Zał. Nr 1 do ZW 78/2023

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 (3 semesters)

FORM OF STUDIES: full-time studies

PROFILE: general academic

LANGUAGE OF STUDY: English

Content:

In effect since .2023/2024

Zał. Nr 2 do ZW 78/2023
Attachment no. 1. to the Program of Studies

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 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	P7S_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 Geology**

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

LANGUAGE OF STUDY: English

SPECIALIZATION: **Mineral Resources Exploration - Track Lulea**

Zał. nr 3 do ZW 78/2023

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: 3	*1.2 Total number of ECTS points necessary to complete studies at a given level: 90*
1.3 Total number of hours: 1035	*1.4 Prerequisites (particularly for second-level studies): Bachelor of Science in Engineering diploma, interview*
1.5 Upon completion of studies graduate obtains *professional degree of: **magister inżynier** - 2nd degree qualifications*	*1.6 Graduate profile, employability:* *The program will train T-shaped earth science specialists having a strong background in classical disciplines of geology and geophysics complemented with modern 3D modelling as well as data processing and interpretation skills, while the boundary-crossing competences will cover skills in innovative mineral exploration techniques and technologies used in the field, in laboratories, in an underground and underwater environment. Students will also be trained in sustainability, social responsibility and social licence to operate. T-shaped mineral explorers will use Industry 4.0-derived tools and methods for mineral resource exploration, mentored by experts.* *They will be prepared to work in enterprises, technical supervision institutions, public state and local administration, in research and development organisations, in Poland and*

	abroad, will also be prepared to start own business or work as free lanced exploration geologists. The graduates will be able to use English freely and will be prepared to work in an international environment and intercultural groups during their 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 study programs of all specializations within the field of study Mining and Geology respond to the strategic goals of the University (Strategia Politechniki Wrocławskiej 2023–2030), by rising the level of correlation of the study offer with the needs of the market (C3), by enhancing the quality of education through didactic interdisciplinarity and by cooperation with industrial partners as well as increasing the level of entrepreneurship, creativity and involvement of students in research processes (C4, C2). Graduates of the faculty should be creative, professional, have theoretical background and practical abilities, as well as have interpersonal skills and cross-cultural experience (C5).* *The Faculty of Geoengineering, Mining and Geology, as one of the units of the Wrocław University of Science and Technology, educates in the field of engineering, broadened by knowledge in natural and economic sciences. The profile and quality of education are at the international level and are adapted to the needs of the national and global mineral industries.*

[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 classes – after the letter E or Z - enter in brackets the final subject form (lec, cl, lab, pr, sem)
[4]University-wide subject /group of classes – 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 subject / group of classes – 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) 62 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 classes – after the letter E or Z - enter in brackets the final subject form (lec, cl, lab, pr, sem)
[4]University-wide subject /group of classes – 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) **49,3 ECTS**

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

Number of ECTS points for obligatory subjects	6
Number of ECTS points for optional subjects	0
Total number of ECTS points	6

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	24
Number of ECTS points for optional subjects	42,5
Total number of ECTS points	65,5

[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 classes – after the letter E or Z - enter in brackets the final subject form (lec, cl, lab, pr, sem)
[4]University-wide subject /group of classes – 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 subject / group of classes – 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)

54 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 classes – after the letter E or Z - enter in brackets the final subject form (lec, cl, lab, pr, sem)
[4]University-wide subject /group of classes – 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 subject / group of classes – 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 *(7 ECTS points):*

No.	Subject/ group of classes code	Name of subject/group of classes (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	Subject/group of classes			
			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-SM3003G	Project Management, Appraisal and Risk Evaluation (GK)	1		2	1		K2_GIG_W03,W05,W11 K2_GIG_U04,U06,U08,U15 K2_GIG_K01	60	100	4	4	3,1	T/Z(w)	E(w), Z(l,p)		DN	P (3)	KO
2	W06GIG-SM3000W	Operations Research	1					K2_GIG_W06 K2_GIG_U10,U14 K2_GIG_K01	15	25	1	1	0,8	T /Z	Z		DN		KO
3	W06GIG-SM3000L	Operations Research			1				15	50	2	2	0,7	T	Z		DN	P (2)	KO
		Total	**2**	**0**	**3**	**1**	**0**		**90**	**175**	**7**	**7**	**4,6**					**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**	**175**	**7**	**7**	**4,6**

[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 classes – after the letter E or Z - enter in brackets the final subject form (lec, cl, lab, pr, sem)
[4]University-wide subject /group of classes – 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 subject / group of classes – 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.	Subject/ group of classes code	Name of subject/group of classes (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	Subject/group of classes			
			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-SM3002W	Computer Aided Geological Modelling & Geostatistics (część: Geostatistics)	1					K2_GIG_W06,W08,W15 K2_GIG_U04,U08,U14	15	50	2		0,8	T	Z				PD
2	W06GIG-SM3002L	Computer Aided Geological Modelling & Geostatistics (część: Geostatistics)			1				15	25	1		0,6	T	Z			P (1)	PD
		Total	**1**	**0**	**1**	**0**	**0**		**30**	**75**	**3**		**1,4**					**1**	

4.1.2.3 *Physics block*

No.	Subject/ group of classes code	Name of subject/group of classes (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	Subject/group of classes			
			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-SM3004W	Engineering Geophysics	1					K2_GIG_W02,W08,W10 K2_GIG_U04,U13	15	25	1	1	0,8	T /Z	Z		DN		PD
2	W06GIG-SM3004P	Engineering Geophysics				1			15	50	2	2	0,9	T	Z		DN	P(2)	PD
		Total	**2**	**0**	**0**	**0**	**0**		**30**	**75**	**3**	**3**	**1,7**					**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**	**150**	**6**	**3**	**3,1**

[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 classes – after the letter E or Z - enter in brackets the final subject form (lec, cl, lab, pr, sem)
[4]University-wide subject /group of classes – 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 subject / group of classes – 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.	Subject/ group of classes code	Name of subject/group of classes (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	Subject/group of classes			
			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-SM3002L	Computer Aided Geological Modelling & Geostatistics (Część: Computer Aided Geological Modelling)			2			K2_GIG_W06,W08,W15 K2_GIG_U04,U08,U14	30	50	2	2	1,3	T	Z		DN	P(2)	K
2	W06GIG-SM3006W	Digital Mine	1					K2_GIG_W07,W12,W18,W19 K2_GIG_U04,U07,U08	15	25	1	1	0,8	T /Z(w)	Z		DN		K
3	W06GIG-SM3006L	Digital Mine			1				15	25	1	1	0,8	T	Z		DN	P(1)	K
4	W06GIG-SM3005W	Occupational Health and Safety	1					K2_GIG_W11,W12,W14,W17 K2_GIG_U11, K2_GIG_K02, K03	15	25	1	1	0,7	T /Z(w)	Z		DN		K
5	W06GIG-SM3005P	Occupational Health and Safety				1			15	25	1	1	0,8	T	Z		DN	P(1)	K
6	W06GIG-SM3007W	Principles and Application of InSAR and GIS in mining	2					K2_GIG_W15,W16,W18 K2_GIG_U04,U07,U08	30	50	2	2	1,4	T/Z(w)	E		DN		K
7	W06GIG-SM3007L	Principles and Application of InSAR and GIS in mining			3				45	75	3	3	2,0	T	Z		DN	P(3)	K
8	W06GIG-SM3001W	Environmental Management	2					K2_GIG_W04,W12,W13,W18 K2_GIG_U05,U10,U11,U12 K2_GIG_K02,K03	30	50	2	2	1,3	T /Z(w)	Z		DN		K
9	W06GIG-SM3001S	Environmental Management					1		15	25	1	1	0,8	T	Z		DN	P(1)	K
10	W06GIG-SM3012G	Exploration Entrepreneurship GK	1			1	2	K2_GIG_W03,W05,W09 K2_GIG_U08,U09 K2_GIG_K01,K02,K03	60	100	4		3,0	Z	Z			P(3)	S
11	W06GIG-SM3013P	SOC Internship				2		K2_GIG_W05,W09 K2_GIG_U08,U09 K2_GIG_K01,K02,K03	30	50	2		1,5	T	Z			P(2)	S
12	W06GIG-SM3016P	Applied Field Exploration				3		K2_GIG_W08,W15 K2_GIG_U04,U09,U10,U13 K2_GIG_K02	45	75	3	1	2,1	T	Z		DN	P(3)	S
		Total	**7**	**0**	**6**	**7**	**3**		**345**	**575**	**23**	**15**	**16,5**					**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 classes – after the letter E or Z - enter in brackets the final subject form (lec, cl, lab, pr, sem)
[4]University-wide subject /group of classes – 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 subject / group of classes – 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 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	**0**	**6**	**7**	**3**	**345**	**575**	**23**	**15**	**16,5**

