SEMESTER 1

FACULTY OF GEOENGINEERING, MINING AND GEOLOGY

SUBJECT CARD

Name in Polish: Eksploatacja Odkrywkowa
Name in English: Surface Mining Technology
Main field of study: mining and geology
Specialization: Underground and Surface Mining
Level and form of studies: 2nd level, full-time
Kind of subject: obligatory
Subject code: GGG1301
Group of courses: No

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

PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES

1. The student has knowledge concerning geology of loose mineral deposits hydrogeology and mine dewatering.
2. The student has knowledge of soil mechanics and methods of calculation concerning slope stability.
3. The student can apply in practice the basic technologies of basics machinery.
4. The student can use Microsoft Office and can also work with Excel programme.

SUBJECT OBJECTIVES

C1. Familiarizing with the basics of design of loose minerals open-cast mines and types of technological systems in their exploitation.
C2. Getting know how to provide loose mineral deposits and development excavation design.
C3. Presentation of knowledge concerning more advanced technology of wheel excavators in complex geological and mining conditions.
C4. The choice of technological system to perform specific tasks concerning production capacity in particular geological deposit structure conditions.

SUBJECT EDUCATIONAL EFFECTS

relating to knowledge:

PEK_W01 - Familiarizing students with what an open-cast mine consists of if it goes for materials and the processes involved.

PEK_W02 - The obtained knowledge concerning the effects which an open-cast causes in the rock mass and immediate vicinity of the excavation.

PEK_W03 - Sharing knowledge concerning formation of an exploitation project concerning soil mass movement and OCT transformation.

PEK_W04 - Familiarizing students with the phases of bed sharing and related processes of mines reconstruction.

PEK_W05 - Obtaining knowledge concerning relationship between the type of mined rock and possible to obtain excavators yield and how it affects the shape of excavation.

relating to skills:

PEK_U01 - The student can determine the boundaries of a deposit, taking into account identified and described constrains

PEK_U02 - The student can make the optimal excavation division on floors including geotechnical constraints.

PEK_U03 - The student obtains knowledge concerning excavation conduct in complex conditions of excavated floor geological construction (offsets, slopes).

PEK_U04 - The student can, basing on acquired knowledge, realize "The project of sharing excavation construction with the selection of the technological system."

relating to social competences:

PEK_K01 - The student has knowledge concerning the benefits of open-cast mining and is able to limit its environmental drawbacks.

PROGRAMME CONTENT		
Form of classes - lecture		**Number of hours**
Lec 1	Scope of the course, teaching purpose, crediting conditions.	2
Lec 2	A general model of loose mineral mine.	1
Lec 3	Phenomena and processes caused by open-cast excavation in the surrounding rock mass.	2
Lec 4	Deposit's characteristics. Determining deposit's capacity.	2
Lec 5	Geometric and economic indicators describing the vertical shape of the deposit.	1
Lec 6	Types of technological systems in open-cast excavation and conditions of use.	2
Lec 7	The boundaries of a deposit's exploitation. Designing exploitations directions.	2
Lec 8	Providing excavation and stages of the construction.	2
Lec 9	Elements and geometry of front slope and transport.	1
Lec 10	Elements and geometry of moveable slope and side.	1
Lec 11	Division of the excavation on levels based on the condition: - steady progress - the ability of mining excavators and steady progress of the front.	2
Lec 12	Division of the excavation on levels based on the condition of steady front progress and: - floors' height specified in the geotechnical and for these assumptions determining the mining ability of excavators and their technological parameters.	2
Lec 13	Basics of external and internal dump construction technology.	2
Lec 14	Methods of determining the workability of rocks.	2
Lec 15	Working wheel excavators in the regions of faults and tilted layers.	2
Lec 16	Solutions of wheel excavators working practices in land of hard workability and	2

	high abrasiveness.	
Lec 17	Sublevel wheel excavators work technology.	2
	Total hours	**30**

