinansowe, ryzyko finansowe, inżynieria finansowe, Wydawnictwo Naukowe PWN, Warszawa.
2. Jonson H.: Koszt kapitału. Klucz do wartości firmy. Wyd. K.E. Liber, Warszawa 2000
3. Turyna J., Pułaska-Turyna B.: Rachunek kosztów i wyników. Wyd. Finans-Servis, Warszawa 1997.
4. A Guide to Project Management Body of Knowledge (PMBOK®Guide Fourth Edition), Project Management Institute, 2008 (2004). wydanie polskie, MT&DC Warszawa, 2009 (2006)

OPIEKUN PRZEDMIOTU (IMIĘ, NAZWISKO, ADRES E-MAIL)

Dr inż. Gabriela Paszkowska, Gabriela.paszkowska@pwr.wroc.pl

Zał. nr 5 do ZW 8/2020
Załącznik nr … do programu studiów

WYDZIAŁ GEOINZYNIERII, GÓRNICTWA I GEOLOGII

KARTA PRZEDMIOTU

Nazwa przedmiotu w języku polskim ***Zasady i zastosowania InSAR oraz GIS w górnictwie***
Nazwa przedmiotu w języku angielskim ***Principles and Application of InSAR and GIS in mining***
Kierunek studiów (jeśli dotyczy): Górnictwo i geologia
Specjalność (jeśli dotyczy): ***Geomatics for Mineral Resources Management (Geomatyka w zarządzaniu surowcami mineralnymi)***
Poziom i forma studiów: ~~I~~ / II stopień / ~~jednolite studia magisterskie~~*, stacjonarna / ~~niestacjonarna~~*
Rodzaj przedmiotu: obowiązkowy / ~~wybieralny~~ / ~~ogólnouczelniany~~ *
Kod przedmiotu W06GIG-SM0037
Grupa kursów ~~TAK~~ / NIE*

	Wykład	Ćwiczenia	Laboratorium	Projekt	Seminarium
Liczba godzin zajęć zorganizowanych w Uczelni (ZZU)	30		45		
Liczba godzin całkowitego nakładu pracy studenta (CNPS)	60		90		
Forma zaliczenia	Egzamin / ~~zaliczenie na ocenę*~~		~~Egzamin~~ / zaliczenie na ocenę*		
Dla grupy kursów zaznaczyć kurs końcowy (X)					
Liczba punktów ECTS	2		3		
w tym liczba punktów odpowiadająca zajęciom o charakterze praktycznym (P)			3		
w tym liczba punktów ECTS odpowiadająca zajęciom wymagającym bezpośredniego udziału nauczycieli lub innych osób prowadzących zajęcia (BU)	2		2		

*niepotrzebne skreślić

WYMAGANIA WSTĘPNE W ZAKRESIE WIEDZY, UMIEJĘTNOŚCI I KOMPETENCJI SPOŁECZNYCH

1. Zna podstawy programowania w językach: C++ oraz Python.
2. Ma podstawową wiedzę z zakresu roli narzędzi geoinformacyjnych (GIS) oraz z zakresu technik pozyskiwania danych przestrzennych.
3. Potrafi posługiwać się pakietem oprogramowania GIS
4. Ma podstawową wiedzę z zakresu baz danych

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CELE PRZEDMIOTU

C1 Przedstawienie wiadomości z zakresu satelitarnej interferometrii radarowej, a także możliwości wykorzystania jej w pomiarach deformacji terenu.
C2 Nabycie umiejętności wyznaczania przemieszczeń powierzchni terenu w oparciu o satelitarne dane radarowe.

C3	Przedstawienie wiadomości dotyczących stosowania GIS w zaawansowanej analizie obiektów, zjawisk i procesów zachodzących w przestrzeni
C4	Nabycie umiejętności formułowania i rozwiązywania zadań z zastosowaniem funkcji analitycznych GIS
C4	Nabycie umiejętności korzystania z danych i usług danych przestrzennych zgodnie z dyrektywą INSPIRE

PRZEDMIOTOWE EFEKTY UCZENIA SIĘ

Z zakresu wiedzy:

PEU_W01 Posiada poszerzoną wiedzę w zakresie wykorzystywania systemów geoinformacyjnych do gromadzenia i przetwarzania danych wykorzystywanych w modelowaniu zjawisk i procesów zarówno naturalnych jak i antropogenicznych

PEU_W02 Zna zasady budowy i funkcjonowania systemów geoinformacyjnych w branży górniczej i administracji publicznej

Z zakresu umiejętności:

PEU_U01 Potrafi korzystać z zaawansowanych narzędzi GIS w górnictwie, badaniach zjawisk przyrodniczych, oddziaływaniu górnictwa na otoczenie i zagospodarowaniu przestrzeni,

PEU_U02 Potrafi formułować i rozwiązywać zadania przestrzenne w środowisku GIS

PEU_U03 Potrafi interpretować otrzymane wyniki oraz wyciągać wnioski

Z zakresu kompetencji społecznych:

PEU_K01 Potrafi formułować i przekazać wiedzę na temat wykorzystania systemów geoinformacyjnych w analizach przestrzennych i prezentacji ich wyników

TREŚCI PROGRAMOWE		
Forma zajęć - wykład		**Liczba godzin**
Wy1	Omówienie syllabusu, warunków zaliczenia, literatury	2
Wy2	Wprowadzenie do teorii sygnałów mikrofalowych do obserwacji Ziemi	2
Wy3	Wykorzystanie pasywnej i aktywnej teledetekcji satelitarnej do wyznaczania przemieszczeń powierzchni terenu	2
Wy4	Akwizycja i przetwarzanie danych SAR	2
Wy5	Teoria obrazów SAR (geometryczne właściwości, polaryzacja)	2
Wy6	Podstawy obliczeń danych SAR metodami: DinSAR oraz SBAS	2
Wy7	Wykorzystanie danych SAR w monitorowaniu aktywności powierzchni terenu (czynniki naturalne i antropogeniczne)	2
Wy8	Usystematyzowanie podstawowych pojęć z zakresu systemów informacji geograficznej	2
Wy9	Modelowanie danych w GIS. Reprezentacja danych przestrzennych. Bazy danych przestrzennych. Stan obecny i trendy rozwojowe	2
Wy10	Metody analiz przestrzennych w GIS	2
Wy11	Interpolacja danych przestrzennych	2
Wy12	Algebra mapy. Analizy powierzchni, funkcje lokalne, funkcje strefowe	2
Wy13	Podstawy statystyki przestrzennej	2
Wy14	Infrastruktury Informacji Przestrzennej. Dyrektywa Inspire. Open data	2
Wy15	Przykłady zastosowań systemów geoinformacyjnych w górnictwie i ochronie środowiska	2
	Suma godzin	**15**

Forma zajęć - laboratorium		Liczba godzin
La1	Konfiguracja środowiska do obliczeń SAR	3
La2	Wprowadzenie do obliczeń danych radarowych – zadania obliczeniowe	6
La3	Pozyskanie danych radarowych oraz obliczenia interferogramu – metoda DInSAR	3
La4	Rozwiniecie fazy interferometrycznej – obliczenia	3
La5	Prezentacja wyników obliczeń danych SAR w środowisku GMT	6
La6	Interpolacja danych dyskretnych. Przygotowanie danych wejściowych do analizy (np. pomiar przemieszczeń powierzchni terenu górniczego)	3
La7	Interpolacja danych dyskretnych. Opracowanie map rozkładu przestrzennego przemieszczeń różnymi metodami interpolacji.	3
La8	Interpolacja danych dyskretnych. Analiza i ocena jakości interpolacji. Mapa prognozy. Opracowanie map zmian zanieczyszczenia pomiędzy dwoma okresami z zastosowaniem kalkulatora rastrowego.	3
La9	Analizy przestrzenne – ocena przydatności terenu pod lokalizację wybranej inwestycji górniczej. Budowa bazy danych przestrzennych kryteriów lokalizacji	3
La10	Analizy przestrzenne – ocena przydatności terenu pod lokalizację Inwestycji górniczej. Wybór procedur i przeprowadzenie operacji analitycznych.	3
La11	Analizy przestrzenne – ocena przydatności terenu pod lokalizację inwestycji górniczej. Opracowanie modelu przetwarzania danych przestrzennych.	3
La12	Analizy przestrzenne – ocena przydatności terenu pod lokalizację inwestycji górniczej. Analiza i interpretacja wyników. Prezentacja graficzna i statystyczna wyników. Geowizualizacja	3
La13	GIS mobilny. Pozyskiwanie danych przestrzennych i atrybutowych w terenie.	3
	Suma godzin	**45**

STOSOWANE NARZĘDZIA DYDAKTYCZNE
N1. Wykład z elementami wykładu problemowego N2. Prezentacje multimedialne N3. Wykonanie indywidualnej pisemnej pracy semestralnej na zadany temat N4. Materiały multimedialne (MOOC) N5. Instrukcje laboratoryjne N6. Wykonanie zadań laboratoryjnych i przygotowanie sprawozdań N7. Konsultacje

OCENA OSIĄGNIĘCIA PRZEDMIOTOWYCH EFEKTÓW UCZENIA SIĘ

Oceny (F – formująca (w trakcie semestru), P – podsumowująca (na koniec semestru)	Numer efektu uczenia się	Sposób oceny osiągnięcia efektu uczenia się
F, P	PEU_W01 – 02 PEU_U01 – 03 PEU_K01	F1 Ocena końcowa z egzaminu w formie pisemnej, F2 Ocena z pisemnej pracy semestralnej, P Ocena końcowa z wykładu (średnia ważona z F1 – 80% oraz F2 - 20%)
F, P	PEU_W01 – 02 PEU_U01 – 03	F3 Ocena z wykonanych zadań i sprawozdań Pisemnych,

	PEU_K01	F4 Ocena ze sprawdzianów pisemnych, P2 Ocena końcowa z laboratorium (średnia ważona z F3 – 80% oraz F4 - 20%)

LITERATURA PODSTAWOWA I UZUPEŁNIAJĄCA

LITERATURA PODSTAWOWA:

[1] Longley P. A., Goodchild M. F., Maguire D. J., Rhind D. 2015: Geographic Information Science and Systems, 4th Edition, John Wiley & Sons;
[2] Maguire D., Batty M., Goodchild M., 2005. GIS Spatial Analysis and Modelling. ESRI Press
[3] Berry J., 2007-2013. Beyond Mapping IV — GIS Modelling
[4] Satellite InSAR Data: Reservoir Monitoring from Space, A. Ferretti, EAGE; 1st edition, 2014
[5] GMTSAR: An InSAR Processing System Based on Generic Mapping Tools (Second Edition), D. Sandwell i in., Scripps Institution of Oceanography, University of California, San Diego, La Jolla, CA, USA, 2016
[6] InSAR Principles - Guidelines for SAR Interferometry Processing and Interpretation, ESA Publications, 2008

LITERATURA UZUPEŁNIAJĄCA:

[1] Directive 2007/2/EC of the European Parliament and of the Council of 14 March 2007 establishing an Infrastructure for Spatial Information in the European Community (INSPIRE)
[2] Kennedy M., 2009: Introducing Geographic Information Systems with ArcGIS: A Workbook Approach to Learning GIS, Second Edition, John Wiley and Sons;
[3] Longley P. A., Goodchild M. F., Maguire D. J., Rhind D. W., 2006. GIS. Teoria i praktyka. Wydawnictwo Naukowe PWN, Warszawa
[4] Urbański J., 2010. GIS w badaniach przyrodniczych, Wydawnictwo Uniwersytetu Gdańskiego
[5] Dokumentacja środowiska GMT (Generic Mapping Tools) - http://gmt.soest.hawaii.edu/projects/gmt/wiki/Documentation

OPIEKUN PRZEDMIOTU (IMIĘ, NAZWISKO, ADRES E-MAIL)

Wojciech Milczarek, wojciech.milczarek@pwr.edu.pl
Jan Blachowski, jan.blachowski@pwr.edu.pl

Semestr 2

TU Bergakademie Freiberg

Data:	MGEOFER.MA.Nr.2013	Stand: 31.10.2017	Start: WiSe 2019
Module name:	Applied Remote Sensing in Geosciences		
Course coordinator:	Prof. Dr.-Ing. Jörg Benndorf		
Instructors:	John, Andre / Dr.-Ing.		
Department:	Department of Mine Surveying and Geodesy		
Duration:	1 Semester		
Study goals	After successful completion of the course students will be able to apply methods of remote sensing in the context of analysis of spatio-temporal processes in geosciences. This includes in particular, - the ability to choose suitable sensor technology based on knowledge about available sensors and related physical principles - processing of remote sensing data using typical software - application of multi-variate statistical methods to infer relevant information from sensor data, relevant to specific case studies - application of spatial modelling techniques for prediction of attributes at not samples location or times. - integration of before mentioned aspects in an efficient work flow.		
Content:	This module covers the introduction to and working on selected applications of remote sensing in geosciences by the means of selected case studies. Topics covered include - review of theoretical foundation of remote sensing - data acquisition techniques (terestrial , airborne, spaceborne) - spatio-temporal analysis of data - Geoscientific background related to the case studies. Practical exercises will be conducted applying multi-spectral and radar data for change detection of ground properties and ground deformations. Students will conduct individual project assignments and present their results.		
Typical literature:	Richards and Jia, Remote Sensing Digital Image Analysis, Springer Schowengerdt, Remote Sensing: Models and Methods for Image Processing, Academic Press		
Teaching mode:	S1 (WS): Lecture (1 SWS) S1 (WS): practical work (3 SWS)		
Prerequisites:	Pre-requisites are basic knowledge in geosciences, remote sensing and statistics.		
Term:	Winter Term		
Examination:	Project assignment and presentation		
ECTS (LP):	6		
Grade:	Assessment of the project assignment and presentation		
Study load:	Total estimated study lead is180h. It consists of 60h supervised lecture and practical time and 120 independent work including group work, practical, self-study and preparation for examination.		