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.	Subject/ group of classes code	Name of subject/group of classes (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	Subject/group of classes			
			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 1		3				K2_GIG_ U03	45	60	2		1,6	T	Z	O		P (2)	KO
2	SJO-SM0004	Foreign Language 2		1				K2_GIG_U01,U02	15	30	1		0,6	T	Z	O		P(1)	KO
		Total	**0**	**4**	**0**	**0**	**0**		**60**	**90**	**3**		**2,2**					**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**	**2,2**

[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 classes – after the letter E or Z - enter in brackets the final subject form (lec, cl, lab, pr, sem)
[4]University-wide subject /group of classes – 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 subject / group of classes – 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 *(30 ECTS points):*

No.	Subject/ group of classes code	Name of subject/group of classes (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	Subject/group of classes			
			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-SM3011P	Senior design project in ore geology				8		K2_GIG_W01, K2_GIG_U08,U10,U13 K2_GIG_K01,K03	120	187,5	7,5	3	5,3	T /Z	Z		DN	P(7,5)	S
2	W06GIG-SM3008G	Exploration GK	5			2		K2_GIG_W02,W07,W08,W10,W11, W14 K2_GIG_U08,U10,U13,U15 K2_GIG_K01,K03	105	187,5	7,5	3	4,8	T /Z(w)	E, Z		DN	P(3)	S
3	W06GIG-SM3009G	Geochemical exploration GK	3			4		K2_GIG_W02,W07,W08, W10, W14 K2_GIG_U08,U10 K2_GIG_K03	105	187,5	7,5	5	4,8	T /Z(w)	E, Z		DN	P(4)	S
4	W06GIG-SM3010G	Mining geology GK	4			4		K2_GIG_W03,W05,W07,W08,W10, W14,W15,W16,W18 K2_GIG_U04,U06,U10,U13,U15 K2_GIG_K01,K02,K03	120	187,5	7,5	5	5,4	T /Z(w)	E, Z		DN	P(4)	K
		Total	**12**	**0**	**0**	**18**	**0**		**450**	**750**	**30**	**16**	**20,3**					**18,5**	

4.2.4.2 *Diploma (e.g. diploma profile)* block *(21 ECTS points):*

No.	Subject/ group of classes code	Name of subject/group of classes (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	Subject/group of classes			
			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-SM3014S	Diploma Seminar					1	K2_GIG_W01 K2_GIG_U01,U13 K2_GIG_K03	15	25	1	1	0,8	T	Z		DN	P(1)	S
2	W06GIG-SM3015D	Master Thesis				1		K2_GIG_W01,W05,W10 K2_GIG_U01,U04, U08,U10,U13,U15 K2_GIG_K01,K03	15	500	20	20	1,8	T	Z		DN	P (20)	S
		Total	**0**	**0**	**0**	**1**	**1**		**30**	**525**	**21**	**21**	**2,6**					**21**	

[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 classes – after the letter E or Z - enter in brackets the final subject form (lec, cl, lab, pr, sem)
[4]University-wide subject /group of classes – 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 subject / group of classes – 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 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					
12	**0**	**0**	**19**	**1**	**480**	**1275**	**51**	**37**	**22,9**

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**
	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	**20**	**W06GIG-SM3015D**
Character of diploma dissertation		
Literature survey, project, computer program, etc.		
Number of BU[1] ECTS points	**1,8**	

[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 classes – after the letter E or Z - enter in brackets the final subject form (lec, cl, lab, pr, sem)
[4]University-wide subject /group of classes – 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 subject / group of classes – 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

Form 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. Occupational risk assessment methods. Identification of harmful, dangerous and nuisance factors in the work environment.
2. Costs as the subject of cost accounting. Variable and fixed costs. Break even point.
3. Capital budgeting, evaluation of different methods
4. Liquidity vs profitability of a company. Ways of their evaluation
5. Environmental management systems
6. Characteristics of hazards for the natural environment resulting from human activities
7. Variogram and methods of its modelling
8. Kriging, its properties and types
9. Geophysical methods of exploration and identification of deposits.
10. Surface seismic methods. Reflective and refractive seismics.
11. Computer aided exploration and identification of deposits.
12. Decision models used in management.
13. Geological and geochemical exploration methods
14. Factors controlling metal prices and long-term trends in exploration and ore extraction.
15. Strategies for selecting target areas in exploration and the importance of local conditions
16. Cut-off theory and its effect on size and grade of mineral resources
17. Different drilling methods, logging and sampling of drill cores

[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 classes – after the letter E or Z - enter in brackets the final subject form (lec, cl, lab, pr, sem)
[4]University-wide subject /group of classes – 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 subject / group of classes – 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

18. The modifying factors which affect conversion of mineral resources to mineral reserves
19. The importance of different strategies for grade control and mine mapping in operating mines
20. Basic geochemical processes that control geochemical anomalies and their application during exploration
21. Mobility of elements at the Earth surface. Ion exchange and sorption
22. Advances of technology & methods of future mining operations.
23. Aims, benefits, drawbacks of automation and industrial revolutions.
24. Applications of Interferometric Synthetic Aperture Radar.
25. Applications of map algebra and spatial statistics to determine surface deformation models.
26. Sedimentary environments
27. Rock-forming processes
28. Characteristic of a selected minerals group
29. Plate tectonics and large scale structures
30. Water management issues
31. Sustainability and protection of groundwater
32. Vulnerability of groundwater
33. Laws and regulations related to exploration and exploitation of minerals / water

[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 classes – after the letter E or Z - enter in brackets the final subject form (lec, cl, lab, pr, sem)
[4]University-wide subject /group of classes – 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 subject / group of classes – 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.	Subject / group of classes code	Name of subject / group of classes	Crediting by deadline of... (number of semester)
1	W06GIG-SM3003G	Principles and Application of InSAR and GIS in mining	1-3
2	W06GIG-SM3002	Computer Aided Geological Modelling & Geostatistics	1-3
3	W06GIG-SM3003G	Project Management, Appraisal and Risk Evaluation	1-3
4	W06GIG-SM3004	Engineering Geophysics	1-3
5	W06GIG-SM3001	Environmental Management	1-3
6	W06GIG-SM3005	Occupational Health and Safety	1-3
7	SJO-SM0003	Foreign language 1	1-3
8	SJO-SM0004	Foreign language 2	1-3
9	W06GIG-SM3006	Digital Mine	1-3
10	W06GIG-SM3000	Operations Research	1-3
11	W06GIG-SM3011P	Senior design project in ore geology	2-3
12	W06GIG-SM3008G	Exploration	2-3
13	W06GIG-SM3010G	Mining geology	2-3
14	W06GIG-SM3009G	Geochemical exploration	2-3
15	W06GIG-SM3012G	Exploration Entrepreneurship	1-3
16	W06GIG-SM3013P	SOC Internship	1-3
17	W06GIG-SM3016P	Applied Field Exploration	1-3
18	W06GIG-SM3015D	Master Thesis	3
19	W06GIG-SM3014S	Diploma Seminar	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 classes – after the letter E or Z - enter in brackets the final subject form (lec, cl, lab, pr, sem)
[4]University-wide subject /group of classes – 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 subject / group of classes – 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
WYDZIAŁ GEOINŻYNIERII
GÓRNICTWA I GEOLOGII
Samorząd Studencki Wydziału Geoinżynierii,
Górnictwa i Geologii
50-421 Wrocław, Na Grobli 15, pokój 370

Jakub Dobrzański

Jakub Dobrzański
Chairman of the Student Government
of the Faculty of Geoengineering, Mining and Geology

28.09.23
Date

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

28.09.23
Date

DZIEKAN
prof. dr hab. inż. Radosław Zimroz

.....
Dean's signature

Zał. nr 4 do ZW 78/2023
Attachment no. 3 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: Mineral Resources Exploration - Track Lulea

LANGUAGE OF STUDY: English

In effect since academic year 2023/24

	Summer		Winter		Summer	
semester	**1**	**ECTS**	**2**	**ECTS**	**3**	**ECTS**
hours	WUST		LTU		WUST	
1	Operations Research 10100Z W06GIG-SM3000	3	Exploration 50020E W06GIG-SM3008G	7,5	Exploration entrepreneurship (EFG) 10012Z W06GIG-SM3012G	4
2						
3	Environmental Management 20001Z W06GIG-SM3001	3				
4						
5					SOC Internship 00020Z W06GIG-SM3013P	2
6	Computer Aided Geological Modelling & Geostatistics 10300Z W06GIG-SM3002	5				
7					Diploma Seminar 00001Z W06GIG-SM3014S	1
8			Geochemical exploration 30040E W06GIG-SM3009G	7,5		
9					Master Thesis W06GIG-SM3015D	20
10	Project Management, Appraisal and Risk Evaluation 10210E W06GIG- SM3003G	4				
11						
12						
13						
14	Engineering Geophisics 10010 Z W06GIG- SM3004	3			Applied field exploration 00030Z W06GIG-SM3016P	3
15			Mining geology 40040E W06GIG-SM3010G	7,5		
16	Occupational Health and Safety 100100Z W06GIG- SM3005	2				
17						
18	Foreign Language 1 03000 Z SJO- SJO-SM0003	2				
19						
20						
21	Digital Mine 10100 Z W06GIG- SM3006	2				
22						
23	Principles and Application of InSAR and GIS in mining 20300E W06GIG-SM3007	5	Senior design project in ore geology 00080Z	7,5		
24						
25						
26						
27						
28	Foreign Language 2 01000 Z SJO- SM0004	1				
29						
30						
31						
Total ECTS		**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 classes – after the letter E or Z - enter in brackets the final subject form (lec, cl, lab, pr, sem)
[4]University-wide subject /group of classes – 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 subject / group of classes – 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 subjects and groups of classes in semestral arrangement