	Form of classes - project	**Number of hours**
Proj 1	Organizational matters, crediting, literature Project objectives presentation "The project of sharing excavation construction with the selection of the technological system."	2
Proj 2	Discussion concerning data input to the project and assigning topics.	2
Proj 3	Descriptions of methods and stages of providing drill.	2
Proj 4	Design solutions of providing drills solids.	2
Proj 5	Basic design of front slope construction.	2
Proj 6	Basic design of transport slope construction.	2
Proj 7	Basic design of moveable slope construction in dependence of geological-mining conditions.	2
Proj 8	Basic design of moveable slope construction in dependence of excavation changeability and the level of ready and prepared supplies.	2
Proj 9	Basic design of the side slope.	2
Proj 10	Division of the excavation into providing floors, for steady front excavation conditions.	2
Proj 11	Division into floors, for steady front excavation conditions and excavation ability of possessed excavators.	2
Proj 12	The division into levels based on geotechnical calculations (setting values) and specify the required excavation capacity in the particular floor.	2
Proj 13	For certain excavation capacity (Pr 12) the selection of technological excavators' parameters on the particular floor.	2
Proj 14	The choice of belt conveyors for excavators in the particular exploitation floor.	2
Proj 15	Handing in projects, their defence and a grade.	2
	Total hours	**30**

TEACHING TOOLS USED
N1. Type of lectures - traditional, illustrated with multimedia presentations with the usage of audio-visual equipment N2. Discussion concerning lectures and projects. N3. Projects preparation in a paper form N4. Projects defence - oral or 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 Grade from project's performance and its merits F.1.2 Grade from project's oral or written defence P1.Final grade from the project No. 1 (weighted average of F1.1 - 50% and F1.2 - 50%).
P2	PEK_W01-PEK_W05	P1.Final grade of written test.

PRIMARY AND SECONDARY LITERATURE

PRIMARY LITERATURE:

[1] Bęben A. Maszyny i urządzenia do wydobywania kopalin pospolitych bez użycia materiałów wybuchowych. Kraków: AGH Uczelniane Wydawnictwa Naukowo- Dydaktyczne, 2008
[2] Hawrylak H. Sobolski R. Maszyny podstawowe górnictwa odkrywkowego Pub. "Śląsk", Katowice 1967.
[3] Kołkiewicz W. Zastosowanie maszyn podstawowych w górnictwie odkrywkowym Wyd. Śląsk Publishing 1974
[4] Kozłowski Z. Technika prowadzenia robót w kopalniach odkrywkowych Pub. "Śląsk", Katowice 1974.
[5] Pod red. K. Strzodki, J. Sajkiewicza, A. Dunikowskiego Górnictwo odkrywkowe Tom I
[6] Wiśniewski S. Zasady projektowania kopalń Cz. "Śląsk" Publishing, Katowice 1971.
[7] Praca zbiorowa pod redakcją Wiśniewskiego S. Projektowanie kopalń Cz. I. Kopalnie odkrywkowe. Skrypt Politechniki Wrocławskiej, 1980
[8] Wojtkiewicz H. Technologiczne rozwiązania pracy koparek kołowych w rejonach uskoków i warstw nachylonych. Raport SPRJ-11/S-95/2009 Politechnika Wrocławska, Instytut Górnictwa
[9] Żur T. Przenośniki taśmowe w górnictwie "Śląsk" Publishing, Katowice 1974

SECONDARY LITERATURE:

[1] Glapa W., Korzeniowski J.I., Mały Leksykon Górnictwa Odkrywkowego, Wydawnictwa i Szkolenia Górnicze Burnat & Korzeniowski, Wrocław 2005
[2] Górnictwo i Geologia, Prace Naukowe Instytutu Górnictwa Politechniki Wrocławskiej. Studia i Materiały
[3] Kasztelewicz Z. Koparki wielonaczyniowe i zwałowarki taśmowe. Technologia pracy. AGH Kraków 2012
[4] Czasopisma: Węgiel Brunatny. Pub. Porozumienie Producentów Węgla Brunatnego

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

dr inż. Henryk Wojtkiewicz, henryk.wojtkiewicz@pwr.wroc.pl
dr inż. Justyna Woźniak, justyna.woźniak@pwr.wroc.pl

MATRIX OF CORRELATION BETWEEN EDUCATIONAL EFFECTS FOR SUBJECT
Surface Mining Technology
AND EDUCATIONAL EFFECTS FOR MAIN FIELD OF STUDY
mining and geology
AND SPECIALIZATION
Underground and Surface Mining