Data:	Geomod. MA. Nr. 638 / Prüfungs-Nr.: 30105	Stand: 31.10.2017	Start: WiSe 2019
Module name:	Geomodelling – Geostatistics for natural resource modelling		
Course coordinator:	Prof. Dr.-Ing. Jörg Benndorf		
Instructors:	Prof. Dr.-Ing. Jörg Benndorf		
Department:	Department of Mine Surveying and Geodesy		
Duration:	1 Semester		
Study goals	After successful completion of the course, students are able to: - explain the theoretical foundation of spatial data analysis, geostatistical model building and estimation - apply geostatistical methods in the context of estimating natural resources/reserves - critically evaluate model assumptions of different estimation and simulation method and choose suitable methods for specific applications - discuss the critical character of the SMU-size to recoverable reserves - conduct a resource/reserve estimation in a simple case study		
Content:	Importance of Resource Modeling and Estimation in the Value Chain of Mining, uni-variate and multi-variate Explorative Data Analysis, Analysis of Spatial Continuity, the Spatial Random Function Model, Model Assumptions of Stationarity and Ergodicity, Inference of a Spatial Random Function using unbiased Estimators, Dealing with Preferential Sampling, Variography and Variogram Modeling, Simple Methods for Spatial Estimation including the Polygon Method, Triangulation, Inverse Distance Power and Polynomial Regression, Geostatistical Methods for Spatial Estimation including Simple Kriging, Ordinary Kriging and Universal Kriging, Integrating Secondary Information into Spatial Modeling using Techniques of Co-Kriging, other methods including Indicator Kriging and Block Kriging, Introduction in Modeling spatial Uncertainty using Conditional Simulation, the Method of Sequential Gaussian Simulation, Geostatistical Considerations in Estimating Reserves in Terms of Volume-Variance Relationship for defining Smallest Minable Units and Grade Tonnage Curves, Applications in Mining Cases, Introduction to CRIRSCO-based International Reporting standards (example JORC Code).		
Typical literature:	M. Armstrong: “Basic Linear Geostatistics”, Springer Verlag; H. Akin, H. Siemes: „Praktische Geostatistik“, Springer Verlag; A. G. Journel, and C.J. Huijbregts, 1978, Mining Geostatistics, Academic Press; P. Goovaerts: “Geostatistics for Natural Resource Evaluation“, Oxford University Press; T. Schafmeister: “Geostatistik für die hydrogeologische Praxis“, Springer Verlag		
Teaching mode:	S1 (WS): Lecture, language English (2 SWS) S1 (WS): practical work in groups (2 SWS)		
Prerequisites:	**Recommended:** Introduction to Statistics Calculus		
Term:	Winter Term.		

Examination:	Written Exam of 90 minutes Group Work Assignment For modules with multiple assessment methods, each of these must be passed with a minimum grade of "sufficient" (4.0).
ECTS (LP):	5
Grade:	Written Exam (weight 2) Set of assignment (weight 1)
Study load:	Total estimated study lead is150h. It consists of 60h presence time (lectures and practical), and 90 hours independent work including group work, practical, self-study and preparation for examination

Data:	GEOMON. BA. 128 / Prüfungs-Nr.: -	Stand: 31.10.2017	Start: WiSe 2019
Module name:	Geomonitoring		
Course coordinator:	Prof. Dr.-Ing. Jörg Benndorf		
Instructors:	Benndorf, Jörg/ Prof. Dr.-Ing. John, Andre / Dr.-Ing.		
Department:	Department of Mine Surveying and Geodesy		
Duration:	1 Semester		
Study goals	Students are able to build on their knowledge about geodetic and geotechnical measurement methods on the one hand and their understanding about the geogenic/ antropogenic process to monitor on the other hand to generate reliable and effective monitoring concepts for spatial, temporal and spatio-temporal processes. Students are able to critically analyze monitoring concepts and interpret monitoring results.		
Content:	The Lecture introduces to applications and to the methodological approach of Geomonitoring. Starting on the basis of measurement and data acquisition techniques it discusses monitoring design aspects and statistical and model based inference strategies. The aim is to infer an understanding of geo-processes and their relevant spatio-temporal dynamics, including change detection. Topical application in the context of resource extraction impact- and environmental impact monitoring on different scales in time and space will be discussed and analyzed.		
Typical literature:	Kavanagh, B.F. (2002): Geomatics. Pearson Education, Upper Saddle River; Jain, R. (2015). Environmental Impact of Mining and Mineral Processing: Management, Monitoring, and Auditing Strategies. Butterworth-Heinemann. Fischer-Stabel, P. (2005): Umweltinformationssysteme. Wichmann, Heidelberg. de Gruijter, J., Brus, D.J., Bierkens, M.F.P., Knotters, M.(2006). Sampling for Natural Resources. Springer.		
Teaching mode:	S1 (WS): Lecture (2 SWS) S1 (WS): practical work in groups (2 SWS)		
Prerequisites:	**Recommended:** Introduction to Remote Sensing Geodetic Surveying Introduction to GIS Engineering Surveying Geomodelling		
Term:	Winter Term		
Examination:	Oral Exam Set of Assignments		
ECTS (LP):	5		
Grade:	Oral Exam (weight 1) Assignment (weight 1)		
Study load:	Total estimated study lead is150h. It consists of 60h supervised lecture and practical time and 90 independent work including group work, practical, self-study and preparation for examination.		

Data:	MARVERM. BA. Nr. 641 / Prüfungs-Nr.:	Stand: 31.10.2017	Start: WiSe 2019
Module name:	Underground Mine Surveying		
Course coordinator:	Prof. Dr.-Ing. Jörg Benndorf		
Instructors:	Prof. Dr.-Ing. Jörg Benndorf		
Department:	Department of Mine Surveying and Geodesy		
Duration:	1 Semester		
Study goals	After successful completion of the course, students are able to: - apply the theory of error propagation in the context of planning and critical analysis of measurement results for underground surveying campaigns - optimize the case specific use of suitable surveying instrumentation, the measurement design and data processing method for campaigns related to the absolute spatial orientation of underground mining workings. - independently conduct typically underground mine surveying tasks and analyze results.		
Content:	- Legal regulations with respect to underground mine surveying (in particular German law: Verordnung über markscheiderische Arbeiten und Beobachtung der Oberfläche - Markscheider-Bergverordnung vom 19. Dezember 1986) - Application of the theory of error propagation and GUM - Guide to the Expression of Uncertainty in Measurement - Transfer of coordinates and directional angels from surface to underground (mechanical and optical shaft plumbing, gyroscopic measurements, application of inertial systems) - Alignment control in underground drifts and tunnels - Underground geodetic infrastructure and mine mapping - Drill hole surveying - Recent developments		
Typical literature:	Schulte, Löhr, Vosen: Markscheidekunde für das Studium und die betriebliche Praxis. Springer Verlag; Meixner, H. und Bukrinskij, A.: Markscheidewesen für Bergbaufachrichtungen. VEB Deutscher Verlag für Grundstoffindustrie, Leipzig 1985; Knufinke, P.: Allgemeine Vermessungs- und Markscheidekunde.; 1. Auflage, ISBN: 3-89653-530-7,; Deutscher Markscheiderverein e.V., Bochum, 1999; Ogundare, J. O. (2015). Precision surveying: the principles and geomatics practice. John Wiley & Sons. Zeitschriften: Markscheidewesen, AVN, VDV-Magazin		
Teaching mode:	S1 (WS): Lecture (2 SWS) S1 (WS): exercises and practical work in groups (3 SWS)		
Prerequisites:	Basic knowledge about surveying, surveying instrumentation and underground mining.		
Term:	Winter Term.		
Examination:	Oral Assessment (30 Minutes) Set of assignments		

	For modules with multiple assessment methods, each of these must be passed with a minimum grade of "sufficient" (4.0).
ECTS (LP):	5
Grade:	Oral assessment (weight 1)
Study load:	Total estimated study load is180h. It consists of 75h presence time (lectures and underground surveying practical), and 105 hours independent work including group work, practical, self-study and preparation for examination

Semestr 3

TU Bergakademie Freiberg

Data:	GEOINF2. MA. Nr. 529 / Prüfungs-Nr.:	Stand: 31.10.2017	Start: SoSe 2018
Module name:	Applied Spatial Data Analysis and Modelling for After Mine Care - Case Study		
Course coordinator:	Prof. Dr.-Ing. Jörg Benndorf		
Instructors:	Löbel, Karl-Heinz / Dr.-Ing. Benndorf, Jörg/ Prof. Dr.-Ing.		
Department:	Department of Mine Surveying and Geodesy		
Duration:	1 Semester		
Study goals	After successful completion of the course, students are able to: • independently create solutions for complex practical problems in mining and geoengineering applying knowledge about mine surveying, mining engineering, geotechnical engineering and engineering geology and utilizing modern methods in geospatial data analysis, geo-modelling and GIS. • critically assess and interpreted results of the analysis and provide recommendations related to expected impact of mining activities during active and post-mining phase. • coordinate team work, create project plans and manage the work progress • present results in a report and/or a presentation to a panel of independent experts. conduct auto-didactical education related to detailed handling of typical software.		
Content:	• project work on a case study related to after mine care • supporting acquisition of georeferenced data • impact analysis on environment and safety • data base structures suited to map the problem on hand • GIS project management • Interpolation, 2½- and 3D model building • Geospatial data analysis • Network analysis • Client/Server concepts • GIS and internet • Presentation of results in thematic maps and presentations		
Typical literature:	David Maguire, Michael Batty, Michael Goodchild: GIS, Spatial Analysis, and Modeling. ISBN: 1-58948-130-5; The ESRI Guide to GIS Analysis, Volume 1 - Geographic Patterns and Relationships. ISBN: 1-879102-06-4, Volume 2 - Spatial Measurements and Statistics. ISBN: 1-58948-116-X; Josef Fürst: GIS in Hydrologie und Wasserwirtschaft, ISBN 978-3-87907-413-6; Wolfgang Liebig, Jörg Schaller (Hrsg.) : ArcView GIS - GIS-Arbeitsbuch, ISBN 978-3-87907-346-7; Peter Fischer-Stabel (Hrsg.):Umweltinformationssysteme, ISBN 978-3-87907-423-5; Franz-Josef Behr: Strategisches GIS-Management - Grundlagen, Systemeinführung und Betrieb, ISBN 978-3-87907-350-4; Thomas Brinkhoff: Geodatenbanksysteme in Theorie und Praxis, ISBN • 978-3-87907-433-4		
Teaching mode:	S1 (SS): Lecture (1 SWS) S1 (SS): practical work in groups (2 SWS)		
Prerequisites:	**Recommended:** Introduction to GIS, 2014-06-16 Introduction to Mine Surveying .		
Term:	Summer Term.		
Examination:	Oral Exam Group Work Assignment		

ECTS (LP):	5
Grade:	Oral Exam (weight 2) Assignment (weight 3)
Study load:	Total estimated study lead is150h. It consists of 45h lectures 105 independent work including group work, practical, self-study and preparation for examination