Semester 1

Obligatory subjects / groups of classes Number of ECTS points 27

No.	Subject / groups of classes code	Name of subject / groups of classes (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	Subject / groups of classes			
			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-SM3000W	Operations Research	1					K2_GIG_W06 K2_GIG_U10,U14 K2_GIG_K01	15	25	1	1	0,8	T /Z	Z		DN		KO
2	W06GIG-SM3000L	Operations Research			1				15	50	2	2	0,7	T	Z		DN	P (2)	KO
3	W06GIG-SM3002W	Computer Aided Geological Modelling & Geostatistics	1					K2_GIG_W06,W08,W15 K2_GIG_U04,U08,U14	15	50	2		0,8	T /Z	Z				PD/K
4	W06GIG-SM3002L	Computer Aided Geological Modelling & Geostatistics			3				45	75	3	2	1,9	T	Z		DN	P (3)	PD/K
5	W06GIG-SM3003G	Project Management, Appraisal and Risk Evaluation (GK)	1		2	1		K2_GIG_W03,W05,W11 K2_GIG_U04,U06,U08,U15 K2_GIG_K01	60	100	4	4	3,1	T/Z(w)	E(w), Z(l,p)		DN	P (3)	KO
6	W06GIG-SM3001W	Environmental Management	2					K2_GIG_W04,W12,W13,W18 K2_GIG_U05,U10,U11,U12 K2_GIG_K02,K03	30	50	2	2	1,3	T /Z(w)	Z		DN		K
7	W06GIG-SM3001S	Environmental Management					1		15	25	1	1	0,8	T	Z		DN	P(1)	K
8	W06GIG-SM3004W	Engineering Geophysics	1					K2_GIG_W02,W08,W10 K2_GIG_U04,U13	15	25	1	1	0,8	T /Z	Z		DN		PD
9	W06GIG-SM3004P	Engineering Geophysics				1			15	50	2	2	0,9	T	Z		DN	P(2)	PD
10	W06GIG-SM3007W	Principles and Application of InSAR and GIS in mining	2					K2_GIG_W15,W16,W18 K2_GIG_U04,U07,U08	30	50	2	2	1,4	T/Z(w)	E		DN		K
11	W06GIG-SM3007L	Principles and Application of InSAR and GIS in mining			3				45	75	3	3	2,0	T	Z		DN	P(3)	K
12	W06GIG-SM3005W	Occupational Health and Safety	1					K2_GIG_W11,W12,W14,W17 K2_GIG_U11, K2_GIG_K02, K03	15	25	1	1	0,7	T /Z(w)	Z		DN		K

[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 classes – after the letter E or Z - enter in brackets the final subject form (lec, cl, lab, pr, sem)
[4]University-wide subject /group of classes – 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 subject / group of classes – 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-SM3005P	Occupational Health and Safety				1			15	25	1	1	0,8	T	Z		DN	P(1)	K
14	W06GIG-SM3006W	Digital Mine	1					K2_GIG_W07,W12,W18,W19	15	25	1	1	0,8	T /Z(w)	Z		DN		K
15	W06GIG-SM3006L	Digital Mine			1			K2_GIG_U04,U07,U08	15	25	1	1	0,8	T	Z		DN	P(1)	K
		Total	**10**	**0**	**10**	**3**	**1**		**360**	**675**	**27**	**24**	**17,6**					**15**	

Optional subjects / groups of classes (3 ECTS points)

No.	Subject / groups of classes code	Name of subject / groups of classes (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	Subject / groups of classes			
			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 1		3				K2_GIG_ U03	45	60	2		1,6	T	Z	O		P(2)	KO
2	SJO-SM0004	Foreign Language 2		1				K2_GIG_U01,U02	15	30	1		0,6	T	Z	O		P(1)	KO
		Total	**0**	**4**	**0**	**0**			**60**	**90**	**3**	**0**	**2,2**					**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**	**1**	**420**	**765**	**30**	**24**	**19,8**

[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 classes – after the letter E or Z - enter in brackets the final subject form (lec, cl, lab, pr, sem)
[4]University-wide subject /group of classes – 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 subject / group of classes – 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 subjects / groups of classes (0 ECTS points)

No.	Subject / groups of classes code	Name of subject / groups of classes (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	Subject / groups of classes			
			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																			
		Total																	

Optional subjects / groups of classes Number of ECTS points 30

No.	Subject / groups of classes code	Name of subject / groups of classes (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	Subject / groups of classes			
			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-SM3011P	Senior design project in ore geology				8		K2_GIG_W01, K2_GIG_U08,U10,U13 K2_GIG_K01,K03	120	187,5	7,5	3	5,3	T /Z	Z		DN	P(7,5)	S
2	W06GIG-SM3008G	Exploration GK	5			2		K2_GIG_W02,W07,W08,W10,W11, W14 K2_GIG_U08,U10,U13,U15 K2_GIG_K01,K03	105	187,5	7,5	3	4,8	T /Z(w)	E, Z		DN	P(3)	S
3	W06GIG-SM3010G	Mining geology GK	4			4		K2_GIG_W03,W05,W07,W08,W10, W14,W15,W16,W18 K2_GIG_U04,U06,U10,U13,U15 K2_GIG_K01,K02,K03	120	187,5	7,5	5	5,4	T /Z(w)	E, Z		DN	P(4)	K
4	W06GIG-SM3009G	Geochemical exploration GK	3			4		K2_GIG_W02,W07,W08, W10, W14 K2_GIG_U08,U10 K2_GIG_K03	105	187,5	7,5	5	4,8	T /Z(w)	E, Z		DN	P(4)	S
		Total	**12**	**0**	**0**	**18**	**0**		**450**	**750**	**30**	**16**	**20,3**					**18,5**	

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	**0**	**0**	**18**	**0**	**450**	**750**	**30**	**16**	**20,3**

[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 classes – after the letter E or Z - enter in brackets the final subject form (lec, cl, lab, pr, sem)
[4]University-wide subject /group of classes – 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 subject / group of classes – 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 subjects / groups of classes Number of ECTS points 9

No.	Subject / groups of classes code	Name of subject / groups of classes (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	Subject / groups of classes			
			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-SM3012G	Exploration Entrepreneurship GK	1			1	2	K2_GIG_W03,W05,W09 K2_GIG_U08,U09 K2_GIG_K01,K02,K03	60	100	4		3,0	Z	Z			P(3)	S
2	W06GIG-SM3013P	SOC Internship				2		K2_GIG_W05,W09 K2_GIG_U08,U09 K2_GIG_K01,K02,K03	30	50	2		1,5	T	Z			P(2)	S
3	W06GIG-SM3016P	Applied Field Exploration				3		K2_GIG_W08,W15 K2_GIG_U04,U09,U10,U13 K2_GIG_K02	45	75	3	1	2,1	T	Z		DN	P(3)	S
		Total	**1**	**0**	**0**	**6**	**2**		**135**	**225**	**9**	**1**	**6,6**					**8**	

Optional courses / groups of courses (21 ECTS points)

No.	Subject / groups of classes code	Name of subject / groups of classes (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	Subject / groups of classes			
			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-SM3014S	Diploma Seminar					1	K2_GIG_W01 K2_GIG_U01,U13 K2_GIG_K02,K03	15	25	1	1	0,8	T	Z		DN	P(1)	S
2	W06GIG-SM3015D	Master Thesis				1		K2_GIG_W01,W05,W10 K2_GIG_U01,U04,U08,U10,U13,U15 K2_GIG_K01,K02,K03	15	500	20	20	1,8	T	Z		DN	P (20)	S
		Total	**0**	**0**	**0**	**1**	**1**		**30**	**525**	**21**	**21**	**2,6**					**21**	

[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 classes – after the letter E or Z - enter in brackets the final subject form (lec, cl, lab, pr, sem)
[4]University-wide subject /group of classes – 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 subject / group of classes – 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					
1	**0**	**0**	**7**	**3**	**165**	**750**	**30**	**22**	**9,2**

2. Set of examinations in semestral arrangement

Subjects / groups of classes	Names of subjects / groups of classes ending with examination	Semester
W06GIG-SM3003G	1. Project Management, Appraisal and Risk Evaluation	1
W06GIG-SM3007W	2. Principles and Applications of InSAR in Mining	1
W06GIG-SM3008G	1. Exploration	2
W06GIG-SM3010G	2. Mining geology	2
W06GIG-SM3009G	3. Geochemical exploration	2
	Final diploma examination	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 classes – after the letter E or Z - enter in brackets the final subject form (lec, cl, lab, pr, sem)
[4]University-wide subject /group of classes – 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 subject / group of classes – 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

POLITECHNIKA WROCŁAWSKA
WYDZIAŁ GEOINŻYNIERII
GÓRNICTWA I GEOLOGII
Samorząd Studencki Wydziału Geoinżynierii,
Górnictwa i Geologii
50-421 Wrocław, Na Grobli 15, pokój 370

28.09.23 ..... Jakub Dobrzański .....