SUBJECT EDUCATIONAL EFFECT	Correlation between subject educational effect and educational effects defined for main field of study and specialization	SUBJECT OBJECTIVES	Programme content	Teaching tool number
PEK_W01	K_W05	C1, C2	Lec 2, Lec 4 Lec 5, Lec 13	N1, N2, N5
PEK_W02	K_W05	C2	Lec 3, Lec 7, Lec 14	N1, N2, N5
PEK_W03	K_W05	C1, C4	Lec 6, Lec 7, Lec 11	N1, N2, N3, N5
PEK_W04	K_W05	C2, C4	Lec 8-Lec 12	N1, N2, N3, N5
PEK_W05	K_W05	C4	Lec 12	N1, N2, N3, N5
PEK_U01	K_U07	C1	Lec 5, Lec 6, Lec 7	N1, N2, N5
PEK_U02	K_U07	C2	Lec 11, Lec 12, Lec 14	N1, N2, N5
PEK_U03	K_U07	C3	Lec 15, Lec 16, Lec 17	N1, N2, N5
PEK_U04	K_U07	C4	Lec 8, Lec 9, Lec 10	N1, N2, N5
PEK_K01	K_K01	C1	Lec 3, Lec 7, Lec 13	N1, N2

FACULTY OF GEOENGINEERING, MINING AND GEOLOGY

SUBJECT CARD

Name in Polish: Mechanika Górotworu
Name in English: Rock Mass Mechanics
Main field of study: mining and geology
Specialization: Underground and Surface Mining
Level and form of studies: 2nd level, full-time
Kind of subject: obligatory
Subject code: GGG1304
Group of courses: No

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

PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES

1. The student has knowledge of the constitutive models of continuous body: various elastic models, plastic, adhesive, and strength hypotheses.
2. The student has the ability to describe and understand the parameters describing mine geological conditions for assessing the quality of a rock.
3. The student has basic knowledge concerning measurement methods used in geomechanics: MES, MRS, MEO.
4. The student has knowledge concerning the distribution of stresses in a rock mass in the vicinity of underground excavations and can document it using appropriate calculations.
5. The student can fluently use both Microsoft Office, AutoCad, and also has a practice in the usage of standard software for numerical modelling of the rock mass.

SUBJECT EDUCATIONAL EFFECTS

relating to knowledge:

PEK_W01 - The student has the ability to use the principles of elastic-plasticity-adhesive mechanics of continuous body to conclude about changes in the state of stress / strain in the rock mass as a result of the excavation.

PEK_W02 - The student has advanced knowledge in order to observe the phenomena occurring in the rock mass and basing on these parameters conclude about the danger and how appropriately protect excavations using a support.

PEK_W03 - The student understands that the state of stress and strain around the underground excavation is variable in time and depends on various system parameters such as rock type, degree of cracking, the actual excavation geometry, excavation progress, characteristics of the initial strains, et al.

relating to skills:

PEK_U01 - Through visual observations the student can confidently assess the quality of rocks surrounding the excavation and at the same time is able to offer the right form of its support.

PEK_U02 - For real underground geological and mining conditions the student can choose the most appropriate method of analysis / calculations and successfully implement it.

PEK_U03 - The student possessed the ability to use computer technology (mainly FEM) to model the rock mass behaviour disturbed by excavation and to identify the places and types of related risks.

relating to social competences:

PEK_K01 - The student can work in a team and has the ability to present the results of her/his work as a paper report.

PEK_K02 - The student can present her/his case to the public and is able to justify it.

PROGRAMME CONTENT

Form of classes - lecture		Number of hours
Lec 1	Subject's programme, conditions of crediting, literature The essence of rock mechanics as a field of knowledge which identifies and explains the causes and effects of various physical and geomechanical phenomena occurring around the underground excavations.	2
Lec 2	The base model of the exploitation field and its environment and the impact of their parameters on the degree of risk of the dynamic manifestations of rock mass pressure.	2
Lec 3	Rock mass behaviour in the vicinity of excavation, depending on the type of rock and the depth of its foundation.	2
Lec 4	Tensor state of stress in the rock mass. Determination of stresses in the rock using various experimental methods.	2
Lec 5	The effect of excavation orientation according to the direction of the largest horizontal component of the initial stress on the degree of risk for fall.	2
Lec 6	Interchamber pillar load assessment and the floor, which it lies on.	2
Lec 7	Rock panel model and its use in assessing the risk of instability phenomena in the rock mass. Modelling cases of large mine areas using FEA and MRS.	2
Lec 8	Types of underground excavation supports. Division, working mechanisms, analytical methods of design.	2