Data:	MARKLAG. BA. Nr. 648 / Prüfungs-Nr.: -	Stand: 31.10.2017	Start: SoSe 2019
Module name:	Geomatics for Resource and Reserve Management		
Course coordinator:	Prof. Dr.-Ing. Jörg Benndorf		
Instructors:	Prof. Dr.-Ing. Jörg Benndorf		
Department:	Department of Mine Surveying and Geodesy		
Duration:	1 Semester		
Study goals	After successful completion of the course, students are able to create case specific work flows and apply methods that support a safe, economical end environmental responsible exploitation of mineral deposits. The particular focus of this module is on: - exploration of the resource and geo-mechanical aspects including tectonics, - evaluation of mineral resources and reserves according international standards, - monitoring of operational accessible reserves (in-pit reserves), - grade control and reconciliation, - operational production and safety monitoring and - aspects related to optimization of mine design.		
Content:	– Methods and phases of resource exploration – Resource/Reserve estimation – Operational production and safety monitoring – Grade control and reconciliation – Tectonic structures and its visualization in mine maps (folding structures and discontinuities) – Geotechnical design aspects – Applied operations resource for optimized mine design		
Typical literature:	Eisbacher, G.H.: Einführung in die Tektonik. Ferdinand Enke Verlag Stuttgart; Klassifikation von Lagerstätten. GDMB-Hefte, GDMB-Clausthal- Zellerfeld; Michaely, H., Blasgude H.G.: Rissmusteratlas- Bergmännisches Risswerk. FABERG-Normenausschuss Bergbau im DIN Deutsches Institut für Normung e.V. Domschke, W., Drexl, A., Klein, R., Scholl, A. (2015) Einführung in das Operations Research. Springer, Berlin.		
Teaching mode:	S1 (SS): Lecture (2 SWS) S1 (SS): exercises and practical work in groups (2SWS)		
Prerequisites:	Basic knowledge about mine mapping.		
Term:	Summer Term.		
Examination:	Oral Assessment (30 Minutes) Set of assignments Excursion (successful completion is a pre-requisite for oral examination)		
ECTS (LP):	6		
Grade:	Oral assessment (weight 1)		
Study load:	Total estimated study load is180h. It consists of 60h presence time (lectures and underground surveying practical), and 120 hours independent work including group work, practical, self-study and preparation for examination		

Data:	BODBEWB. BA. Nr. 646 / Prüfungs-Nr.: -	Stand: 31.10.2017	Start: SoSe 2019
Module name:	Special Topics Geokinematics		
Course coordinator:	Prof. Dr.-Ing. Jörg Benndorf		
Instructors:	Benndorf, Jörg/ Prof. Dr.-Ing. John, Andre / Dr.-Ing.		
Department:	Department of Mine Surveying and Geodesy		
Duration:	1 Semester		
Study goals	After successful completion of the course, students are able to: • solve topical problems related to predicting and monitoring mining induced ground movements, • utilize methods of inverse modelling to estimate parameters of prediction models based on monitoring data and • apply methods of machine learning to analyse highly dimensional data and identify relations between independent and dependent variables.		
Content:	• Review of methods for predicting mining induced ground movements on topical examples • Applied inverse modelling and geostatistics for parameter estimation in the context of ground movement prediction • Introduction to supervised and unsupervised learning (Machine Learning) in the context of resource extraction monitoring and prediction • Case studies of machine learning in the context of mining induced ground movement modelling and exploration • Case studies for ground movement prediction and parameter estimation		
Typical literature:	Kratzsch, Helmut: Bergschadenkunde. 4. Aufl., 2004, 873 S., ISBN 3-00-001661-9; Whittaker, B.N., Reddish D.J.: Subsidence. -Occurrence, Prediction and Control, 1989, 528 S., ISBN 0-444-87274-4; Kanevski, M., Timonin, V., & Pozdnukhov, A. (2009). Machine learning for spatial environmental data: theory, applications, and software. EPFL press Dzegniuk, B., Fenk, J., Pielok, J. : Analyse und Prognose von Boden und Gebirgsbewegungen im Flözbergbau. 1987,105 S., ISBN 0071-9390; Journals: Markscheidewesen, Geotechnik, Mathematical Geosciences, Computer and Geosciences, Journal of Mining Sciences		
Teaching mode:	S1 (SS): Lecture, language English (2 SWS) S1 (SS): practical work in groups (2 SWS)		
Prerequisites:	**Recommended:** Mining Subsidence Engineering (Allgemeine Grundlagen der Bergschadenkunde) Geomodelling (Geomodellierung) Geodetic Adjustment Theory (Ausgleichungsrechnung) .		
Term:	Summer Term.		
Examination:	Oral Exam Group Work Assignment		
ECTS (LP):	4		
Grade:	Oral exam of duration 20 to 30 minutes (weight 2) Set of assignment (weight 1)		

Study load:	Total estimated study lead is120h. It consists of 60h presence time (lectures and practical), and 60 hours independent work including group work, practical, self-study and preparation for examination

COURSE DESCRIPTIONS/
KARTY PRZEDMIOTÓW

second-level studies/ studia II stopnia
main field of study/ kierunek studiów:
Mining and Geology/ Górnictwo I Geologia

specialisation/specjalność:
GEOMATICS FOR MINERAL RESOURCE MANAGEMENT

ścieżka studiów/study track: LEOBEN

1-st Semester

Semestr 1

Zał. nr 5 do ZW 8/2020
Załącznik nr … do programu studiów

WYDZIAŁ **Geoinżynierii, Górnictwa i Geologii**

KARTA PRZEDMIOTU

Nazwa przedmiotu w języku polskim Wspomagane komputerowo modelowanie geologiczne i geostatystyka. ….(zajęcia są prowadzone w języku angielskim)
Nazwa przedmiotu w języku angielskim Computer Aided Geological Modelling and Geostatistics……………………………………………….
Kierunek studiów (jeśli dotyczy): Górnictwo i geologia.
Specjalność (jeśli dotyczy): Mining Engineering,
Geotechnical and Environmental Engineering,
Geomatics for Mineral Resource Management
Poziom i forma studiów: II stopień, stacjonarna
Rodzaj przedmiotu: obowiązkowy *
Kod przedmiotu W06GIG-SM0038
Grupa kursów NIE*

	Wykład	Ćwiczenia	Laboratorium	Projekt	Seminarium
Liczba godzin zajęć zorganizowanych w Uczelni (ZZU)	15		45		
Liczba godzin całkowitego nakładu pracy studenta (CNPS)	30		120		
Forma zaliczenia	~~Egzamin /~~ zaliczenie na ocenę*	Egzamin / zaliczenie na ocenę*	~~Egzamin /~~ zaliczenie na ocenę*	Egzamin / zaliczenie na ocenę*	Egzamin / zaliczenie na ocenę*
Dla grupy kursów zaznaczyć kurs końcowy (X)					
Liczba punktów ECTS	**1**		4		
w tym liczba punktów odpowiadająca zajęciom o charakterze praktycznym (P)			4		
w tym liczba punktów ECTS odpowiadająca zajęciom wymagającym bezpośredniego udziału nauczycieli lub innych osób prowadzących zajęcia (BU)	1		2		

*niepotrzebne skreślić

WYMAGANIA WSTĘPNE W ZAKRESIE WIEDZY, UMIEJĘTNOŚCI I KOMPETENCJI SPOŁECZNYCH

1. Mathematical Statistics,
2. Fundamentals of Geology and Mineral Deposits

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CELE PRZEDMIOTU

C1 Developing basic skills in computer modelling of 3-D objects.
C2 Introduction of the principles of digital modelling of typical geological structures.
C3 Introduction to the methods of deposit parameters estimation and resources evaluation.

PRZEDMIOTOWE EFEKTY UCZENIA SIĘ
Z zakresu wiedzy: PEU_W01 Estimation methods, principles of geostatistics, kriging estimators PEU_W02 Geostatistical modelling of the selected deposit parameters (domain analysis, variogram modelling, PEU_W03 Creating and validating 3-D models of various geological structures in the comprehensive dedicated software environment. Z zakresu umiejętności: PEU_U01 Application of relevant estimation methods for quality modelling of a deposit PEU_U02 Evaluating 3-D objects against structural and quality block models (volumes, tonnages, grades) PEU_U03 Describing the interpretation and applied approach, creating models, evaluation results, recommendations for possible enhancements Z zakresu kompetencji społecznych: PEK_K01 The student can think and act in a creative and enterprising way

TREŚCI PROGRAMOWE		
Forma zajęć - wykład		**Liczba godzin**
Wy1	Introduction to the course. Geological database and validation of the geological data.	2
Wy2	Geology of the seam.	2
Wy3	Structural model of the stratified deposit. Methods of the prediction of the surface layer parameters.	2
Wy4	Spatial distribution of samples values. Regionalized variable.	2
Wy5	BLUE Estimator of the mean value: Kriging.	2
Wy6	Quality model of the deposit – block model of the parameter layers. Estimation and evaluation of the block model.	2
Wy7	Reserves modelling and evaluation.	2
Wy8	Mineral resources. International reporting. The JORC Code	1
	Suma godzin	**15**

Forma zajęć - ćwiczenia		**Liczba godzin**
Ćw1		
Ćw2		
Ćw3		
Ćw4		
..		
	Suma godzin	0

Forma zajęć - laboratorium	**Liczba godzin**

La1	Determining the rules of work at the laboratory.	3
La2	Assignment of the individual dataset for the exercises and creating initial data files.	3
La3	Data validation and creating initial geological database.	3
La4	Construction of the structural wireframe model of stratigraphy layers.	3
La5	Construction of the block model of the deposit and overburden layers. Thickness and stripping ratio analysis.	3
La6	Data preparation to geostatistical analysis. Compositing of the samples.	3
La7	Domain analysis with the use of the statistical methods.	3
La8	Determination of the empirical variogram. Anisotropy analysis.	3
La9	Variogram modelling.	3
La10	Kriging Neighborhood Analysis - defining optimal parameters of the estimation procedure.	3
La11	Estimation of quality parameters in block model of the deposit layers. Validation of the estimation quality.	3
La12	Validation of the quality model and classification of the resources. Balance resources evaluation.	3
La13	Preparation of data for continuous surface mining ultimate pit design. Ultimate pit outlines generation	3
La14	Wireframe and block modelling of the ultimate pit	3
La15	Reserves evaluation, visualization and interrogation of created models	3
	Suma godzin	45

Forma zajęć - projekt		Liczba godzin
Pr1		
Pr2		
Pr3		
Pr4		
…		
	Suma godzin	0

Forma zajęć - seminarium		Liczba godzin
Se1		
Se2		
Se3		
…		
	Suma godzin	0

STOSOWANE NARZĘDZIA DYDAKTYCZNE
N1. Form of lectures - traditional, multimedia presentations using specialized software and demonstrations of its application "live", individual development of specialist topics covered during the lecture, N2. individual development of project tasks within the laboratories frames, individual development of electronic reports concerning project tasks within the laboratories frames, N3. evaluation of laboratory tasks reports with multipoint grade of student's work, group analysis of the results obtained during laboratory tasks; preparation of conclusions concerning data dependencies and constraints of mining projects, skill control tests, duty hours in laboratory.

OCENA OSIĄGNIĘCIA PRZEDMIOTOWYCH EFEKTÓW UCZENIA SIĘ

Oceny (F – formująca (w trakcie semestru), P – podsumowująca (na koniec semestru)	Numer efektu uczenia się	Sposób oceny osiągnięcia efektu uczenia się
F1	PEU_W01, PEU_W02	Lecture grade on the basis of the written examination
F2	PEU_W03,	Laboratory task assessment: “structural modelling assessment
F3	PEU_U01	Laboratory task assessment: “geostatistical modelling”
F4	PEU_U02, PEU_U03	Laboratory task assessment: “reserves evaluation”.
P average of F1, F2, F3, F4		

LITERATURA PODSTAWOWA I UZUPEŁNIAJĄCA

LITERATURA PODSTAWOWA:

[1] M. Armstrong, Basic Linear Geostatistics, Springer Verlag, 1998.
[2] P. Goovaerts: “Geostatistics for Natural Resource Evaluation“, Oxford University Press, 1997.
[3] R. H. Grishong, Jr., 3-D Structural Geology, Springer Verlag, 2008
[4] K. Hefferan, J. O’Brien, Earth materials, Willey-Blacwell, Chichester U.K., 2010
[5] W. Hustrulid, M. Kuchta, Open pit mine planning and design. Chapter 3. Orebody description, Taylor&Francis, 2013.
[6] A. G. Journel, and C.J. Huijbregts, Mining Geostatistics, Academic Press, 1978.
[7] Ch.C. Plummer, D.H. Carlson, L. Hammersley, Physical geology, McGraw-Hill I.E. N.Y. 2010
[8] D.R. Prothero, R.H. Dott Jr., Evolution of the Earth, McGraw-Hill I.E. N.Y., 2010
[9] M.W. Rossi, C.V. Deutsch, Mineral Resources Estimation, Springer Verlag 2014.

LITERATURA UZUPEŁNIAJĄCA:

[10] Handouts, tutorials.