Jakub Dobrzański
Chairman of the Student Government
of the Faculty of Geoengineering, Mining and Geology

Date — Name and surname, signature of student representative

DZIEKAN

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

Date — 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:
Mineral Resources Exploration - Track Lulea

Semester 1
WUST

Zał. nr 5 do ZW 78/2023

Attachment no. 4. to the Program of Studies

FACULTY OF GEOENGINEERING, MINING AND GEOLOGY

SUBJECT CARD

Name of subject in Polish … Geofizyka inżynierska
Name of subject in English Engineering Geophysics
Main field of study: Mining and geology
Specialization: Mining Engineering,
Geotechnical and Environmental Engineering,
Geomatics for Mineral Resource Management
……. Mineral Resource Exploration
Level and form of studies: 2nd level, full-time
Kind of subject: obligatory
Subject code …… W06GIG-SM3004….
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)	25			50	
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 classes (P)				2	
including number of ECTS points corresponding to classes that require direct participation of lecturers and other academics (BU)	0,8			0,9	

*delete as not necessary

PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES

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.

SUBJECT OBJECTIVES

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.

SUBJECT EDUCATIONAL EFFECTS

relating to knowledge:
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.

relating to skills:

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.

relating to social competences:

PEU_K01 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.

PROGRAMME CONTENT

	Lecture	**Number of hours**
Lec 1	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
Lec 2	Engineering problems solved with geophysical surveying. Case studies.	2
Lec 3	Electrical resistivity methods. Tomography and VSE. IP method. Physical principles. Equipment. Methods of field surveying. Interpretation and application. Case studies.	2
Lec 4	Electromagnetic methods. FDEM and TDEM methods. Magnetotelluric methods. Physical principles. Methods of field surveying. Equipment. Interpretation and application. Case studies.	2
Lec 5	GPR surveying. Physical principles. Methods of field surveying. Equipment. Interpretation and application. Case studies.	2
Lec 6	Seismic tomography. Seismic interferometry. Physical principles. Applications. Case studies.	2
Lec 7	Mine geophysics. Seismology. Seismic methods. Active and passive seismic tomography. Microgravimetry. Case studies.	2
Lec 8	Gravity and magnetic surveying. Equipment. Methods of field surveying. Interpretation and application. Case studies.	2
	Total hours	15

Project	**Number of hours**

Proj 1	One selected geophysical technique. Fundamentals and equipment. Field surveying	4
Proj 2	Processing and interpretation of field data.	3
Proj 3	Solving the geophysical problems.	8
	Total hours	15

TEACHING TOOLS USED

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

EVALUATION OF SUBJECT LEARNING OUTCOMES ACHIEVEMENT

Evaluation (F – forming during semester), P – concluding (at semester end)	Learning outcomes code	Way of evaluating learning outcomes achievement
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.

PRIMARY AND SECONDARY LITERATURE

PRIMARY LITERATURE:

[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).

SECONDARY LITERATURE:

[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.

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

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

Zał. nr 5 do ZW 78/2023
Attachment no. 4. to the Program of Studies

FACULTY OF GEOENGINEERING, MINING AND GEOLOGY

SUBJECT CARD

Name of subject in Polish Wspomagane komputerowo modelowanie geologiczne i geostatystyka.)

Name of subject in English: Computer Aided Geological Modelling and Geostatistics

Main field of study (if applicable): Górnictwo i geologia.

Specialization (if applicable): Mining Engineering,
Geotechnical and Environmental Engineering,
Geomatics for Mineral Resource Management
Mineral Resource Exploration

Profile: academic

Level and form of studies: 2nd level, full-time

Kind of subject: obligatory

Subject code W06GIG-SM3002

Group of courses No

	Lecture	Classes	Laboratory	Project	Seminar
Number of hours of organized classes in University (ZZU)	15		45		
Number of hours of total student workload (CNPS)	50		75		
Form of crediting	crediting with grade	Examination / crediting with grade*	crediting with grade	Examination / crediting with grade*	Examination / crediting with grade*
For group of courses mark (X) final course					
Number of ECTS points	**2**		3		
including number of ECTS points for practical classes (P)			3		
including number of ECTS points corresponding to classes that require direct participation of lecturers and other academics (BU)	0,8		1,9		

PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES

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

SUBJECT OBJECTIVES

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.

SUBJECT EDUCATIONAL EFFECTS

relating to knowledge:

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.

relating to skills:

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

relating to social competences:

PEK_K01 The student can think and act in a creative and enterprising way

PROGRAMME CONTENT		
Lecture		**Number of hours**
Lec 1	Introduction to the course. Geological database and validation of the geological data.	2
Lec 2	Geology of the seam.	2
Lec 3	Structural model of the stratified deposit. Methods of the prediction of the surface layer parameters.	2
Lec 4	Spatial distribution of samples values. Regionalized variable.	2
Lec 5	BLUE Estimator of the mean value: Kriging.	2
Lec 6	Quality model of the deposit – block model of the parameter layers. Estimation and evaluation of the block model.	2
Lec 7	Reserves modelling and evaluation.	2
Lec 8	Mineral resources. International reporting. The JORC Code	1
	Total hours	**15**

Laboratory		**Number of hours**
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	3

	estimation procedure.	
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
	Total hours	45

TEACHING TOOLS USED
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.

EVALUATION OF SUBJECT LEARNING OUTCOMES ACHIEVEMENT

Evaluation (F – forming during semester), P – concluding (at semester end)	Learning outcomes code	Way of evaluating learning outcomes achievement
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		

PRIMARY AND SECONDARY LITERATURE

PRIMARY LITERATURE:

[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.

SECONDARY LITERATURE:

[10] Handouts, tutorials.

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

Dr inż. Krzysztof Hołodnik
Dr inż. Witold Kawalec

Zał. nr 5 do ZW 78/2023
Attachment no. 4. to the Program of Studies

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,
……. Mineral Resource Exploration
Level and form of studies: 2nd level, full-time
Kind of subject: **obligatory**
Subject code: **W06GIG-SM3006**
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)	25		25		
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	0,8		0,8		

PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES

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

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 78/2023
Attachment no. 4. to the Program of Studies

FACULTY OF GEOENGINEERING, MINING AND GEOLOGY

SUBJECT CARD

Name in Polish: Zarządzanie Środowiskiem
Name in English: Environmental Management
Faculty of studies (if applicable): Mining and Geology
Specialisation (if applicable): Mining Engineering
Mineral Resource Exploration
Level and form of studies: 2nd level, full-time
Subject Type: Obligatory
Subject code: W06GIG-SM3001
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)	**50**				**25**
Form of crediting	**Crediting with grade**				**Crediting with grade**
For a group of courses mark (X) for the final course					
Number of ECTS points	**2**				**1**
including number of ECTS points for practical (P) classes					
including number of ECTS points for direct teacher-student contact (BU) classes	**1,3**				**0,8**

PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES

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

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 78/2023
Attachment no. 4. to the Program of Studies

FACULTY OF GEOENGINEERING, MINING AND GEOLOGY

SUBJECT CARD

Name of subject in Polish Bezpieczeństwo i higiena pracy
Name of subject in English: Occupational Health and Safety
Main field of study (if applicable): Górnictwo i geologia.
Specialization (if applicable): Mining Engineering,
Geotechnical and Environmental Engineering,
Mineral Resource Exploration
Profile: academic
Level and form of studies: 2nd level, full-time
Kind of subject: obligatory
Subject code W06GIG-SM3005
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)	25			25	
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 classes (P)				1	
including number of ECTS points corresponding to classes that require direct participation of lecturers and other academics (BU)	0,7			0,8	

PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES

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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SUBJECT OBJECTIVES

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.

SUBJECT EDUCATIONAL EFFECTS

relating to knowledge:

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.…

relating to skills:

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.…

relating to social competences:

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

PROGRAMME CONTENT		
Lecture		**Number of hours**
Lec 1	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
Lec 2	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
Lec 3	Dangerous factors - identification and assessment of risks.	3
Lec 4	Nuisance factors in occupational risk assessment: psychological burden, static burden, monotype.	3
Lec 5	Methods of occupational risk assessment: STER software, the RISC SCORE method, written test	3
	Total hours	**15**

Project		Number of hours
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	3

	harmful factors (vibration, chemical agents)	
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**

TEACHING TOOLS USED
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.