Lec 9	Support prone to underground excavations. Designing a support in the conditions of rock mass squeezing. New Austrian Tunnelling Method.	2
Lec 10	Underground excavations in the rock mass having a block construction. Spatial analysis and separation of rock blocks having the greatest spall potential. Determination of the required capacity of stabilizing anchors.	2
Lec 11	Empirical methods for underground support selection. RMR rock mass classification method and the method used in the copper mines LGOM.	2
Lec 12	Selection of the excavation complex support on the basis of various contemporary classification methods: the Q number, RMR, MRMR, RMI etc.	2
Lec 13	Risk assessment of shaft support in the field of static loads based on measurements and analytical solutions.	2
Lec 14	Shaft support hazard analysis because of induced seismic events.	2
Lec 15	Assessment of excavation destruction risk in the light of simplified methods and the theory of stochastic processes.	2
	Total hours	**30**

Form of classes - project		**Number of hours**
Proj 1	Presentation of the project's essence, crediting conditions, and giving recommended literature. Providing students with individual design topics and discussion of the next stages of project under the title: "The project of support supporting / coating / vaulted / anchor of tunnel excavation in alternative geological and mining conditions."	1
Proj 2	Discussion of geological and mining conditions and their most important parameters; Appointment of calculating geotechnical parameters of the rock. The problem of scale and its impact on the values of strength and deformation parameters. Determination of the appropriate type of support in selected geological and mining conditions.	2
Proj 3	Determination of the initial state of stress in the rock mass with regard to the action of a big horizontal component being the result of distant tectonic interactions. Practical calculation of a load acting on the support.	2
Proj 4	Discussion of the classification method applied to practical tests of the complex support selection in a fractured rock mass.	2
Proj 5	Presentation of UNWEDGE computer program and its application to the structure of the block rock mass.	2
Proj 6	Presentation of the control calculations samples of the rock mass deformation and stress in the support elements for the selected student projects, using computer software (i.e. PHASE).	2
Proj 7	Presentation of ready-made projects and their defence in the presence of other students.	2
Proj 8	Handing the project to the teacher. Performance grade and oral test concerning the project's merits. Crediting.	2
	Total hours	**15**

TEACHING TOOLS USED
N1. Informative lecture with the elements of problem solving lecture. N2. Multimedia presentations. N3. Didactic discussion considering the lecture and the project. N4. Projects preparation in a report form. N5. Projects presentation and test concerning issues covered by the project N6. Computer counting and their immediate presentation on a screen and detailed description. N7. 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
P	PEK_W01-PEK_W03, PEK_U01, PEK_U02	P1.Final grade of written test.
F, P	PEK_U02, PEK_U03, PEK_K01, PEK_K02	F1 Grade from performance and merits of the project F2- written test grade or presentation of issues covered in the project P2 = (0,4 F1 + 0,6 F2) - Final grade from the project

PRIMARY AND SECONDARY LITERATURE

PRIMARY LITERATURE

[1] CHUDEK M., Geomechanika z podstawami ochrony środowiska górniczego i powierzchni terenu, Pol. Śląska Publishing, Gliwice 2002,
[2] CHUDEK M., Obudowa wyrobisk górniczych, część I, Obudowa wyrobisk korytarzowych i komorowych. "Śląsk", Katowice 1986.
[3] GAŁCZYŃSKI S., Podstawy budownictwa podziemnego, Pol. Wr. Pubishing House, Wrocław 2001
[4] GERGOWICZ Z., Geotechnika górnicza. Skrypt PWr., Wrocław 1974.
[5] Hoek E., Kaiser P.K., W.F. Bawden. Support of Underground Excavations in Hard Rock. Funding by Mining Research Directoriate and Universities Research Incentive Fund (www.rockscience.com/)
[6] Hoek E. Rock Engineering. (www.rockscience.com/)
[7] Kidybiński A., Podstawy geotechniki kopalnianej. "Śląsk", Katowice 1982.
[8] Kłeczek Z., Geomechanika górnicza, Śląskie Techn. Publishing, Katowice 1994.
[9] PIECHOTA S. Podstawy górnictwa kopalin stałych, AGH Publishing, Kraków 1996,
[10] Pytel W. Płytowy model współpracy układu: strop-filar-spąg i jego zastosowanie w mechanice górotworu. Zesz. Nauk. PŚl Nr. 1532, Gliwice 2002
[11] RYNCARZ T. Zarys fizyki górotworu, Śląska Techn. Publishing, Katowice 1993.
[12] SAŁUSTOWICZ A., Zarys mechaniki górotworu, "Śląsk", Katowice 1968.
[13] Ulusay R., Hudson J. A. The complete ISRM suggested nethods for rock characterization, resting and monitoring: 1974-2006, Commision on Testing Methods, ISRM, Ankara 2007
[14] Wiłun Z., Zarys geotechniki, Komunikacji i Łączności Publishing, Warszawa 1987.