OPIEKUN PRZEDMIOTU (IMIĘ, NAZWISKO, ADRES E-MAIL)

Dr inż. Krzysztof Hołodnik
Dr inż. Witold Kawalec, Dr Paweł Zagożdżon

Zał. nr 5 do ZW 8/2020
Załącznik nr … do programu studiów

WYDZIAŁ GEOINŻYNIERII, GÓRNICTWA i GEOLOGII

KARTA PRZEDMIOTU

Nazwa przedmiotu w języku polskim Geofizyka inżynierska
….(zajęcia są prowadzone w języku angielskim)
Nazwa przedmiotu w języku angielskim Engineering Geophysics
Kierunek studiów (jeśli dotyczy): górnictwo i geologia
Specjalność (jeśli dotyczy): Mining Engineering,
Geotechnical and Environmental Engineering,
Geomatics for Mineral Resource Management
Poziom i forma studiów: **~~I~~ / II stopień / ~~jednolite studia magisterskie~~*, stacjonarna / ~~niestacjonarna~~***
Rodzaj przedmiotu: **~~obowiązkowy~~ / wybieralny / ~~ogólnouczelniany~~ ***
Kod przedmiotu **W06GIG-SM0040**
Grupa kursów **~~TAK~~ / NIE***

	Wykład	Ćwiczenia	Laboratorium	Projekt	Seminarium
Liczba godzin zajęć zorganizowanych w Uczelni (ZZU)	15			15	
Liczba godzin całkowitego nakładu pracy studenta (CNPS)	40			50	
Forma zaliczenia	~~Egzamin~~ / zaliczenie na ocenę*			~~Egzamin~~ / zaliczenie na ocenę*	
Dla grupy kursów zaznaczyć kurs końcowy (X)					
Liczba punktów ECTS	1			2	
w tym liczba punktów odpowiadająca zajęciom o charakterze praktycznym (P)				2	
w tym liczba punktów ECTS odpowiadająca zajęciom wymagającym bezpośredniego udziału nauczycieli lub innych osób prowadzących zajęcia (BU)				2	

*niepotrzebne skreślić

WYMAGANIA WSTĘPNE W ZAKRESIE WIEDZY, UMIEJĘTNOŚCI I KOMPETENCJI SPOŁECZNYCH

1. has knowledge of fundamentals of applied geophysics, physics and geology.
2. knows fundamentals of soil and rock mechanics.
3. is able to use MS Office software.
4. is able to work in a team.

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CELE PRZEDMIOTU

C1 familiarize with physical phenomena in geosphere of the Earth
C2 familiarize with engineering problems solved by means of geophysical surveying
C3 familiarize with various geophysical surveys.

C4 acquisition of skills to plan geophysical field surveying and to interpret its results. C5 development of skills to work in a group.

PRZEDMIOTOWE EFEKTY UCZENIA SIĘ
Z zakresu wiedzy: PEU_W01 recognizes, names and explains engineering problems in different fields. PEU_W02 identifies, describes and chooses geophysical surveying methods. PEU_W03 analyses and assesses case studies from solving the engineering problems. Z zakresu umiejętności: PEU_U01 is able to coordinate team work, create field research plans and manage the work progress. PEU_U02 is able to independently create solutions for complex practical problems in engineering and geoengineering applying knowledge about geophysical surveying, mining geophysics, utilizing modern methods in geophysical data acquisition and interpretation. PEU_U03 is able to critically assess, process and interpreted results of the geophysical surveying and provide recommendations related to engineering problems in mining, civil engineering, engineering geology, municipal waste site, archeology, engineering properties of soil and rocks, hydrogeology, monitoring seepage in river dykes or dams. PEU_U04 is able to solve geophysical problems. PEU_U05 is able to conduct auto-didactical education related to detailed handling of typical software. Z zakresu kompetencji społecznych: PEU_K02 understands the need to create and transfer to the society – among others by mass media- information and opinions related to mining engineering achievements and other activities of mining engineer; tries to transfer the information in commonly understood way, presenting different points of view; is aware of the quality and need to shape the work safety culture in mining and the responsibility for the health and life of other employees.

TREŚCI PROGRAMOWE		
Forma zajęć - wykład		**Liczba godzin**
Wy1	Physical properties of rocks. Inter-relationships between the various subdisciplines of applied geophysics. Overview of geophysical methods, their physical principles and applications. Methodology of geophysical surveying.	1
Wy2	Engineering problems solved with geophysical surveying. Case studies.	2
Wy3	Electrical resistivity methods. Tomography and VSE. IP method. Physical principles. Equipment. Methods of field surveying. Interpretation and application. Case studies.	2
Wy4	Electromagnetic methods. FDEM and TDEM methods. Magnetotelluric methods. Physical principles. Methods of field surveying. Equipment. Interpretation and application. Case studies.	2
Wy5	GPR surveying. Physical principles. Methods of field surveying.	2

	Equipment. Interpretation and application. Case studies.	
Wy6	Seismic tomography. Seismic interferometry. Physical principles. Applications. Case studies.	2
Wy7	Mine geophysics. Seismology. Seismic methods. Active and passive seismic tomography. Microgravimetry. Case studies.	2
Wy8	Gravity and magnetic surveying. Equipment. Methods of field surveying. Interpretation and application. Case studies.	2
	Suma godzin	**15**

Forma zajęć - projekt		**Liczba godzin**
Pr1	One selected geophysical technique. Fundamentals and equipment. Field surveying	4
Pr2	Processing and interpretation of field data.	3
Pr3	Solving the geophysical problems.	8
	Suma godzin	**15**

STOSOWANE NARZĘDZIA DYDAKTYCZNE
N1.Lecture aided by presentation. N2.Demonstration. N3.Discussion and consultations N3Calculations N5Practical field surveying

OCENA OSIĄGNIĘCIA PRZEDMIOTOWYCH EFEKTÓW UCZENIA SIĘ

Oceny (F – formująca (w trakcie semestru), P – podsumowująca (na koniec semestru)	Numer efektu uczenia się	Sposób oceny osiągnięcia efektu uczenia się
P1	W01-W03	Test related to lecture content. Final grade.
F1	U01-U02, U05	Test. Project 1. Report on Project 1
F2	U03, U05	Test. Project 2. Report on Project 2
F3	U04, U05	Test. Solving geophysical problems
F1-F3, P2	U01-U05 K02	Grades are given for each of three project tasks including tests and reports. The final grade P2 for the project course is the weighted average grade of F1-F3.

LITERATURA PODSTAWOWA I UZUPEŁNIAJĄCA

LITERATURA PODSTAWOWA:

[1] Aki, K., Richards P.G., 1980. Quantitative Seismology: Theory and Methods. W.H. Freeman Co.. San Francisco.

[2] Burger, H.R., Sheehan, A.F., Jones, C.H., 2006. Introduction to Applied Geophysics: Exploring the Shallow Subsurface. W.W. Norton & Company, Inc.

[3] Mendecki, A.J. (ed.), 1997. Seismic Monitoring in Mines. Chapman & Hall.

[4] Reynolds, J.M., 2011. An Introduction to Applied and Environmental Geophysics. Wiley – Blackwell. John Wiley & Sons.

[5] Sharma, Prem V., 2002. Environmental and engineering geophysics. Cambridge University Press.
[6] Torge, W., 1989. Gravimetry. Water de Gruyter. Berlin. New York.
[7] Selected Journal Publications (for example journals: Progress in Geophysics, Engineering Geophysics Journal, Environmental and Engineering Geophysics, Journal of Geophysics and Engineering, Pure and Applied Geophysics).

LITERATURA UZUPEŁNIAJĄCA:

[1] Lowrie, W., 2007. Fundamentals of Geophysics. Cambridge University Press.
[2] Milsom, J., 2003. Field Geophysics. John Wiley & Sons Ltd.
[3] Telford, W.M., Geldart, L.P., Sheriff, R.E., 1990. Applied Geophysics. Cambridge University Press.

OPIEKUN PRZEDMIOTU (IMIĘ, NAZWISKO, ADRES E-MAIL)

ANNA BARBARA GOGOLEWSKA, anna.gogolewska@pwr.edu.pl

Zał. nr 5 do ZW 8/2020
Załącznik nr … do programu studiów

WYDZIAŁ GEOINŻYNIERII, GÓRNICTWA I GEOLOGII

KARTA PRZEDMIOTU

Nazwa przedmiotu w języku polskim: Zintegrowana analiza deformacji w geomechanice…….(zajęcia są prowadzone w języku angielskim)
Nazwa przedmiotu w języku angielskim: Integrated Analysis of Deformations in Geomechanical Engineering
Kierunek studiów (jeśli dotyczy): górnictwo i geologia
Specjalność (jeśli dotyczy): Geomatics for Mineral Resources Management
Poziom i forma studiów: ~~I~~ / II stopień / ~~jednolite studia magisterskie~~*, stacjonarna / ~~niestacjonarna*~~
Rodzaj przedmiotu: ~~obowiązkowy~~ / wybieralny ~~/ ogólnouczelniany~~ *
Kod przedmiotu W06GIG-SM0041G
Grupa kursów ~~TAK~~ / NIE*

	Wykład	Ćwiczenia	Laboratorium	Projekt	Seminarium
Liczba godzin zajęć zorganizowanych w Uczelni (ZZU)	30		30		
Liczba godzin całkowitego nakładu pracy studenta (CNPS)	90		60		
Forma zaliczenia	Egzamin / ~~zaliczenie na ocenę*~~		~~Egzamin~~ / zaliczenie na ocenę*		
Dla grupy kursów zaznaczyć kurs końcowy (X)					
Liczba punktów ECTS	5				
w tym liczba punktów odpowiadająca zajęciom o charakterze praktycznym (P)	3		2		
w tym liczba punktów ECTS odpowiadająca zajęciom wymagającym bezpośredniego udziału nauczycieli lub innych osób prowadzących zajęcia (BU)	2,5		1,5		

*niepotrzebne skreślić

WYMAGANIA WSTĘPNE W ZAKRESIE WIEDZY, UMIEJĘTNOŚCI I KOMPETENCJI SPOŁECZNYCH

1. Podstawowa wiedza z zakresu goemechaniki
2. Podstawową wiedza dotycząca eksploatacji górniczej
3. Podstawowa wiedza monitorowania zmian górotworu

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CELE PRZEDMIOTU

C1 Przedstawienie roli monitorowania w górnictwie zrównoważonym
C2 Przygotowanie i przeprowadzenie analizy deformacji górotworu spowodowanych działalnością górniczą

C3 Przygotowanie i przeprowadzenie analizy deformacji zapór i usypisk ziemnych
C4 Nauczenie zasad modelowania MES
C5 Nabycie umiejętności wykorzystania analizy zintegrowanej wykorzystując modelowanie deterministyczne MES i wyniki pomiarów geodezyjnych i geotechnicznych

PRZEDMIOTOWE EFEKTY UCZENIA SIĘ

Z zakresu wiedzy:
PEU_W01 Potrafi rozróżnić i opisać zastosowania technik monitorowania deformacji w sPEUtrum dyscyplin inżynieryjnych takich jak górnictwo i inżynieria budowlana
PEU_W02 Potrafi scharakteryzować górotwór i metody górnicze
PEU_W03 . Posiada wiedzę z zakresu analiz: empirycznych i deterministycznych z zastosowaniem FEM deformacji górotworu,
PEU_W04 . Posiada wiedzę podstaw i zastosowań analizy zintegrowanej metody deterministycznej z wynikami pomiarów geodezyjnych
PEU_W05 . Potrafi wyznaczyć główne założenia pomiaru geodezyjnego deformacji wywołanych eksploatacja górniczą
PEU_W06 Ma znajomość przygotowania modelu MES
Z zakresu umiejętności:

Z zakresu kompetencji społecznych:
PEU_K01 Potrafi ocenić rolę monitorowania i predykcji w górnictwie zrównoważonym w całym jego cyklu

TREŚCI PROGRAMOWE		
Forma zajęć - wykład		**Liczba godzin**
Wy1	Syllabus, warunki zaliczenia, literatura,	2
Wy2	Wstęp do zintegrowanej analizy deformacji	2
Wy3	Rola monitorowania w górnictwie zrównoważonym	2
Wy4	Opis zjawisk fizycznych: statyka- dynamika , rozchodzenie się ciepła, przepływ cieczy, zmiany siły grawitacji, zastosowania	2
Wy5	Metody analizy deformacji: stosując analizę systemów i mechaniki ciała stałego	2
Wy6	Ogólna klasyfikacja metod monitorowania: absolutne i względne pomiary deformacji,	**2**
Wy7	zalety i wady metod geodezyjnych i geotechniczno-strukturalnych, koncepcja pomiarów zintegrowanych	**2**