EVALUATION OF SUBJECT LEARNING OUTCOMES ACHIEVEMENT

Evaluation (F – forming during semester), P – concluding (at semester end)	Learning outcomes code	Way of evaluating learning outcomes achievement
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)

PRIMARY AND SECONDARY LITERATURE

PRIMARY LITERATURE:

[1] Occupational Safety and Health in Mining. Anthology on the situation in 16 mining countries. Ed.: Kaj Elgstrand and Eva Vingård. University of Gothenburg nr 2013;47(2) (gupea.ub.gu.se › bitstream › gupea_2077_32882_1)

[2] Boyle, Tony: Health and safety: Risk management. IOSH, 2001. (http://www.iosh.co.uk/index.cfm?go=publications.main)

[3] Encyclopaedia of occupational health and safety. Fourth edition Stellman, Jeanne M. (ed.). International Labour Organization, 1998 (http://www.ilo.org/public/english/support/publ/xtextre.htm#b103) http://www.ilo.org/public/english/support/publ/encyc/)

[4] McKeown, Céline; Twiss, Michael: Workplace ergonomics: A practical guide, IOSH, 2001, 160 p. http://www.iosh.co.uk/index.cfm?go=publications.main

SECONDARY LITERATURE:
Handouts, articles
OPIEKUN PRZEDMIOTU (IMIĘ, NAZWISKO, ADRES E-MAIL)
Dr inż. Żaklina Konopacka

Zał. nr 5 do ZW 78/2023
Attachment no. 4. to the Program of Studies

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, Mineral Resource Exploration
Level and form of studies: 2nd, full-time
Kind of subject: obligatory
Subject code: W06GIG-SM3000
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)	**25**		**50**		
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	**0,8**		**0,7**		

*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

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

Zał. nr 5 do ZW 78/2023
Attachment no. 4. to the Program of Studies

FACULTY OF GEOENGINEERING, MINING AND GEOLOGY

SUBJECT CARD

Name of subject in Polish … Zarządzanie projektami, ocena ich opłacalności i ryzyka..
Name of subject in English: Project Management, Appraisal and Risk Evaluation.
Main field of study (if applicable): Mining and Geology
Specialization (if applicable): Mining Engineering,
Geotechnical and Environmental Engineering,
Geomatics for Mineral Resource Management
…….. Mineral Resource Exploration
Profile: academic
Level and form of studies: 2nd level, full-time
Kind of subject: obligatory
Subject code … W06GIG-SM3003G …….
Group of courses YES

	Lecture	Classes	Laboratory	Project	Seminar
Number of hours of organized classes in University (ZZU)	15		30	15	
Number of hours of total student workload (CNPS)	25		50	25	
Form of crediting	Examination				
For group of courses mark (X) final course	X				
Number of ECTS points	4				
including number of ECTS points for practical classes (P)	3				
including number of ECTS points corresponding to classes that require direct participation of lecturers and other academics (BU)	3,1				

PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES

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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SUBJECT OBJECTIVES

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.

SUBJECT EDUCATIONAL EFFECTS

relating to knowledge:

PEU_W01 knows the concepts of demand, supply and price elasticities, understands how they affect markets
PEU_W02 knows the concepts of costs in economics and accounting, understands how they differ
PEU_W03 knows the main cost categories and cost accounting methods
PEU_W04 has basic knowledge about the contents of financial statements
PEU_W05 has basic knowledge about the method of ratio analysis of financial statements
PEU_W06 knows and understands the concepts of Present Value and Future Value for simple cash flows and annuities.
PEU_W07 knows the capital budgeting methods (NPV, IRR, PBP) and understand how to interpret the results
PEU_W08 has basic knowledge about the project risk evaluation methods

relating to skills:

PEU_U01 is able to analyze the causes and effects of demand and supply changes
PEU_U02 is able to interpret and use information presented in financial statements also by means of ratio analysis
PEU_U03 is able to use different cost analysis methods and make decisions based on the rsults
PEU_U03 can calculate Future and Present value, also for annuities and solve simple calculation problems
PEU_U04 is able to perform discounted cash flow analysis and draw conclusions based on the results
PEU_U05 is able to carry out sensitivity analysis and scenario analysis using a financial model of an investment
PEU_U06 is able to work out basic project documentation and initiate a project
PEU_U07 is able to use basic methods of project management, monitoring and project risk management
PEU_U08 is able to implement basic conflict management methods in a project group
PEU_U09 is able to use basic group management methods, can undertake and shape the leadership position

relating to social competences:

PEU_K01 is able to think and act in a systematic, creative and entrepreneurial way
PEU_K02 has an established attitude of economic operation and decision-making based on available financial information and forecasts

PROGRAMME CONTENT		
Lecture		**Number of hours**
Lec.1	Supply and demand, equilibrium price, changes in demand and supply. Stock and commodity markets used by mineral industries	2
Lec.2	Costs in economics and in accounting. Cost and money outflow. Relevant cost, incremental cost, marginal cost, alternative cost. Short-term decision making.	2
Lec.3	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
Lec.4	Variable and fixed costs. Break even point. Cost-volume –profit analysis.	1
Lec.5	Basics of financial accounting. Income statement and cash flow statement. Balance sheet. Working capital. Examples of financial statements of mining companies	2
Lec.6	Financial ratio analysis. Liquidity, profitability, activity and debt ratios. Financial and operating leverage.	2
Lec.7	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
Lec.8	The concept of risk and return. Quantification of risk. Risk analysis in project evaluation: sensitivity analysis, scenario analysis, other methods.	2
	Total hours	15

Project		**Number of hours**
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 Team roles Belbin perspective Discussion group roles Effective managerial behaviour in the context of team roles	3
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;	3

	Effective managerial behaviour from the different contexts.	
	Total hours	15

Laboratory		Number of hours
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**

TEACHING TOOLS USED
N1. Interactive lecture with the use of multimedia and discussion N2. Laboratory classes: individual problem solving with the use of Excel spreadsheet N3. Laboratory classes part B and project classes: case studies solving in groups and individually. Project presentations, discussion N4. Consultation N5. Self-study: solving assigned problems, literature studies

EVALUATION OF SUBJECT LEARNING OUTCOMES ACHIEVEMENT

Evaluation (F – forming during semester), P – concluding (at semester end)	Learning outcomes code	Way of evaluating learning outcomes achievement
F1	PEU_W01-W08 PEU_K01-K02	Assesment of student class activity
F2	PEU_U01-U10 PEU_K01-K02	Evaluation of student's assignements
P1	PEU_W01-W08 PEU_U01-U10 PEU_K01-K02	Written test

PRIMARY AND SECONDARY LITERATURE

PRIMARY LITERATURE:

1. Erhardt M., Brigham E.: Financial Management Theory and Practice. South-Western Cengage Learning, USA
2. Brigham E., Glapenski L.: Financial Management, 1997
3. Johnson H.: Making Capital Budgeting Decisions – Maximising the Value of the Firm. Financial Times/Prentice Hall (April 15, 1999)
4. Jonson H.: Strategic Capital Budgeting: Developing and Implementing the Corporate Capital Allocation Program, January 1994.
5. Lock Dennis, Project Management, Published April 11, 2013 by Routledge

SECONDARY LITERATURE:

1. Jonson H.: Determining Cost of Capital: The Key to Firm Value. Apr 1999.
2. A Guide to Project Management Body of Knowledge (PMBOK®Guide Fourth Edition), Project Management Institute, 2008 (2004). wydanie polskie, MT&DC Warszawa, 2009 (2006)

3. Johnson H.: Global Financial Institutions and Markets. December 1999

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

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

Zał. nr 5 do ZW 78/2023
Attachment no. 4. to the Program of Studies

FACULTY OF GEOENGINEERING, MINING AND GEOLOGY

SUBJECT CARD

Name in Polish: ***Zasady i zastosowania InSAR oraz GIS w górnictwie***
Name in English: ***Principles and Application of InSAR and GIS in mining***
Main field of study: **Mining and geology**
Specialization: **Geomatics for Mineral Resources Management**
…….Mineral Resource Exploration
Level and form of studies: 2nd level, full-time
Kind of subject: **obligatory**
Subject code: **W06GIG-SM3007**
Group of courses: **No**

	Lecture	Classes	Laboratory	Project	Seminar
Number of hours of organized classes in University (ZZU)	30		45		
Number of hours of total student workload (CNPS)	50		75		
Form of crediting	Examination		crediting with grade		
For group of courses mark (X) final course					
Number of ECTS points	**2**		3		
including number of ECTS points for practical (P) classes			3		
Including number of ECTS points for direct teacher-student contact (BU) classes	1,4		2,0		

*niepotrzebne skreślić

PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES

1. Basic knowledge of C ++ and Python programming language.
2. Basic knowledge of GIS functions and spatial data acquisition techniques
3. Ability to use GIS software package
4. Basic knowledge of databases