SECONDARY LITERATURE

[1] Bieniawski Z. T., Engineering Rock Mass Clasifications.Wiley & Sons, Intersc. publication. NY 1989

[2] Borecki M.,Chudek M., Mechanika górotworu. "Śląsk", Katowice 1972.
[3] Butra J. Eksploatacja złoża rud miedzi w warunkach zagrożenia tąpaniami i zawałami. KGHM Cuprum Pub. , Wrocław 2010
[4] FILCEK H., KŁECZEK Z., ZORYCHTA A., Poglądy i rozwiązania dotyczące tąpań w kopalniach węgla kamiennego. Zeszyty Nauk. AGH Górnictwo, nr.123, Kraków 1984.
[5] Franasik K., Mechanika górotworu - Zwalczanie zagrożeń od zawałów i tąpań w kopalniach rud miedzi. Skrypt PWr. Wrocław 1978.
[6] Hoek E.,Brown E. T., Underground Excavations in Rock. Institution of Mining and Met., London 1980.
[7] Kisiel I., Mechanika techniczna tom VII - Mechanika skał i gruntów. PWN, Warszawa 1982.
[8] Kwaśniewski M. Zachowanie się skał izo-i anizotropowych w warunkach trójosiowego ściskania, Zeszyty Nauk. Pol. Śląskiej, Górnictwo z. 247, Gliwice 2002.
[9] SAŁUSTOWICZ A., Mechanika górotworu, Górniczo-Hutnicze Publishing, Katowice 1955.
[10] THIEL K., Mechanika skał w inżynierii wodnej. PWN, Warszawa 1980,
[11] Praca zbiorowa: Materiały konferencyjne Zimowych Szkół Mechaniki Górotworu i Geoinżynierii,: PWr, i AGH Publishing
[12] NORMY:
PN-98/B-02481 – Geotechnika. Terminologia podstawowa. Symbole literowe i jednostki miar.
PN-98/B-02479 – Geotechnika. Dokumentowanie geotechniczne. Zasady ogólne.
PN - G- 04200 - Kopaliny. Próbki geologiczne. Ogólne wytyczne pobierania.
PN - G- 04301 - Skały zwięzłe. Pobieranie i przygotowanie próbek do badań własności mechanicznych i technologicznych.
PN - G- 04302 - Skały zwięzłe. Oznaczenie wytrzymałości na rozciąganie metodą poprzecznego ściskania
PN - G- 04303 - Skały zwięzłe. Oznaczanie wytrzymałości na ściskanie z użyciem próbek foremnych.
PN - G- 04304 - Skały zwięzłe. Oznaczanie wytrzymałości na ścinanie proste.
PN - G- 04305 - Skały zwięzłe. Oznaczanie wytrzymałości na zginanie z użyciem próbek foremnych
PN - G- 04306 - Skały zwięzłe. Oznaczanie wytrzymałości na zginanie z użyciem próbek w postaci krążka.
PN - G- 04351 - Grunty skaliste i nieskaliste. Oznaczanie gęstości właściwej szkieletu gruntowego metodą próżniową
BN - 80/8704-15 - Oznaczanie wskaźnika wytrzymałości przy punktowym obciążeniu próbki
PN - G- 05016 - Szyby górnicze. Obudowa. Obciążenia
PN - G- 05020 - Podziemne wyrobiska korytarzowe i komorowe. Obudowa sklepiona. Zasady projektowania i obliczeń statycznych.
PN - G- 05600 - Podziemne wyrobiska korytarzowe i komorowe. Obudowa powłokowa. Zasady projektowania i obliczeń statycznych.