Wy8	Mechanika ciała stałego, Problem warunków brzegowych	**2**
Wy9	Rozwiązanie systemu kratownicy - relacja do MES MES	**2**
Wy10	Empiryczne metody wyznaczania deformacji powierzchni wywołanych eksploatacją podziemną (gaz i nafta) i eksploatacją odkrywkową, zastosowanie MES, Kategoria terenu	**2**
Wy11	Przykłady zastosowania integracji : stabilności zboczy w kopalniach odkrywkowych, Chiquqimata, Chile, NevadaUSA	**2**
Wy12	Przykłady zastosowania integracji : deformacja górotworu na terenach podziemnej eksploatacji górniczej w kopalni soli w Kanadzie,	**2**
Wy13	Problemy wydobycia gazu naturalnego i nafty	**2**
Wy14	Podsumowanie	**2**
Wy15	Kolokwium	**2**
	Suma godzin	**30**

Forma zajęć - ćwiczenia		Liczba godzin
Ćw1		
Ćw2		
Ćw3		
Ćw4		
..		
	Suma godzin	

Forma zajęć - laboratorium		Liczba godzin
La1	Przedstawienie zakresu ćwiczeń, warunków zaliczenia oraz literatury.	2
La2	Analiza wpływu obciążenia na górotwór –zastosowanie programu GeoStudio 2007	2
La3	Analiza naprężeń in-situ górotworu i górotworu obciążonego	2
La4	Zaprojektowanie pomiaru geodezyjnego na terenie górniczym prowadzenia podziemnej eksploatacji na podstawie wyników MES. Dyskusja projektu pomiarów.	2
La5	Wyznaczenie kategorii terenu górniczego Dyskusja wyników projektu	2
La6	Zaprojektowanie pomiaru geodezyjnego na terenie kopalni odkrywkowej na podstawie modelu MES . Dyskusja projektu pomiarów.	2
La7	Zaprojektowanie pomiaru geodezyjnego ziemnej zapory wodnej na podstawie modelu MES. Dyskusja analizy	2
La8	Podsumowanie	1
	Suma godzin	15

Forma zajęć - projekt		Liczba godzin
Pr1	Wyznaczenie MES deformacji górotworu spowodowanych eksploatacją podziemną, wyznaczenie kategorii terenu. Analiza sprężysta i nieliniowa . Omowienie monitorowania	6
Pr2	Podsumowanie	1
Pr3	Wyznaczenie MES deformacji usypiska/zapory ziemnej w warunkach zmiennego poziomu wody. Wyznaczenie wspolczynnika bezpieczeństwa stosując oprogramowanie Geostudio. Omowienie monitorowania	6
Pr4	Podsumowanie	2
…		
	Suma godzin	**15**

Forma zajęć - seminarium		Liczba godzin
Se1		
Se2		
Se3		
…		
	Suma godzin	

STOSOWANE NARZĘDZIA DYDAKTYCZNE
N1. Wykład, film N2. N3.

OCENA OSIĄGNIĘCIA PRZEDMIOTOWYCH EFEKTÓW UCZENIA SIĘ

Oceny (F – formująca (w trakcie semestru), P – podsumowująca (na koniec semestru)	Numer efektu uczenia się	Sposób oceny osiągnięcia efektu uczenia się
F1	PEK_U01 – PEK_U06	Oceny z Lab 2-7, projekt 1 i 2.
F2		
F3		
P P PEU_W01 – PEU_W06, Kolokwium , Ocena końcowa z wykładu PEU_U01 – PEU_U06 Ocena końcowa z laboratorium . Średnia ze sprawozdań i projektu		

LITERATURA PODSTAWOWA I UZUPEŁNIAJĄCA
<u>LITERATURA PODSTAWOWA:</u> [1] Szostak-Chrzanowski, A., A. Chrzanowski,(2010), „INTEGETED ANALYSIS OF DEFORMATIONS IN GEOMECHANICS “, UNB, Fredericton, N.B., 220p. **<u>LITERATURA UZUPEŁNIAJĄCA:</u>** 1 Szostak-Chrzanowski, A., A. Chrzanowski, M. Massiera (2005) “Use of deformation monit results in solving geomechanical problems – case studies “, *Engineering Geology,* vol. 7 Issues 1-2, pp. 3-12. 2 Chrzanowski,A. (1993):"Modern Surveying Techniques for Mining and Civil Engineering 33 in: *Comprehensive Rock Engineering,* Pergamon Press,Vol.3.Chapter 33, pp.773-809.
OPIEKUN PRZEDMIOTU (IMIĘ, NAZWISKO, ADRES E-MAIL)
Anna Chrzanowska anna.chrzanowska@pwr.edu.pl

Zał. nr 5 do ZW 8/2020
Załącznik nr … do programu studiów

WYDZIAŁ **Geoinżynierii, Górnictwa i Geologii**

KARTA PRZEDMIOTU

Nazwa przedmiotu w języku polskim Bezpieczeństwo i higiena pracy ….(zajęcia są prowadzone w języku angielskim)
Nazwa przedmiotu w języku angielskim Occupational Health and Safety
Kierunek studiów (jeśli dotyczy): Górnictwo i geologia.
Specjalność (jeśli dotyczy): Mining Engineering
Geotechnical and Environmental Engineering,
Geomatics for Mineral Resource Management
Poziom i forma studiów: II stopień, stacjonarna
Rodzaj przedmiotu: obowiązkowy *
Kod przedmiotu W06GIG-SM0042
Grupa kursów NIE*

	Wykład	Ćwiczenia	Laboratorium	Projekt	Seminarium
Liczba godzin zajęć zorganizowanych w Uczelni (ZZU)	15			15	
Liczba godzin całkowitego nakładu pracy studenta (CNPS)	30			30	
Forma zaliczenia	~~Egzamin /~~ zaliczenie na ocenę*	Egzamin / zaliczenie na ocenę*	Egzamin / zaliczenie na ocenę*	~~Egzamin~~ / zaliczenie na ocenę*	Egzamin / zaliczenie na ocenę*
Dla grupy kursów zaznaczyć kurs końcowy (X)					
Liczba punktów ECTS	**1**			1	
w tym liczba punktów odpowiadająca zajęciom o charakterze praktycznym (P)				1	
w tym liczba punktów ECTS odpowiadająca zajęciom wymagającym bezpośredniego udziału nauczycieli lub innych osób prowadzących zajęcia (BU)	1			1	

*niepotrzebne skreślić

WYMAGANIA WSTĘPNE W ZAKRESIE WIEDZY, UMIEJĘTNOŚCI I KOMPETENCJI SPOŁECZNYCH

1. Possesses basic knowledge of technologies used in open-pit mines and underground mines.
2. Is able to use Microsoft Office environment to prepare documents in Word, multimedia presentations in Power Point and work with Excel spreadsheets.
3. Is able to identify harmful, dangerous and nuisance factors in the workplace environment.

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CELE PRZEDMIOTU

C1. To introduce the principles of occupational risk assessment in accordance with relevant

standards C2 To present the principles of occupational risk assessment and the determination of admissibility with the use of STER software and the RISC SCORE method.

PRZEDMIOTOWE EFEKTY UCZENIA SIĘ

Z zakresu wiedzy:

PEU_W01 Possesses general knowledge of rules of occupational risk assessment formulation

PEU_W02 – Possesses knowledge of evaluating and determining the admissibility of occupational risk.

PEU _W0 3 – Possesses general knowledge of corrective and preventive actions regarding hazards of typical work posts in the mining industry.…

Z zakresu umiejętności:

PEU_U01 Is able to identify hazards of harmful, dangerous and nuisance factors of typical work posts in the mining industry

PEU_U02 Is able to estimate and determine risk acceptability with methods according to STER software and the RISC SCORE method.

PEU_U03 - Is able to plan corrective and preventive actions for hazards of typical work posts in the mining industry.…

Z zakresu kompetencji społecznych:

PEU_K01 - Is able to work in a team and together complete occupational risk assessment and develop its results and the required documentation in the form of a team report

TREŚCI PROGRAMOWE		
Forma zajęć - wykład		**Liczba godzin**
Wy1	Definition of occupational risk. Legal basics of occupational risk assessment. Risk assessment methods. Course of occupational risk assessment. Information necessary for occupational risk assessment. Identification of harmful, dangerous and nuisance factors in the work environment.	3
Wy2	Estimation of occupational risk assessment and determination of admissibility. Corrective and preventive actions. Familiarising employees with the results of occupational risk assessment. Implementation of agreed corrective and preventive actions. Monitoring the effectiveness of implemented actions. Periodic occupational risk assessment. Harmful factors – identification and assessment of risks.	3
Wy3	Dangerous factors - identification and assessment of risks.	3
Wy4	Nuisance factors in occupational risk assessment: psychological burden, static burden, monotype.	3
Wy 5	Methods of occupational risk assessment: STER software, the RISC SCORE method, written test	3
	Suma godzin	**15**

Forma zajęć - ćwiczenia		**Liczba godzin**
Ćw1		
Ćw2		
Ćw3		

Ćw4		
..		
	Suma godzin	

Forma zajęć - laboratorium		Liczba godzin
La1		
La2		
La3		
La4		
La5		
…		
	Suma godzin	

Forma zajęć - projekt		Liczba godzin
Pr1	Occupational risk assessment with the use of STER software for two work posts – description of work post, identification of hazards. Occupational risk assessment with the use of STER software for two work posts – estimation of occupational risk and determination of admissibility of harmful factors (dust, noise)	3
Pr2	Occupational risk assessment with the use of STER software for two work posts – estimation of occupational risk and determination of admissibility of harmful factors (vibration, chemical agents)	3
Pr3	Occupational risk assessment with the use of STER software for two work posts – estimation of occupational risk and determination of admissibility of dangerous factors (slippery or uneven surfaces, falling elements, moving parts, moving machinery and transported bimi items)	3
Pr4	Occupational risk assessment with the use of STER software for two work posts – estimation of occupational risk and determination of admissibility for nuisance factors (psychological burden, static burden, monotype)	3
Pr 5	Occupational risk assessment for a selected work post with the use of the RISC SCORE method, presentation of executed exercises, test	3
	Suma godzin	**15**

Forma zajęć - seminarium		Liczba godzin
Se1		
Se2		
Se3		
…		
	Suma godzin	

STOSOWANE NARZĘDZIA DYDAKTYCZNE
N1. Informative lecture with elements of problematic lectures. N2 Multimedia presentations. N3 Didactic discussions during lectures. N4 Didactic discussions during laboratory classes. N5Computer presentation of executed occupational risk assessments. N6Consultation.

OCENA OSIĄGNIĘCIA PRZEDMIOTOWYCH EFEKTÓW UCZENIA SIĘ

Oceny (F – formująca (w trakcie semestru), P – podsumowująca (na koniec semestru)	Numer efektu uczenia się	Sposób oceny osiągnięcia efektu uczenia się
F1	PEU_W01-W03	grade from a test
F2	PEU_W01-W03 PEU_U01- U03	grade from a presentation
P2	PEU_W01-W03 PEU_U01- U03	final grade from project classes (arithmetic average of F1 and F2)
P		

LITERATURA PODSTAWOWA I UZUPEŁNIAJĄCA

LITERATURA PODSTAWOWA:

[1] Iwona Romanowska Słomka, Adam Słomka Zarządzanie ryzykiem zawodowym. Wydawnictwo TARBONUS, Krakow Tarnobrzeg, 2009

[2] Iwona Romanowska Słomka, Adam Słomka Ocena ryzyka zawodowego. Wydawnictwo TARBONUS, Krakow Tarnobrzeg, 2010

[3] Wiesława Horst Ryzyko zawodowe na stanowisku pracy. Część 1, Ergonomiczne czynniki ryzyka. Wydawnictwo Politechniki Poznańskiej, Poznan, 2004

LITERATURA UZUPEŁNIAJĄCA:

[1] PN-N-18002 Systemy zarządzania bezpieczeństwem i higieną pracy - Ogólne wytyczne do oceny ryzyka zawodowego

[2]

OPIEKUN PRZEDMIOTU (IMIĘ, NAZWISKO, ADRES E-MAIL)

Dr inż. Żaklina Konopacka

Zał. nr 5 do ZW 8/2020
Załącznik nr … do programu studiów

WYDZIAŁ **Geoinżynierii, Górnictwa i Geologii**

KARTA PRZEDMIOTU

Nazwa przedmiotu w języku angielskim: Project Management, Appraisal and Risk Evaluation ….(zajęcia są prowadzone w języku angielskim)

Nazwa przedmiotu w języku polskim :Zarządzanie projektami, ocena ich opłacalności i ryzyka.
Kierunek studiów (jeśli dotyczy): Górnictwo i geologia
Specjalność (jeśli dotyczy): Mining Engineering,
Geotechnical and Environmental Engineering,
Geomatics for Mineral Resource Management
Poziom i forma studiów: II stopień , stacjonarna
Rodzaj przedmiotu: obowiązkowy
Kod przedmiotu W06GIG-SM0039G
Grupa kursów TAK

	Wykład	Ćwiczenia	Laboratorium	Projekt	Seminarium
Liczba godzin zajęć zorganizowanych w Uczelni (ZZU)	15		30	15	
Liczba godzin całkowitego nakładu pracy studenta (CNPS)	30		60	30	
Forma zaliczenia	Egzamin				
Dla grupy kursów zaznaczyć kurs końcowy (X)	X				
Liczba punktów ECTS	4				
w tym liczba punktów odpowiadająca zajęciom o charakterze praktycznym (P)	3				
w tym liczba punktów ECTS odpowiadająca zajęciom wymagającym bezpośredniego udziału nauczycieli lub innych osób prowadzących zajęcia (BU)	3				

*niepotrzebne skreślić

WYMAGANIA WSTĘPNE W ZAKRESIE WIEDZY, UMIEJĘTNOŚCI I KOMPETENCJI SPOŁECZNYCH

1. Knowledge of basic mathematical analysis, probability and statistical models
2. Skills in using Excel spreadsheets
3. Understanding of the need of lifelong learning and the importance of application of Economics, Management and Social Sciences in engineering.