SUBJECT OBJECTIVES

C1 Presentation of knowledge of satellite radar interferometry, as well as the possibility of using it in the ground deformation measurements.
C2 Acquiring the ability to determine surface displacements based on satellite radar data.
C3 Presentation of information on the use of GIS in advanced analysis of objects, phenomena and processes occurring in space.
C4 Acquiring the ability to formulate and solve tasks using GIS analytical functions.
C5 Acquiring skills to use spatial data and services in accordance with the INSPIRE Directive

SUBJECT EDUCATIONAL EFFECTS

relating to knowledge:

PEK_W01 Has expanded knowledge in the field of using geoinformation systems to collect and process data used in modeling of both natural and anthropogenic phenomena and processes

PEK_W02 Knows the principles of construction and functioning of geoinformation systems in the mining industry and public administration

relating to skills:

PEK_U01 has the ability to use advanced GIS tools in mining, studies of natural phenomena, the impact of mining on the environment and space development,

PEK_U02 has the ability to formulate and solve spatial tasks in the GIS environment

PEK_U03 has the ability to interpret the results obtained and draw conclusions

relating to social competences:

PEU_K01 has the ability to formulate and transfer knowledge on the use of geoinformation systems in spatial analysis and presentation of their results

PROGRAMME CONTENT

	Lecture	**Number of hours**
Lec 1	Discussion of syllabus, requirements for passing the course, literature	2
Lec 2	Introduction to Microwave Signals for Earth Observation	2
Lec 3	Principles and Applications of Passive and Active Microwave Remote Sensing	2
Lec 4	Acquisition and processing of SAR data	2
Lec 5	SAR image theory (geometric properties, polarization)	2
Lec 6	Basics of SAR data calculation using the DInSAR and SBAS methods	2
Lec 7	Principlesand Applicationsof Interferometric SAR (monitoring surface activity, natural and anthropogenic phenomena)	2
Lec 8	Fundamental concepts of geographical information systems	2
Lec 9	Data modelling in GIS. Representation of spatial data. Spatial databases. Current status and development trends	2
Lec 10	Methods of spatial analysis in GIS	2
Lec 11	Spatial data interpolation	2
Lec 12	Map algebra. Surface analysis, local and zonal functions	2
Lec 13	Basics of spatial statistics	2
Lec 14	Spatial Information Infrastructure. Inspire Directive. Open Data	2
Lec 15	Examples of applications of geoinformation systems in mining and environmental protection	2
	Total hours	**30**

Laboratory		Number of hours
La1	Configuration of the environment for SAR calculations	3
La2-3	Introduction to radar data calculations - calculation tasks	6
La4	Acquiring radar data and calculating the interferogram - DInSAR method	3
La5	Unwrapping of the interferometric phase - calculations	3
La6-7	Presentation of results in the GMT environment	6
La8	Discrete data interpolation. Preparation of input data for analysis (e.g. deformation measurements in the mining area)	3
La9	Discrete data interpolation. Development mining area terrain deformation maps with various interpolation methods.	3
La10	Discrete data interpolation. Analysis and assessment of the quality and uncertainty of interpolation. Prediction map. Development of maps of changes between two periods using a raster calculator.	3
La11	Spatial analysis - assessment of the suitability of the area for the location	3
La12	of mining operation. Construction of a database of spatial location criteria	3
La13	Spatial analysis - assessment of the suitability of the area for the location	3
La14	of mining operation. Selection of analytical procedures and conducting analytical operations.	3
La15	Spatial analysis - assessment of the suitability of the area for the location	3
	Total hours	**45**

TEACHING TOOLS USED
N1. Lectures N2. Multimedia presentations N3. Preparation of individual written term paper on a given topic N4. Multimedia materials (MOOC) N5. Laboratory instructions N6. Reports from laboratory exercises N7. Consultations

EVALUATION OF SUBJECT LEARNING OUTCOMES ACHIEVEMENT

Evaluation (F – forming during semester), P – concluding (at semester end)	Learning outcomes code	Way of evaluating learning outcomes achievement
F, P	PEU_W01 – 02 PEU_U01 – 03 PEU_K01	F1 Final mark for the written examination F2 Mark for the written report, P Final mark for the lecture (weighted average of F1 and F2, where F1 – 80% and F2 - 20%)
F, P	PEU_W01 – 02 PEU_U01 – 03 PEU_K01	F3 Mark for the written assignment reports F4 Mark from written tests, P2 Final mark for the laboratory (weighted average of F3 and F4, where F3 – 80% and F4 - 20%)

PRIMARY AND SECONDARY LITERATURE

PRIMARY LITERATURE:

[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

SECONDARY LITERATURE:

[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

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

Wojciech Milczarek, wojciech.milczarek@pwr.edu.pl
Jan Blachowski, jan.blachowski@pwr.edu.pl

Semester 2
LTU

EIT label – Teaching units <TIMREX – T-shaped Master Programme for Innovative Mineral Resource Exploration>

LTU

Course title	Geochemical Exploration					
European Credits (ECTS)	7.5		**Time (hours) given to the students**	105		
Type (Lecture, internship, exercise etc.)	Lectures: 3, Auditorium classes: , Lab. Classes: , Project classes: 3, Practical classes: 1.5, Seminar classes: , Fieldwork:		**Student whole working time (hours)**	187,5		
Description of content	The objective of course is that the students should aqcquire an advanced understanding basic geochemical processes that control geochemical anomalies and their application during exploration Distribution of trace metals in minerals Geochemical associations Mobility of elements at the earth surface Ion exchange and sorption Interpretation of geochemical anomaly data Practical examples in geochemical prospecting					
Learning outcomes of the curricular unit (knowledge, skills and competences to be developed by the students)	Knowledge: After completing the course, the student should be able to demonstrate knowledge and understanding of: - basic geochemical processes that control geochemical anomalies - controls on the distribution of trace elements in minerals - common geochemical associations - mobility of elements at the Earth surface - ion exchange and sorption Skills: After completing the course the student should be able to - define geochemical anomalies - analyse, explain and apply the basic geochemical processes that control geochemical anomalies - apply geochemical data for mineral exploration Competences: ,					
Assessment methods and criteria	Assignment report I (Group) 3.0, Assignment report II (Individually) 1.5, Written exam 3.0 The course is built around practical field examples from geochemical prospecting which are solved individually or in groups by the students. In these examples are the fundamental geochemical principles and processes, which creates geochemical anomalies, discussed. The lectures constitute the theoretical support for assignment reports and the written exam. The ability to explain the geochemical processes that create anomalies is checked with a written exam at the end of the course (grade 3, 4, 5).The ability to analyse and apply these processes on real cases are tested with practical examples that are given both individually and in group.					
Recommended readings	Choosen examples from international literature.					
TU Coordinator	Anders Widerlund, Anders.Widerlund@ltu.se					
Contribution to EIT's Overarching Learning Outcomes (tick relevant box/es)*	**OLO 1 Entrepreneurship**	**OLO2 Innovation**	**OLO3 Creativity**	**OLO4 Intercultural**	**OLO5 Value judgments /**	**OLO6 Leadership**

					Sustainability	
					Complex evaluation of exploration datasets with the need to satisfy environmental, legal and economic requirements	Students should compile a sampling plan during the course, to be able to lead a geochemical sampling campaign
Justification for OLO contribution						

EIT label – Teaching units <TIMREX – T-shaped Master Programme for Innovative Mineral Resource Exploration>

Course title	Mining Geology		
European Credits (ECTS)	7.5	**Time (hours) given to the students**	120
Type (Lecture, internship, exercise etc.)	Lectures: 4, Auditorium classes: , Lab. Classes: , Project classes: 2.5, Practical classes: 1, Seminar classes: , Fieldwork:	**Student whole working time (hours)**	187,5
Description of content	The purpose of the course is that the students should acquire an advanced understanding of the ore and mineral deposits' investigation and evaluation. During the course, students work with various aspects in the value chain of mining projects and advanced exploration projects, from modelling mineral resources from geological data before mining, to the process of converting mineral resources to mineral reserves by applying modifying factors, to the mining geological methods used for further characterization and evaluation of deposits in connection with mining.		
Learning outcomes of the curricular unit (knowledge, skills and competences to be developed by the students)	Knowledge: After completing the course, the student should be able to demonstrate knowledge and understanding of: - how mineral resources are modelled from geological and assay data in 3D - cut-off theory and its effect on size and grade of mineral resources - geostatistics and its application during resource estimation - the difference in confidence level between inferred, indicated and measured resources - the modifying factors which affect conversion of mineral resources to mineral reserves - the importance of different strategies for grade control and mine mapping in operating mines Skills: The student should be able to model the grade and tonnage of mineral deposits based on geological data in a 3D environment. The student should be able to explain how cut-off affects the size and grade of mineral resources and be able to use basic geostatistical methods for calculation of average content in drill cores and profiles based on grade, length and density data. The student should be able to account for the difference in confidence level between inferred, indicated and measured mineral resources, as well as their distinction from mineral reserves. This includes the ability to explain how various modifying factors such as choice of mining methods, processing methods, metallurgical factors, environmental factors, social factors, legal factors and economic factors affect the feasibility of a mining project. The student should be able to critically analyze technical reports from mining and exploration projects with regard to how well they meet the requirements set by international industry standards for reporting mineral resources. The student should be able to account for different strategies for grade control and mining mapping, and be able to choose methods based on the deposit geology and the mining method. The student should be able to collect geological information from mines to characterize ore boundaries and geological structures, and use this information to make estimates of dilution in active production environments. Competences: ,		
Assessment methods and criteria	Written exam G U 3 4 5 4.00 Project work G U 3 4 5 2.50 Exercises U G# 1.00 The subject is presented in the form of class lectures by several lecturers. In-depth study of the subject takes place through individual student projects based on a literature study of technical reports from mining projects and advanced exploration projects, written presentation, and group discussions in seminar form. Practical skills are trained through exercises in mineral resource estimation methodology on paper and in software, calculation of ore sections, mining mapping, grade control and delineation of ore contacts. The exercises will be partly linked to lectures performed in parallel. Document management takes place in the learning platform CANVAS		