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

dr hab. inż. Witold Pytel, prof. PWr, **wpytel@cuprum.wroc.pl**

MATRIX OF CORRELATION BETWEEN EDUCATIONAL EFFECTS FOR SUBJECT
Rock Mass Mechanics
AND EDUCATIONAL EFFECTS FOR MAIN FIELD OF STUDY
mining and geology
AND SPECIALIZATION
Underground and Surface Mining

SUBJECT EDUCATIONAL EFFECT	Correlation between subject educational effect and educational effects defined for main field of study and specialization	SUBJECT OBJECTIVES	Programme content	Teaching tool number
PEK_W01	K_W03	C3	Lec 1-Lec 6 Lec 14	N1-N3, N6, N7
PEK_W02	K_W09	C2, C3, C7	Lec 6-Lec 7 Lec 13-Lec 15	N1-N3, N7
PEK_W03	K_W03	C2, C3, C6	Lec 12	N1-N3, N6, N7
PEK_U01	K_U05	C4	Lec 6, Lec 8 Proj 1-Proj 4	N1-N5, N7
PEK_U02	K_U05, K_U14	C4, C5	Lec 9-Lec 11 Proj 1-Proj 4	N1-N5, N7
PEK_U03	K_U14	C3	Proj 5-Proj 6	N6
PEK_K01 PEK_K02	K_K01 K-K02	C1	Proj 7, Proj 8	N5

FACULTY OF GEOENGINEERING, MINING AND GEOLOGY

SUBJECT CARD

Name in Polish: Modele Decyzyjne w Zarządzaniu
Name in English: Operational Research in Management
Main field of study: mining and geology
Specialization: Underground and Surface Mining
Level and form of studies: 2nd level, full-time
Kind of subject: obligatory
Subject code: ZMG1302
Group of courses: NO

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

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 application 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 EDUCATIONAL EFFECTS

relating to knowledge:

PEK_W01 The student has knowledge concerning basic decision models in management
PEK_W02 The student has knowledge concerning line programming models.
PEK_W03 The student has knowledge concerning models for planning and monitoring of activities, deposits, and costs of projects
PEK_W04 The student has knowledge concerning queuing system models
PEK_W05 The student has knowledge concerning simulation models.

relating to skills:

PEK_U01 The student has the ability to apply and interpret models using linear programming applications
PEK_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
PEK_U03 The student has the ability to apply and interpret queuing system models using programming applications
PEK_U04 The student has the ability to apply and interpret simulation models using programming applications

relating to social competences:

PEK_K01 The student can think and act in a system, creative and enterprising way
PEK_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**
Lec 1	Introduction to modelling systems	2
Lec 2	Linear programming issues - optimization of production	2
Lec 3	Linear programming issues - flow in networks optimization (optimal allocation issues, the issue of transportation, maximum flow, minimizing costs)	2
Lec 4	Projects scheduling using critical path	2
Lec 5	Planning and balancing of deposits in projects	2
Lec 6	Optimization issues of queuing systems	2
Lec 7	Monte Carlo methods and digital simulation	3
	Total hours	**15**

Form of classes - laboratory		Number of hours
Lab 1	Defining and solving linear programming issues (Microsoft Excel-Solver)	2
Lab 2	Production optimization (Microsoft Excel - Solver)	2
Lab 3	Flows in networks optimization (Microsoft Excel - Solver)	2
Lab 4	Projects scheduling (Microsoft Project)	2
Lab 5	Planning and balancing of deposits in projects (Microsoft Project)	2
Lab 6	Optimization issues of queuing systems (Microsoft Excel)	2
Lab 7	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 EDUCATIONAL EFFECTS ACHIEVEMENTS

Evaluation F – forming (during semester), P – concluding (at semester end)	Educational effect number	Method of evaluating educational effect achievement
F1	PEK_U01-PEK_U04	short written test
P1	PEK_U01-PEK_U04	written test (counting exercise)
P2	PEK_W01-PEK_W05, PEK_K01-PEK_K02	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. Bogumił Tomasz Dałkowski, tomasz.dalkowski@pwr.wroc.pl