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CELE PRZEDMIOTU

The course combines two groups of topics: basics of mineral economics and financial management and introduction to project management.
Part A: The purpose of the course is

C1 to introduce basic concepts of Microeconomics and financial management
C2 to introduce the concept of time value of money and present the methods used to evaluate investment projects. Different techniques are illustrated by examples and case studies. The range of application as well as the advantages and disadvantages of each method are discussed. The issues of inflation and risk analysis are included.

Part B:
C3 Introduction to project management basic concepts, methods and tools.
C4 Presentation of given project management areas: Project scope management, Project time management, Project cost management, Project risk management. Project planning, scheduling and control using Microsoft Project.
C5 Presentation of the issues of effective communication in project teams, group behaviour and leadership.

PRZEDMIOTOWE EFEKTY UCZENIA SIĘ

Z zakresu wiedzy:
PEU_W01 rozumie pojęcia podaży i popytu, elastyczności popytu i ich wpływ na rynki
PEU_W02 zna pojęcia kosztów w ekonomii i rachunkowości, rozumie różnice
PEU_W03 zna sposoby klasyfikacji kosztów w przedsiębiorstwach, zna i rozumie podstawowe pojęcia rachunku kosztów
PEU_W04 ma podstawową wiedzę o treści i wzajemnych relacjach bilansu, rachunku zysków i strat oraz rachunku przepływów pieniężnych, zna sposób prezentacji danych finansowych przedsiębiorstw w ustawowych sprawozdaniach finansowych i zna ich warianty.
PEU_W05 ma podstawową wiedzę na temat metody analizy wskaźnikowej sprawozdań finansowych
PEU_W06 zna pojęcia wartości przyszłej i wartości obecnej przepływów pieniężnych i rent rocznych
PEU_W07 zna podstawowe i zaawansowane metody oceny efektywności inwestycji (NPV, IRR, MIRR, DPBP, PBP) oraz zakresy ich stosowania
PEU_W08 ma podstawową wiedzę o metodach oceny ryzyka inwestycji

Z zakresu umiejętności:

PEU_U01 potrafi przeprowadzić analizę przyczyn i skutków zmiany popytu i podaży
PEU_U02 na podstawie krzywych kosztowych potrafi przeprowadzić optymalizację wielkości produkcji w różnych przypadkach.
PEU_U03 umie zinterpretować i korzystać z informacji zawartych w ustawowych sprawozdaniach finansowych. Umie przeprowadzić analizę wskaźnikową sprawozdań finansowych w podstawowym zakresie
PEU_U03 umie korzystać z danych kosztowych przedstawionych w różnych układach ewidencyjnych kosztów, umie stosować podstawowe metody rachunkowości zarządczej do podejmowania decyzji krótkoterminowych
PEU_U04 potrafi obliczyć wartość przyszłą i obecną pieniądza dla szeregu płatności oraz rozwiązać zadania rachunkowe z zakresu wartości pieniądza w czasie
PEU_U05 potrafi przeprowadzić ocenę opłacalności inwestycji poznanymi metodami
PEU_U06 potrafi przeprowadzić analizę wrażliwości i analizę scenariuszy z wykorzystaniem modelu finansowego inwestycji
PEU_U07 potrafi przygotować dokumentację projektową w podstawowym zakresie i

zainicjować projekt PEU_U08 potrafi zastosować podstawowe metody zarządzania projektami, monitorowania i zarządzania ryzykiem projektu PEU_U09 potrafi zastosować podstawowe metody zarządzania konfliktami w grupie PEU_U10 potrafi zastosować podstawowe metody zarządzania grupą i kreowania pozycji lidera, potrafi ocenić skuteczność zarządzania grupą <u>Z zakresu kompetencji społecznych:</u> PEU_K01 potrafi myśleć i działać w sposób systemowy, kreatywny i przedsiębiorczy PEU_K02 ma utrwaloną postawę ekonomicznego działania i podejmowania decyzji w oparciu o dostępne informacje finansowe i prognozy

TREŚCI PROGRAMOWE		
Forma zajęć - wykład		**Liczba godzin**
Wy1	Supply and demand, equilibrium price, changes in demand and supply. Stock and commodity markets used by mineral industries	2
Wy2	Costs in economics and in accounting. Cost and money outflow. Relevant cost, incremental cost, marginal cost, alternative cost. Short-term decision making.	2
Wy3	Costs as the subject of cost accounting, different systems of cost accounting Different methods of cost data presentation (by types, divided into direct and indirect costs). Cost allocation	2
Wy4	Variable and fixed costs. Break even point. Cost-volume –profit analysis.	1
Wy5	Basics of financial accounting. Income statement and cash flow statement. Balance sheet. Working capital. Examples of financial statements of mining companies	2
Wy6	Financial ratio analysis. Liquidity, profitability, activity and debt ratios. Financial and operating leverage.	2
Wy7	The concept of time value of money. Computation of future and present value of money by means of spreadsheet functions. Basics of capital budgeting. Evaluation of different methods.	2
Wy8	The concept of risk and return. Quantification of risk. Risk analysis in project evaluation: sensitivity analysis, scenario analysis, other methods.	2
	Suma godzin	15

Forma zajęć - projekt		**Liczba godzin**
Pr 1	Issues of understanding communication: Definitions Models (Schramm model, Berlo's SMCR (source, message, channel, receiver) model, McCroskey model, Reusch and Bateson model, Westley-MacLean model)	3
Pr 2	Conflict Sources of conflicts Kilmann and Thomas classification of conflict Kilmann and Thomas test Different styles of conflict solving Roles of conflict in group development.	3
Pr3	Team roles	3

	Team roles Belbin perspective Discussion group roles Effective managerial behaviour in the context of team roles	
Pr4	Leadership Hersey and Blanchard theory Black and Mouton approach to leadership Fiedler theory and his Least Preferred Coworker Scale Situational leadership self-assessment	3
Pr5	Summary; Effective managerial behaviour from the different contexts.	3
	Suma godzin	15

Forma zajęć - laboratorium		Liczba godzin
Part A		
La1	Supply and Demand curves. Elasticity of demand.	2
La2	Economic costs. Cost curves. Profit maximization cases.	2
La3	Managerial cost accounting. Decision making cases.	2
La4	Basic financial accounting. Creation of simple Balance Sheet, Profit and Loss Statement and Cash Flow Statement	2
La5	Ratio analysis based on financial statements of companies	2
La6	Time value of money and capital budgeting – calculation by means of Excel functions	2
La7	Financial model of an investment. Sensitivity and Scenario analysis.	3
Part B		
La8	Basic concepts (process, project, project management, management by projects, critical factors for project success, competences). Preparing and initiation of the project. Project analysis (project environment, stakeholders, project objectives).	3
La9	Planning and estimating of the project. Project phases and life cycle	3
La10	Project organization. Project scope management. Planning of activities, resources and costs.	3
La11	Project risk management. Project monitoring. Project management methodologies.	3
La12	Quality management. Change control. Project closing.	3
	Suma godzin	**30**

STOSOWANE NARZĘDZIA DYDAKTYCZNE
N1. Wykład interaktywny z pokazem slajdów i dyskusją N2. Ćwiczenia laboratoryjne: indywidualne rozwiązywanie zadań z wykorzystaniem arkusza kalkulacyjnego. N3. Ćwiczenialaboratoryjne: rozwiązywanie zadań w grupach. Prezentacja wyników. Dyskusja o otrzymanych wynikach N4. Konsultacje N5. Praca własna – rozwiązywanie zadań domowych N6. Praca własna – samodzielne studia literaturowe

OCENA OSIĄGNIĘCIA PRZEDMIOTOWYCH EFEKTÓW UCZENIA SIĘ

Oceny (F – formująca (w trakcie semestru), P	Numer efektu uczenia się	Sposób oceny osiągnięcia efektu uczenia się

– podsumowująca (na koniec semestru)		
F1	PEU_W01-W08 PEU_K01-K02	Dyskusja na zajęciach, ocena aktywności studentów na zajęciach laboratoryjnych i projektowych
F2	PEU_U01-U10 PEU_K01-K02	Ocena rozwiązań zadań uzyskanych przez studentów w trakcie zajęć laboratoryjnych i projektowych
P1	PEU_W01-W08 PEU_U01-U10 PEU_K01-K02	Egzamin pisemny
P2	PEU_W01-W08 PEU_U01-U10 PEU_K01-K02	Ocena indywidualnych rozwiązań zadań nadesłanych przez studentów po zajęciach

LITERATURA PODSTAWOWA I UZUPEŁNIAJĄCA

LITERATURA PODSTAWOWA:

1. Erhardt M., Brigham E.: Financial Management Theory and Practice. South-Western Cengage Learning, USA
2. Brigham E.: Podstawy zarządzania finansami. Polskie Wydawnictwo Ekonomiczne, Warszawa 1997
3. Czekaj J., Dresler Z.: Podstawy zarządzania finansami firm. PWN Warszawa 1996
4. Jaruga A., Sobańska J., Kopczyńska L. Szychta A.: *Rachunkowość dla menedżerów*. Towarzystwo Gospodarcze RAFIB, Łódź 1996.
5. Jonson H.: Ocena projektów inwestycyjnych. Maksymalizacja wartości przedsiębiorstwa. Wyd. K.E. Liber, Warszawa 2000.
6. Nowak E.: Rachunek kosztów przedsiębiorstwa. Wydawnictwo Ekspert, Wrocław 2001
7. Sierpińska M., Jachna T.: Ocena przedsiębiorstwa według standardów światowych, PWN Warszawa 1994.
8. Świderska G. K.(red): Rachunkowość zarządcza. (praca zbiorowa) Wyd. Poltext, Warszawa 1997
9. Wysocki Robert K., McGary R., Efektywne zarządzanie projektami, OnePress, 2005
10. Lock Dennis, Podstawy zarządzania projektami, PWE, 2009

LITERATURA UZUPEŁNIAJĄCA:

1. Jajuga K., Jajuga T., 2006. Inwestycje. Instrumenty finansowe, aktywa niefinansowe, ryzyko finansowe, inżynieria finansowe, Wydawnictwo Naukowe PWN, Warszawa.
2. Jonson H.: Koszt kapitału. Klucz do wartości firmy. Wyd. K.E. Liber, Warszawa 2000
3. Turyna J., Pułaska-Turyna B.: Rachunek kosztów i wyników. Wyd. Finans-Servis, Warszawa 1997.
4. A Guide to Project Management Body of Knowledge (PMBOK®Guide Fourth Edition), Project Management Institute, 2008 (2004). wydanie polskie, MT&DC Warszawa, 2009 (2006)

OPIEKUN PRZEDMIOTU (IMIĘ, NAZWISKO, ADRES E-MAIL)

Dr inż. Gabriela Paszkowska, Gabriela.paszkowska@pwr.wroc.pl

WYDZIAŁ GEOINZYNIERII, GÓRNICTWA I GEOLOGII

KARTA PRZEDMIOTU

Nazwa przedmiotu w języku polskim ***Zasady i zastosowania InSAR oraz GIS w górnictwie***
Nazwa przedmiotu w języku angielskim ***Principles and Application of InSAR and GIS in mining***
Kierunek studiów (jeśli dotyczy): Górnictwo i geologia
Specjalność (jeśli dotyczy): ***Geomatics for Mineral Resources Management (Geomatyka w zarządzaniu surowcami mineralnymi)***
Poziom i forma studiów: ~~I~~ / II stopień / ~~jednolite studia magisterskie~~*, stacjonarna / ~~niestacjonarna~~*
Rodzaj przedmiotu: obowiązkowy / ~~wybieralny~~ / ~~ogólnouczelniany~~ *
Kod przedmiotu W06GIG-SM0037
Grupa kursów ~~TAK~~ / NIE*