	Written exam is given with differentiated grades. Grading scale: 5 4 3 U. In order to pass the course, it is also required that the student complete and report practical assignments and individual project work, and get these improved by the examiner. Reports that have not met the set quality requirements within one week after the end of the current reading period means that the grade has failed for the practical part. The practical part in its entirety may then be carried out at a future course opportunity, provided that vacant spots are available.					
Recommended readings	Evans, Whateley & Moon. Introduction to Mineral Exploration, Blackwell, 2006.					
TU Coordinator	Nils Jansson, Nils.Jansson@ltu.se					
Contribution to EIT's Overarching Learning Outcomes (tick relevant box/es)*	**OLO 1 Entrepreneurship**	**OLO2 Innovation**	**OLO3 Creativity**	**OLO4 Intercultural**	**OLO5 Value judgments / Sustainability**	**OLO6 Leadership**
	The course covers the core legal and economic concepts of a mineral resource project from the operator's / entrepreneur's perspective, via active involvement of mining professionals in teaching and practicals on resource estimation, grade control and mine mapping.			The importance of social license to operate and stakeholder engagement is adressed in the context of the modifying factors for converting resources to reserves. Co-reading with multi-national students from the Emerald program including a seminar on the topic ensure a large diversity in terms of student background.	Students should be able to conduct a critical assessment on an advanced exploration project or a mining project, utilizing publically available technical reports within the NI43-101, JORC or PERC standard. This involves a critical assessment of the key strenths and weaknesses of projects with regards to modifying factors.	
Justification for OLO contribution						

EIT label – Teaching units <TIMREX – T-shaped Master Programme for Innovative Mineral Resource Exploration>

Course title	Senior Design Project in Ore Geology		
European Credits (ECTS)	7.5	**Time (hours) given to the students**	120
Type (Lecture, internship, exercise etc.)	Lectures: , Auditorium classes: , Lab. Classes: , Project classes: 7.5, Practical classes: , Seminar classes: , Fieldwork:	**Student whole working time (hours)**	187,5
Description of content	The goal of the course is that the student independently shall design, carry out and report a scientific project within the subject. The project theme shall be chosen in cooperation with the examiner and be related to modern research and development.		
Learning outcomes of the curricular unit (knowledge, skills and competences to be developed by the students)	Knowledge: Skills: Competences: ,		
Assessment methods and criteria	Passed oral and written presentation G U 3 4 5 7.50 The student shall gather data/information and present these both written (report) and orally (presentation). The student will work independently with guidance from the examiner or an appointed supervisor. A topic is selected from discussion between the examiner and the student, and thereafter the student works independently with the topic. The topic is reported in a written report and an oral presentation. The course goal of design, carry out and report a scientific project is examined through a written and oral reporting of the chosen topic.		
Recommended readings	Depends on the project choosen, and will therefor be decided later.		
TU Coordinator	Glenn Bark, Glenn.Bark@ltu.se		

	OLO 1 Entrepreneurship	**OLO2 Innovation**	**OLO3 Creativity**	**OLO4 Intercultural**	**OLO5 Value judgments / Sustainability**	**OLO6 Leadership**
Contribution to EIT's Overarching Learning Outcomes (tick relevant box/es)*			Students are motivated to choose multidisciplinar topics wherein theoretical frameworks and methodologies from several subjects can be integrated.			

Justification for OLO contribution	

Course title	Exploration		
European Credits (ECTS)	7.5	**Time (hours) given to the students**	105
Type (Lecture, internship, exercise etc.)	Lectures: 5, Auditorium classes: , Lab. Classes: , Project classes: 1.5, Practical classes: 1, Seminar classes: , Fieldwork:	**Student whole working time (hours)**	187,5
Description of content	The goal of the course is that students should acquire an advanced understanding of geological, geochemical and geophysical exploration methodologies, factors and trends controlling metal prices, and mapping and sampling methodologies. Commodity prices and market mechanisms. Exploration strategy. Geological, geophysical and geochemical exploration methods. Drilling methods and drilling programs. Logging of drill cores. Sampling and mapping methods. Laws and regulations. Ongoing exploration projects in Sweden and case stories.		
Learning outcomes of the curricular unit (knowledge, skills and competences to be developed by the students)	Knowledge: After completing the course, the student should be able to demonstrate knowledge and understanding of: - factors controlling metal prices and long-term trends in exploration and ore extraction. - strategies for selecting target areas in exploration and the importance of local conditions. - geological, geophysical and geochemical exploration methods and how they are used at different stages of an exploration campaign. - different drilling methods, logging and sampling of drill cores and planning of drilling programs during exploration. - methods for mapping and sampling of outcrops in field. - preparation for field work and following-up work in exploration projects, laws and regulations related to exploration, evaluation and reporting of exploration results. - ongoing exploration projects in Sweden. Skills: After completing the course, the student should also be able to - propose exploration methods for different types of ores based on available geological data - conduct mapping and sampling of outcrops in the field - integrate various types of geological, geochemical, and geophysical data for target generation - conduct exploration activites within the legal framework set by Swedish law Competences: ,		
Assessment methods and criteria	Exercises U G# 1.00 Written exam G U 3 4 5 5.00 Project work G U 3 4 5 1.50 Lectures presenting and explaining basic theory and practical applications including use of ore-related alterations, field mapping and sampling, and drill core logging. Oral presentation of a project work that includes identification of a target area for exploration, application for an exploration permit and planning of an exploration campaign. Graded written exam and project work. Approved practical exercise with written report.		
Recommended readings	Evans, Whateley & Moon. Introduction to Mineral Exploration. Blackwell, 2006.		

EIT label – Teaching units <TIMREX – T-shaped Master Programme for Innovative Mineral Resource Exploration>

TU Coordinator	Olof Martinsson, Olof.Martinsson@ltu.se					
Contribution to EIT's Overarching Learning Outcomes (tick relevant box/es)*	**OLO 1 Entrepreneurship**	**OLO2 Innovation**	**OLO3 Creativity**	**OLO4 Intercultural**	**OLO5 Value judgments / Sustainability**	**OLO6 Leadership**
	Students should be able to demonstrate an advanced understanding of geological, geochemical and geophysical exploration methodologies, factors and trends controlling metal prices, and mapping and sampling methodologies, and how these impact on exploration strategies.	Project-type practical exercise stimulates the creativity of the students to synthetize multi-component dataset for targeting mineral deposits, using state-of-the-art exploration models		Complex evaluation of exploration datasets with the need to satisfy environmental, legal and economic requirements		
Justification for OLO contribution						

Semester 3
WUST/LTU

EIT label – Teaching units <TIMREX – T-shaped Master Programme for Innovative Mineral Resource Exploration>

Course title	**Applied field exploration**		
European Credits (ECTS)	3	**Time (hours) given to the students**	45
Type (Lecture, internship, exercise etc.)	Lectures: , Auditorium classes: , Lab. Classes: , Project classes: , Practical classes: , Seminar classes: , Fieldwork: 3	**Student whole working time (hours)**	75
Description of content	The goal of the course is that students should acquire a hands-on understanding of different field exploration methodologies, and how they can be integrated for targeting VMS deposits. Geological, geophysical and geochemical exploration methods in VMS exploration. Practical field mapping exercises in structural geology, stratigraphy, hydrothermal alteration. Practical geophysical surveying using UAV technology. GIS-based data synthesis for exploration target selection. Drill core logging and assaying.		
Learning outcomes of the curricular unit (knowledge, skills and competences to be developed by the students)	Knowledge: when passed the student is expected to have: -knowledge about different field methods and their use during an exploration program. -knowledge about drilling and sampling methods. -knowledge about different methods for field mapping. Skills: when passed the student is expected to have the ability to - acquire in-depth structural, volcanological and alteration data from outcrops in the field - contextualize field observations in relation to ore genetic model for VMS deposits. - synthesize different types of geological and geophysical data for targeting a VMS deposit. Competences: ,		
Assessment methods and criteria	Exercises U G# 1.20 Project work G U 3 4 5 1.80 The course is mainly presented via practicals in the field, but also with complementary lectures and excercises, in addition to project work.		
Recommended readings	Online compendium in Canvas room		
TU Coordinator	Nils Jansson, Nils.Jansson@ltu.se		