MATRIX OF CORRELATION BETWEEN EDUCATIONAL EFFECTS FOR SUBJECT
Operational Research in Management
AND EDUCATIONAL EFFECTS FOR MAIN FIELD OF STUDY
mining and geology
AND SPECIALIZATION
Underground and Surface Mining

SUBJECT EDUCATIONAL EFFECT	Correlation between subject educational effect and educational effects defined for main field of study and specialization	SUBJECT OBJECTIVES	Programme content	Teaching tool number
PEK_W01-PEK_W05	K_W06	C1.1-C1.5	Lec 1-Lec 7	N1, N4, N6
PEK_U01-PEK_U04	K_U08	C2.1-C2.4	Lab 1-Lab 7	N2, N4, N5
PEK_K01-PEK_K02	K_K01	C3	Lec 1	N1

FACULTY OF GEOENGINEERING, MINING AND GEOLOGY

SUBJECT CARD

Name in Polish: AutoCAD
Name in English: AutoCAD
Main field of study: mining and geology
Specialization: Underground and Surface Mining
Level and form of studies: 2nd level, full-time
Kind of subject: obligatory
Subject code: GFG1301
Group of courses: NO

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

PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES

1. Basic knowledge concerning technical drawing.

SUBJECT OBJECTIVES

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

SUBJECT EDUCATIONAL EFFECTS

relating to skills:

PEK_U01 Ability of geometric mapping concerning the designed elements.
PEK_U02 Ability of synthetic description concerning designed elements.
PEK_U03 Ability to prepare drawings for printing.

relating to social competences:

PEK_K01 Understanding the importance of correct drawing mapping of the designed elements for their proper implementation.

PROGRAMME CONTENT		
Form of classes - laboratory		**Number of hours**
Lab 1	Familiarising with AutoCAD and preparation for work.	2
Lab 2	Accurate drawing.	2
Lab 3	Design of characteristic elements.	2
Lab 4	Modification of elements.	2
Lab 5	Modification of elements. (to be continued)	2
Lab 6	Introducing a text.	2
Lab 7	Adding symbols and hatches.	2
Lab 8	Objects drawing.	2
Lab 9	Adding dimensions.	2
Lab 10	Adding dimensions. (to be continued)	2
Lab 11	Creating blocks.	2
Lab 12	Creating dynamic blocks.	2
Lab 13	Creating viewports and printing sheets.	2
Lab 14	Print preparation.	2
Lab 15	Print preparation. (to be continued)	2
	Total hours	**30**

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

EVALUATION OF SUBJECT EDUCATIONAL EFFECTS ACHIEVEMENT

Evaluation (F – forming (during semester), P – concluding (at the end of semester)	Educational effect number	Way of evaluating educational effect achievement
P1	PEK_U01-PEK_U03 PEK_K01	Drawing's printing preparation and detailed analysis.

PRIMARY AND SECONDARY LITERATURE

PRIMARY LITERATURE

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

SECONDARY LITERATURE

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

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

Marek Zombroń, marek.zombron@pwr.wroc.pl

MATRIX OF CORRELATION BETWEEN EDUCATIONAL EFFECTS FOR SUBJECT
AutoCAD
AND EDUCATIONAL EFFECTS FOR MAIN FIELD OF STUDY
mining and geology
AND SPECIALIZATION
Underground and Surface Mining

SUBJECT EDUCATIONAL EFFECT	Correlation between subject educational effect and educational effects defined for main field of study and specialization	SUBJECT OBJECTIVES	Programme content	Teaching tool number
PEK_U01	K_U10	C1	Lab 1-Lab 8, Lab 11-Lab 12	N1
PEK_U02	K_U10	C1	Lab 9-Lab 10	N1
PEK_U03	K_U10	C1	Lab 13-Lab 15	N1
PEK_K01	K_K01	C1	Lab 1-Lab 15	N1

FACULTY OF GEOENGINEERING, MINING AND GEOLOGY

SUBJECT CARD

Name in Polish: Geologia Złóż i Techniki Poszukiwania Złóż
Name in English: Geology and Exploration of Mineral Deposits
Main field of study: mining and geology
Specialization: Underground and Surface Mining
Level and form of studies: 2nd level, full-time
Kind of subject: obligatory
Subject code: GEG1310
Group of courses: NO