	Wykład	Ćwiczenia	Laboratorium	Projekt	Seminarium
Liczba godzin zajęć zorganizowanych w Uczelni (ZZU)	30		45		
Liczba godzin całkowitego nakładu pracy studenta (CNPS)	60		90		
Forma zaliczenia	Egzamin / ~~zaliczenie na ocenę*~~		~~Egzamin~~ / zaliczenie na ocenę*		
Dla grupy kursów zaznaczyć kurs końcowy (X)					
Liczba punktów ECTS	2		3		
w tym liczba punktów odpowiadająca zajęciom o charakterze praktycznym (P)			3		
w tym liczba punktów ECTS odpowiadająca zajęciom wymagającym bezpośredniego udziału nauczycieli lub innych osób prowadzących zajęcia (BU)	2		2		

*niepotrzebne skreślić

WYMAGANIA WSTĘPNE W ZAKRESIE WIEDZY, UMIEJĘTNOŚCI I KOMPETENCJI SPOŁECZNYCH

1. Zna podstawy programowania w językach: C++ oraz Python.
2. Ma podstawową wiedzę z zakresu roli narzędzi geoinformacyjnych (GIS) oraz z zakresu technik pozyskiwania danych przestrzennych.
3. Potrafi posługiwać się pakietem oprogramowania GIS
4. Ma podstawową wiedzę z zakresu baz danych

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CELE PRZEDMIOTU

C1 Przedstawienie wiadomości z zakresu satelitarnej interferometrii radarowej, a także możliwości wykorzystania jej w pomiarach deformacji terenu.
C2 Nabycie umiejętności wyznaczania przemieszczeń powierzchni terenu w oparciu o satelitarne dane radarowe.

C3	Przedstawienie wiadomości dotyczących stosowania GIS w zaawansowanej analizie obiektów, zjawisk i procesów zachodzących w przestrzeni	
C4	Nabycie umiejętności formułowania i rozwiązywania zadań z zastosowaniem funkcji analitycznych GIS	
C4	Nabycie umiejętności korzystania z danych i usług danych przestrzennych zgodnie z dyrektywą INSPIRE	

PRZEDMIOTOWE EFEKTY UCZENIA SIĘ

Z zakresu wiedzy:

PEU_W01 Posiada poszerzoną wiedzę w zakresie wykorzystywania systemów geoinformacyjnych do gromadzenia i przetwarzania danych wykorzystywanych w modelowaniu zjawisk i procesów zarówno naturalnych jak i antropogenicznych

PEU_W02 Zna zasady budowy i funkcjonowania systemów geoinformacyjnych w branży górniczej i administracji publicznej

Z zakresu umiejętności:

PEU_U01 Potrafi korzystać z zaawansowanych narzędzi GIS w górnictwie, badaniach zjawisk przyrodniczych, oddziaływaniu górnictwa na otoczenie i zagospodarowaniu przestrzeni,

PEU_U02 Potrafi formułować i rozwiązywać zadania przestrzenne w środowisku GIS

PEU_U03 Potrafi interpretować otrzymane wyniki oraz wyciągać wnioski

Z zakresu kompetencji społecznych:

PEU_K01 Potrafi formułować i przekazać wiedzę na temat wykorzystania systemów geoinformacyjnych w analizach przestrzennych i prezentacji ich wyników

TREŚCI PROGRAMOWE		
Forma zajęć - wykład		**Liczba godzin**
Wy1	Omówienie syllabusu, warunków zaliczenia, literatury	2
Wy2	Wprowadzenie do teorii sygnałów mikrofalowych do obserwacji Ziemi	2
Wy3	Wykorzystanie pasywnej i aktywnej teledetekcji satelitarnej do wyznaczania przemieszczeń powierzchni terenu	2
Wy4	Akwizycja i przetwarzanie danych SAR	2
Wy5	Teoria obrazów SAR (geometryczne właściwości, polaryzacja)	2
Wy6	Podstawy obliczeń danych SAR metodami: DinSAR oraz SBAS	2
Wy7	Wykorzystanie danych SAR w monitorowaniu aktwyności powierzchni terenu (czynniki naturalne i antropogeniczne)	2
Wy8	Usystematyzowanie podstawowych pojęć z zakresu systemów informacji geograficznej	2
Wy9	Modelowanie danych w GIS. Reprezentacja danych przestrzennych. Bazy danych przestrzennych. Stan obecny i trendy rozwojowe	2
Wy10	Metody analiz przestrzennych w GIS	2
Wy11	Interpolacja danych przestrzennych	2
Wy12	Algebra mapy. Analizy powierzchni, funkcje lokalne, funkcje strefowe	2
Wy13	Podstawy statystyki przestrzennej	2
Wy14	Infrastruktury Informacji Przestrzennej. Dyrektywa Inspire. Open data	2
Wy15	Przykłady zastosowań systemów geoinformacyjnych w górnictwie i ochronie środowiska	2
	Suma godzin	**15**

Forma zajęć - laboratorium		Liczba godzin
La1	Konfiguracja środowiska do obliczeń SAR	3
La2	Wprowadzenie do obliczeń danych radarowych – zadania obliczeniowe	6
La3	Pozyskanie danych radarowych oraz obliczenia interferogramu – metoda DInSAR	3
La4	Rozwiniecie fazy interferometrycznej – obliczenia	3
La5	Prezentacja wyników obliczeń danych SAR w środowisku GMT	6
La6	Interpolacja danych dyskretnych. Przygotowanie danych wejściowych do analizy (np. pomiar przemieszczeń powierzchni terenu górniczego)	3
La7	Interpolacja danych dyskretnych. Opracowanie map rozkładu przestrzennego przemieszczeń różnymi metodami interpolacji.	3
La8	Interpolacja danych dyskretnych. Analiza i ocena jakości interpolacji. Mapa prognozy. Opracowanie map zmian zanieczyszczenia pomiędzy dwoma okresami z zastosowaniem kalkulatora rastrowego.	3
La9	Analizy przestrzenne – ocena przydatności terenu pod lokalizację wybranej inwestycji górniczej. Budowa bazy danych przestrzennych kryteriów lokalizacji	3
La10	Analizy przestrzenne – ocena przydatności terenu pod lokalizację Inwestycji górniczej. Wybór procedur i przeprowadzenie operacji analitycznych.	3
La11	Analizy przestrzenne – ocena przydatności terenu pod lokalizację inwestycji górniczej. Opracowanie modelu przetwarzania danych przestrzennych.	3
La12	Analizy przestrzenne – ocena przydatności terenu pod lokalizację inwestycji górniczej. Analiza i interpretacja wyników. Prezentacja graficzna i statystyczna wyników. Geowizualizacja	3
La13	GIS mobilny. Pozyskiwanie danych przestrzennych i atrybutowych w terenie.	3
	Suma godzin	**45**

STOSOWANE NARZĘDZIA DYDAKTYCZNE
N1. Wykład z elementami wykładu problemowego N2. Prezentacje multimedialne N3. Wykonanie indywidualnej pisemnej pracy semestralnej na zadany temat N4. Materiały multimedialne (MOOC) N5. Instrukcje laboratoryjne N6. Wykonanie zadań laboratoryjnych i przygotowanie sprawozdań N7. Konsultacje

OCENA OSIĄGNIĘCIA PRZEDMIOTOWYCH EFEKTÓW UCZENIA SIĘ

Oceny (F – formująca (w trakcie semestru), P – podsumowująca (na koniec semestru)	Numer efektu uczenia się	Sposób oceny osiągnięcia efektu uczenia się
F, P	PEU_W01 – 02 PEU_U01 – 03 PEU_K01	F1 Ocena końcowa z egzaminu w formie pisemnej, F2 Ocena z pisemnej pracy semestralnej, P Ocena końcowa z wykładu (średnia ważona z F1 – 80% oraz F2 - 20%)
F, P	PEU_W01 – 02 PEU_U01 – 03	F3 Ocena z wykonanych zadań i sprawozdań Pisemnych,

	PEU_K01	F4 Ocena ze sprawdzianów pisemnych, P2 Ocena końcowa z laboratorium (średnia ważona z F3 – 80% oraz F4 - 20%)

LITERATURA PODSTAWOWA I UZUPEŁNIAJĄCA

LITERATURA PODSTAWOWA:

[1] Longley P. A., Goodchild M. F., Maguire D. J., Rhind D. 2015: Geographic Information Science and Systems, 4th Edition, John Wiley & Sons;
[2] Maguire D., Batty M., Goodchild M., 2005. GIS Spatial Analysis and Modelling. ESRI Press
[3] Berry J., 2007-2013. Beyond Mapping IV — GIS Modelling
[4] Satellite InSAR Data: Reservoir Monitoring from Space, A. Ferretti, EAGE; 1st edition, 2014
[5] GMTSAR: An InSAR Processing System Based on Generic Mapping Tools (Second Edition), D. Sandwell i in., Scripps Institution of Oceanography, University of California, San Diego, La Jolla, CA, USA, 2016
[6] InSAR Principles - Guidelines for SAR Interferometry Processing and Interpretation, ESA Publications, 2008

LITERATURA UZUPEŁNIAJĄCA:

[1] Directive 2007/2/EC of the European Parliament and of the Council of 14 March 2007 establishing an Infrastructure for Spatial Information in the European Community (INSPIRE)
[2] Kennedy M., 2009: Introducing Geographic Information Systems with ArcGIS: A Workbook Approach to Learning GIS, Second Edition, John Wiley and Sons;
[3] Longley P. A., Goodchild M. F., Maguire D. J., Rhind D. W., 2006. GIS. Teoria i praktyka. Wydawnictwo Naukowe PWN, Warszawa
[4] Urbański J., 2010. GIS w badaniach przyrodniczych, Wydawnictwo Uniwersytetu Gdańskiego
[5] Dokumentacja środowiska GMT (Generic Mapping Tools) - http://gmt.soest.hawaii.edu/projects/gmt/wiki/Documentation

OPIEKUN PRZEDMIOTU (IMIĘ, NAZWISKO, ADRES E-MAIL)

Wojciech Milczarek, wojciech.milczarek@pwr.edu.pl
Jan Blachowski, jan.blachowski@pwr.edu.pl

Semestr 2

Montanuniversitaet Leoben

Mine Surveying Project Study

Course Nb	200.032
ECTS	4,5
Type	Project Work
Offering period	Wintersemester
Lecturer	Mayer, Pilgram
Course description	
Content	• Project study on various topics in the field of Mine Surveying and Mining Subsidence Engineering
Previous knowledge expected	• Good English skills (Minimum: CEF Level B1) • Successful completion of the courses o Applied Geodesy (200.199) o Applied Geodesy Practical (200.200) o Engineering Surveying (200.201) o Engineering Surveying Practical (200.202) o Pre-Calculation of Ground Movements (200.028)
Objective (expected results of study and acquired competences)	On completion of this course the participants shall be able to: • Structure the project, define the sequence with milestones and form working groups • Combine interdisciplinary knowledge from mine surveying and mining subsidence engineering on a practical topic
Languages of instruction	English
Teaching and learning method (delivery of skills) workload for students	Practical teamwork

Further information	
Recommended reading	Ghilani, C. D., Wolf, P., Elementary Surveying Kratzsch, H.: Bergschadenkunde, ISBN 3-00-001661-9 Kratzsch, H.: Mining Subsidence Engineering, ISBN 0-387-11930-2 Möser, Müller, Schlemmer, Werner: Handbuch Ingenieurgeodäsie- Grundlagen; 3.Auflage; ISBN 3-87907-293-0 Torge, W., Müller, J.: Geodesy; 4th edition; ISBN 978-3-11-020718-7
Note	The assessment methods and the compulsory readings of this course will be announced in detail in the first lecture. The latest version of the lecture notes will be uploaded at the beginning of the semester.
Study Program	
Master program	Mining and Tunneling Specialty 1 "Mining" / Systems Engineering and Open Pit Mining
Type	Compulsory subject

Mining Subsidence Engineering

Course Nb	200.045
ECTS	3
Type	Lecture
Offering period	Wintersemester
Lecturer	Pilgram
Course description	
Content	• Legal issues applied to mining subsidence engineering especially the pre-calculation of ground subsidence • The dynamics of ground movement and the critical areas of extraction in a subsidence trough after Lehmann • Calculation of trough components • Some varieties of calculation procedure • Measures to reduce mining damage • The components of ground movement • The time factor • Mining damage above ground • Compensation of subsidence damage • The calculation of diminished value
Previous knowledge expected	• Good English skills (Minimum: CEF Level B1)
Objective (expected results of study and acquired competences)	On completion of this course the participants shall be able to: • plan, implement and evaluate the pre-calculation of Ground Movements with some simple different methods. • plan, assemble and analyze deformation profiles and monitoring networks of ground movements