Contribution to EIT's Overarching Learning Outcomes (tick relevant box/es)*	**OLO 1 Entrepreneurship**	**OLO2 Innovation**	**OLO3 Creativity**	**OLO4 Intercultural**	**OLO5 Value judgments / Sustainability**	**OLO6 Leadership**

Justification for OLO contribution	

Course title	**SOC Internship**		
European Credits (ECTS)	2	**Time (hours) given to the students**	30
Type (Lecture, internship, exercise etc.)	Lectures:, Auditorium classes: , Lab. Classes: , Project classes: 2 , Practical classes:, Seminar classes: , Fieldwork: x	**Student whole working time (hours)**	50
Description of content	The aim of the course is to enable students to work in socially responsible workplaces, and apply their skills and knowledge to promote social good. While this develops them to become work-ready professionals, it also nurtures them to become advocates who help build a better world. EDUCATIONAL GOALS: 1. To actively participate in the affairs of the community and in concrete actions on the ground that aim to promote the public interest, equality and solidarity. 2. To reflect on social license to operate issues 3. To work in direct contact with the beneficiaries of the civic activities undertaken e.g.: reception, facilitation, support, social assistance, etc. EXAMPLES OF SOCIAL AND CIVIC ISSUES IN MINERALS INDUSTRIES: • Depletion of natural capital (degradation of air, land and water quality), land use conflicts, health impacts • Digitalization and automation generate particular challenges for well-being in mining regions. Limited job opportunities for local workforce and skills mismatches. • High and continuous transparency and accountability standards of the industry, effective methods of information sharing and dialogue • A more equitable value-sharing, Corporate Social Responsibility issues • Facilitation of environmental awareness • Preservation and restoring of historic sites,		
Learning outcomes of the curricular unit (knowledge, skills and competences to be developed by the students)	Knowledge: to understand that social responsibility incorporates an ethical, social and environmentally-friendly perspective to our personal and professional activities Skills: To be able to engage in an informal professional discussion and business communication Competences: To cope with complexity, uncertainty and change in global contexts		

Assessment methods and criteria	Criterion: Submission of a project report					
Recommended readings						
TU Coordinator	Supervisors of the student's Master thesis					
Contribution to EIT's Overarching Learning Outcomes (tick relevant box/es)*	**OLO 1 Entrepreneurship**	**OLO2 Innovation**	**OLO3 Creativity**	**OLO4 Intercultural**	**OLO5 Value judgments / Sustainability**	**OLO6 Leadership**
	Students will be engaged in professional discussion and business communication				Students will be able to understand that social responsibility incorporates an ethical, social and environmentally-friendly perspective to our personal and professional activities	
Justification for OLO contribution						

<table>
<tr><td>Course title</td><td colspan="3">Exploration entrepreneurship</td></tr>
<tr><td>European Credits (ECTS)</td><td>4</td><td>Time (hours) given to the students</td><td>60</td></tr>
<tr><td>Type (Lecture, internship, exercise etc.)</td><td>Lectures: 1, Auditorium classes: , Lab. Classes: , Project classes: 1, Practical classes: 3, Seminar classes: 2, Fieldwork:</td><td>Student whole working time (hours)</td><td>100</td></tr>
<tr><td>Description of content</td><td colspan="3">To equip students with the professional skills to increase their employability and entrepreneurship skills to meet the current market demands. The EFGeoMentoring scheme aims at improving international networking and supporting the life-long learning and CPD requirements of experienced geology professionals. In addition, it allows students to benefit from insider knowledge about international work perspectives in different sectors of geological profession and countries.
Mentoring within the course is a process during which an experienced professional with and EurGeol title (mentor) accompanies the student in a targeted way. Mentoring contributes to developing personal, entrepreneurial, networking, social and professional skills regarding the mineral prospecting and exploration activity. It allows learning from professional experiences that can only be acquired through practice and can't be found in any textbook. Mentoring improves the opportunities of career beginners by providing career-enhancing contacts and involvement in professional networks.
At the beginning of the mentoring cooperation, students formulate clear goals and communicate them to their mentor. In consultation with the mentor, concrete topics and the respective roles within the mentoring process will be defined. Since the student is at the centre of the process, it is their task to become aware of their own plans and their support needs.
OBJECTIVES OF THE MODULE:
• Intensify international networking among geologists all across Europe and beyond
• Provide young professionals with contacts helping them to think through, plan and access their short, medium or long-term career development
• Contribute on internship positions
• Improve gender balance and increase diversity in leadership positions by providing targeted support to women and under-represented minorities
• Facilitate life-long learning and Continuing Professional Development (CPD)
The EFG mentors are professionals who have acquired a high level of industrial and/or academic experience and work in industrial practice, business, academia, education or administration.
• Coaching: The mentor actively guides and encourages the student to develop essential skills and attitudes for the future ("How do I assert myself? How do I behave in negotiations? What do I do in challenging work contexts?")
• Advice: The mentor advises the student in concrete situations, in current questions and difficulties. Mentors support students in solving problems and assist them in making tough decisions.</td></tr>
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	• **Help:** The mentor can help open otherwise locked doors that allow the student to pursue their goals. • **Support:** The mentor supports the student in essential decisions without deciding. Mentors assist in the development of professional strategies, as well as in career planning and review of possible obstacles. • **Inform:** The mentor informs the student about (informal) rules and processes applied in organisations or professional life in general. According to the student's background, mentors can also inform about seminars or conferences that they consider helpful. • **Participation:** Mentors allow students to participate in parts of their professional career, experiences and strategic decisions. They allow students to share their professional life and invite them, for instance, to participate in meetings or appointments. • **Give feedback:** Mentor and student provide each other with constructive feedback about their appearance and public perception. • **Networking:** Mentors give the students hints on maintaining and using contacts. They introduce the students into active networks and provide professional contacts. The mentor provides the student with the chance to create a successful CV and take a chance on social networks such as LinkedIn.
Learning outcomes of the curricular unit (knowledge, skills and competences to be developed by the students)	Knowledge: to provide background training to support the learning process; make students aware of broad professional issues; provide business and entrepreneurship skills to develop an awareness of business management and commercial practices regarding mineral prospecting and exploration. Skills: Develop relationships with other persons and maintain them. Can talk frankly about his ideas, fears and weaknesses. Identifying investment opportunities in the mineral resources sector. Competences: To define professional targets, wants to succeed and is actively committed to implementing these targets. Not afraid of making mistakes and experimenting with new ideas. Willing to question himself critically, accept external advice, and implement it.
Assessment methods and criteria	Practical mark At the end of the mentoring process, students will a) reflect their mentoring experience on a two-page report highlighting benefits and potential gaps for future implementation b) prepare a small business plan for an identified innovative idea of their own. Slack channel will allow for student-mentor exchange and networking within the whole cohort of participants. Mentoring is a one-to-one relationship between a mentor and a student. • Mentoring takes place beyond a dependent relationship (e.g. supervisor-subordinate or professor-student relationships). • During the mentoring process, learning and experimentation occur in a protected environment. • An integral part of mentoring is the development of professional skills and competencies. Mentoring is a reciprocal process of "give and take". Both sides learn from each

	other because even the mentor will have the opportunity to critically question his professional perspective and discover new perspectives, software and applications, and previously unperceived situations.
Recommended readings	Mentoring Mindset, Skills and Tools 4th Edition: Make it easy for mentors and students, 2020, Synergetic People Development Pty Ltd, 252 pages, ISBN 0980356458 The Mentoring Guide: Helping Mentors and Students Succeed, 2019, Michigan Publishing Services, ISBN: 1607855399. Wang, J., Shibayama, S., 2022. Mentorship and creativity: Effects of mentor creativity and mentoring style. Research Policy 51, 104451. doi:10.1016/j.respol.2021.104451 Entrepreneurship: A Guide To Success For Entrepreneurs And Aspiring Entrepreneurs, 2018, ISBN 978-1720221654 Entrepreneurship: Successfully Launching New Ventures, Global Edition, 2018, Pearson, ISBN: 9781292255330
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Contribution to EIT's Overarching Learning Outcomes (tick relevant box/es)*	**OLO 1 Entrepreneurship**	**OLO2 Innovation**	**OLO3 Creativity**	**OLO4 Intercultural**	**OLO5 Value judgments / Sustainability**	**OLO6 Leadership**
	XX		X	XX	XX	XX
Justification for OLO contribution						