	• know the basics about the legal relationship between mining and land ownership • calculate the diminished value • plan and implement measures to reduce mining damage • share the costs for damage from two or more mines.
Languages of instruction	English
Teaching and learning method (delivery of skills) workload for students	Lectures Active participation, discussions Practical examples
Further information	
Recommended reading	Kratzsch, H.: Bergschadenkunde, ISBN 3-00-001661-9 Kratzsch, H.: Mining Subsidence Engineering, ISBN 0-387-11930-2 Pilgram, R.: Lehrbehelf zur Vorausberechnung von Bodenbewegungen, The Precalculation of Ground Subsidence, Chair of Mining, Montanuniversitaet Leoben
Note	The assessment methods and the compulsory readings of this course will be announced in detail in the first lecture. The latest version of the lecture notes will be uploaded at the beginning of the semester.
Study Program	
Master program **Type**	Mining and Tunneling Specialty 1 "Mining" / Rock Mechanics, Systems Engineering und Underground Mining Compulsory subject

Risk Management in Mines

Course Nb	200.145
ECTS	1,5
Type	Lecture
Offering period	Wintersemester
Lecturer	Wagner
Course description	
Content	• Introduction into the objectives and methods of risk management in mines • Definitions: hazard, risk, damage, severity number, risk number • Types of risks in mining: safety, human, geological, technical, economic, contractual, political, time, environmental • Safety risk-safety statistics • Acceptable and tolerable risks • Methods of risk identification: brain storming, risk check lists, expert risk evaluation • Methods of risk analysis: Regression and correlation analysis, probabilistic event analysis, fault tree analysis, Delphi-method, Monte Carlo simulation, scenario building • Risk classification: risk matrix-severity and probability; risk register • Risk treatment: eliminate • Monitoring: physical, environmental, financial, human • Human factor in risk management

Previous knowledge expected	• Good English skills (Minimum: CEF Level B1) • Proven knowledge of mining engineering (Bachelor in Mineral Resources Engineering, examination in major mining engineering subjects) • In case these are missing the student has to pass an entrance test at the beginning of the course with the following contents: o Surface and underground mining methods o Mining equipment o Mine ventilation o Geology
Objective (expected results of study and acquired competences)	On completion of this course the participants shall be able to: • Have an appreciation of the inherent risks in mining • Have skills to identify and quantify mining risks • Know the risk management process with the emphasis on mining risks • Know risk analysis and evaluation techniques • Know about basic capabilities to perform risk assessment and management in mines.
Languages of instruction	English
Teaching and learning method (delivery of skills) workload for students	Lectures Active participation and discussion
Examination	Oral examination
Further information	
Recommended reading	Hartman, h. L. and Mutmansky, J. M. (2002): Introductory Mining Engineering, John Wiley &Sons Inc., 570 pp.

	ISO 3100- Risk Management. Intern. Standards Organization Wagner, H. (2001): Die Besonderheiten des Risikomanagements im Bergbau. Berg- und Hüttenmännische Monatshefte, BHM., 146 Jg., Springerverlag Wien, S.37-41.
Note	The assessment methods and the compulsory readings of this course will be announced in detail in the first lecture. The latest version of the lecture notes will be uploaded at the beginning of the semester.
	Study Program
Master program	Mining and Tunnelling Specialty 1 "Mining" / Elective Subjects
Type	Compulsory subject
Master program	Mining and Tunneling Specialty 3 "Raw Materials and Energy Systems" / Restricted Electives
Type	Compulsory subject
Master program	International Master of Science in Advanced Mineral Resources Development Restricted Electives
Type	Elective subject

Spatial Planning

Course Nb	200.177
ECTS	1,25
Type	Lecture / Practical
Offering period	Wintersemester
Lecturer	Pilgram
Course description	
Content	• Functional and Legal Spatial Planning • Overview of the levels and planning instruments of Spatial Planning in Austria • How to use these planning tools • How and where can I get information about sources of data and accuracy of these data • Data sets and services of the Austrian provinces for free of use based on the principles of Open Data • Spatial Planning tasks associated with Mining License Procedures • Reorganization of Land • Cadaster and Land registration
Previous knowledge expected	• Good English skills (Minimum: CEF Level B1)
Objective (expected results of study and acquired competences)	On completion of this course the participants shall be able to: • Use the basics of Functional and Legal Spatial Planning • Use the planning instruments of Spatial Planning in Austria, the countries and Planning Tools of the regions and urbans • Know how and where to get information about sources of data and accuracy of these data

	• Use data sets and services of the Austrian Provinces • Use Spatial Planning Tasks associated with Mining License Procedures • Know about reorganization of land • Know about cadaster and land registration
Languages of instruction	English
Teaching and learning method (delivery of skills) workload for students	Lectures Active participation, discussions
Further information	
Note	The assessment methods and the compulsory readings of this course will be announced in detail in the first lecture. The latest version of the lecture notes will be uploaded at the beginning of the semester.
Study Program	
Master program	Mining and Tunneling Specialty 1 "Mining" / Elective Subjects
Type	Compulsory subject

Underground Mining

Course Nb	200.036
ECTS	4,5
Type	Lecture
Offering period	Wintersemester
Lecturer	Moser P.
Course description	
Content	• Underground mining methods. • Mine development. • Stoping methods for tabular deposits. • Rock Mechanic design of room and pillar system. • Pillar extraction mining. • Longwall mining. • Cut and fill mining methods. • Shrinkage stoping. • Open stoping. • Caving methods • Backfill
Previous knowledge expected	• Good English skills (Minimum: CEF Level B1) • Sustainable knowledge in the following fields - successful completion of the following lectures: o Mining Rock Mechanics (200.179) o Basics of Excavation Engineering (200.054)
Objective (expected results of study and acquired competences)	On completion of this course the participant should be able to -on the basis of a practical (deposit) example-: • Design the access to the deposit • Develop a mining method

	• Discuss the geotechnical requirements and implications of different mining methods • Join together and combine all his acquired knowledge (systems thinking)!!
Languages of instruction	English
Teaching and learning method (delivery of skills) workload for students	• Lectures • Active participation and discussion.
Further information	
Recommended reading	Brady, B.H.G. and Brown, E.T.; Rock mechanics for underground mining; 3rd Ed., 2004 Cernica, J.; Soil Mechanics; 1995 Hustrulid: Underground mining methods. 200 Potvin, Y.; Thomas, E.; Handbook in Mine Fill; 2005
Note	The assessment methods and the compulsory readings of this course will be announced in detail in the first lecture. The latest version of the lecture notes will be uploaded at the beginning of the semester.
Study Program	
Master program	Mining and Tunneling Specialty 1 "Mining" / Rock Mechanics, Excavation Engineering und Underground Mining
Type	Compulsory subject
Master program	Mining and Tunneling Specialty 3 "Raw Materials and Energy Systems" / Raw Materials
Type	Compulsory subject
Master program	International Master of Science in Advanced Mineral Resources Development Restricted Elective Subjects
Type	Elective subject

3-rd Semester

Semestr 3

Montanuniversitaet Leoben

Environmental Aspects of Mineral Extraction

Course Nb	200.058
ECTS	3
Type	Lecture
Offering period	Summersemester
Lecturer	Tscharf
Course description	
Content	This course provides a comprehensive outline and understanding on the impacts that mineral extraction may have on society and environment. The unit covers 7 broad areas • Mining, sustainability and ethical responsibilities • Impacts of mining projects on atmospheric environment • Impacts of mining projects on terrestrial environment • Impacts of mining projects on aquatic environment • Impacts of mining projects on social values • Site reclamation and mine closure • Environmental Impact Assessment (EIA)
Previous knowledge expected	• Good English skills (Minimum: CEF Level B1) • Basics of Open Pit Mining (200.061) • Basics of Underground Mining (200.180)
Objective (expected results of study and acquired competences)	The students should become familiar and be capable of demonstrating an understanding with the environmental and social aspects associated with mining projects as well as environmental impact assessment processes (EIA) in Austria,

	Europe and Overseas. On completion of this course the participants shall be able to • Describe the principles of mining and sustainable development in context with ethical responsibilities • Identify, analyze and understand the major impacts of mining projects in atmospheric, terrestrial and aquatic environments • Describe the major issues associated with social/community impacts of mining projects • Discuss the aspects of site reclamation and mine closure in context with the prevention of environmental impacts for decades after mining ceases • Describe the purpose and the stages of the EIA process
Languages of instruction	English
Teaching and learning method (delivery of skills) workload for students	Lecture Active participation, discussions
Further information	
Recommended reading	Azcue, J. M., Ed.: Environmental impacts of mining activities. Springer, 1999. Environmental Law Alliance Worldwide (ELAW): Guidebook for Evaluation Mining Project EIAs, 1st edition, 2010 Evans, A.M.: An introduction to economic geology and its environmental impact. Blackwell Science Ltd, 1997.

	Sengupta, M.: Environmental impacts of mining – monitoring, restoration and control. Lewis Publishers, 1993. Wagner, H. et al.: Umweltauswirkungen der Rohstoffgewinnung. Montanuniversitaet Leoben, 2006.
Note	The assessment methods and the compulsory readings of this course will be announced in detail in the first lecture. The latest version of the lecture notes will be uploaded at the beginning of the semester.
	Study Program
Master program	Mining and Tunneling Specialty 1 "Mining" / Rock Mechanics, Excavation Engineering und Underground Mining
Type	Compulsory subject
Master program	Mining and Tunneling Specialty 3 "Raw Materials and Energy Systems" /
Type	Restricted Electives Compulsory subject

Applied Geodesy

Course Nb	200.199
ECTS	3
Type	Lecture
Offering period	Summersemester
Lecturer	Mayer, Pilgram
Course description	
Content	• Theory of errors in observations and adjustments; method of least squares • Reference and mapping systems • Methods of precise surveying • Gyroscopic surveying • Methods of 3D positioning
Previous knowledge expected	• Good English skills (Minimum: CEF Level B1) • Sustainable knowledge in the field of surveying. • At the beginning of the course the students have to pass an entrance test with the following contents: o Implementation and evaluation of an angle measurement with a theodolite o Calculation of the 1st and 2nd main task of geodesy o Planning, implementation and calculation of a traverse o Planning, implementation and calculation of a levelling o Coordinate and mapping systems in geodesy and reference systems for position and height measurements

Objective (expected results of study and acquired competences)	On completion of this course the participants shall be able to • Detect and adjust errors in surveying • Apply reference and mapping systems including calculations • Plan, implement and evaluate precise surveying methods for distance measurements, angle measurements and levelling • Plan, implement and evaluate measurements with gyrotheodolites • Apply 3D positioning methods such as traversing, GNSS-surveying, free positioning, reverse cut and forward cut
Languages of instruction	English
Teaching and learning method (delivery of skills) workload for students	Lectures Active participation and discussion
Further information	
Recommended reading	Ghilani, C. D. and Wolf, P. R., Elementary Surveying
Note	The assessment methods and the compulsory readings of this course will be announced in detail in the first lecture. The latest version of the lecture notes will be uploaded at the beginning of the semester.
Study Program	
Master program **Type**	Mining and Tunneling Specialty 1 „Mining" – Elective Subjects Compulsory subject

Applied Geodesy (Practical)

Course Nb	200.200
ECTS	2
Type	Practical
Offering period	Summersemester
Lecturer	Mayer, Pilgram
Course description	
Content	• See Applied Geodesy (200.199)
Previous knowledge expected	• Good English skills (Minimum: CEF Level B1) • Sustainable knowledge in the field of surveying. • At the beginning of the course the students have to pass an entrance test with the following contents: o Implementation and evaluation of an angle measurement with a theodolite o Calculation of the 1st and 2nd main task of geodesy o Planning, implementation and calculation of a traverse o Planning, implementation and calculation of a levelling o Coordinate and mapping systems in geodesy and reference systems for position and height measurements
Objective (expected results of study and acquired competences)	• See Applied Geodesy (200.199)
Languages of instruction	English

Teaching and learning method (delivery of skills) workload for students	Practical exercises
Further information	
Recommended reading	Ghilani, C. D., Wolf, P. R.: Elementary Surveying
Note	This Practical can only be enrolled together with the lecture Applied Geodesy (200.199)! The assessment methods and the compulsory readings of this course will be announced in detail in the first lecture. The latest version of the lecture notes will be uploaded at the beginning of the semester.
Study Program	
Master program **Type**	Mining and Tunneling Specialty1 „Mining" – Elective Subjects Compulsory subject