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

PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES

1. The student has basic knowledge concerning geology, at the level required by secondary education
2. The student has basic skills in the range of mathematics and using Microsoft Office environment
3. The student can work in a team and understands the need to broaden his skills

SUBJECT OBJECTIVES

C 1 acquainting students with the problems of world's mineral resources
C 2 preparing students to solve specific tasks concerning exploration and deposits' recognition, with particular emphasis on solid mineral deposits

SUBJECT EDUCATIONAL EFFECTS

relating to knowledge:

PEK_W01 The student has systematic knowledge of classification, occurrence, resources and importance of the most important world's solid mineral deposits

PEK_W02 The student has basic knowledge concerning the legal and geological basics of exploration and deposits' recognition

PEK_W03 The student has basic knowledge concerning geophysics and drilling methods of exploration and deposits' recognition and also haw to use computer to aid the methods

relating to skills:

PEK_U01 The student can read, prepare and interpret maps and geological-deposit cross-sections and variability maps of deposits' parameters

PEK_U02 The student can interpret geophysical measurements results

PEK_U03 The student can prepare a simplified project of a research project of the borehole

PEK_U04 The student can designate the variability of deposits parameters using specialized computer software

relating to social competences:

PEK_K01 The student is aware of the consequences of non-technical activities concerning prospecting of mineral resources associated with its impact on the environment and the resulting responsibility for the decisions taken during this activity

PROGRAMME CONTENT		
Form of classes - lecture		**Number of hours**
Lec 1	object of study of mining geology, basic definitions and classification of mineral deposits	2
Lec 2	aim and scope of investments in mining	2
Lec 3	global energy mineral deposits	2
Lec 4	global energy metal deposits	2
Lec 5	global energy chemical deposits	2
Lec 6	global energy rock deposits	2
Lec 7	formal legal basis and geological exploration	2
Lec 8	signs and indications of deposits' occurrence	2
Lec 9	methods of deposits' exploration	2
Lec 9	geophysical methods of exploration and deposits' recognition	4
Lec 10	drilling methods of exploration and deposits' recognition	4
Lec 11	computer aided exploration and deposits' recognition	4
	Total hours	**30**

Form of classes - project		Number of hours
Proj 1	preparing maps and deposits' cross-sections	10
Proj 2	determining variability of a chosen deposit's parameter using the Surfer or RockWorks programme	6
Proj 3	interpretation of geophysical measurements	8
Proj 4	simplified project of a research project of the borehole	6
	Total hours	**30**

TEACHING TOOLS USED
N1. Type of lectures - traditional, illustrated with multimedia presentations with the usage of audio-visual equipment N2. Projects conducted with the use of maps and cross-sections and geological records in both paper and electronic form. N3. Calculation of the variability of deposits' parameters using software RockWorks or Surfer

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
P	PEK_W01-PEK_W03	P1 Final grade of written test according to the given scope of material
F, P	PEK_U01-PEK_U04	F2 every project is graded Final grade is a mean of particular grades

PRIMARY AND SECONDARY LITERATURE

PRIMARY LITERATURE:

[1] Gruszczyk H., Nauka o złożach, Geol. Pub. W-wa 1984 r.
[2] Surowce energetyczne, skrypt AGH nr 1270, Kraków 1991 r.
[3] Rudy żelaza, metale lekkie, skrypt AGH nr 1476, Kraków 1996 r.
[4] Paulo A., Strzelska-Smakowska B., Rudy metali nieżelaznych i szlachetnych, AGH, Kraków 2000
[5] Fajklewicz Z., Zarys geofizyki stosowanej, Geol. Pub. Warszawa, 1972r.
[6] Jarzyna J., Bała M., Zaorski T., Metody geofizyki otworowej, AGH Pub. Kraków, 1999 r.
[7] Gonet A., Strzyczek S., Rzyczniak M., Projektowanie otworów wiertniczych, AGH Kraków 2004

SECONDARY LITERATURE:

[1] Bilans zasobów kopalin i wód podziemnych w Polsce, Państwowy Instytut Geologiczny, Warszawa
[2] Bilans gospodarki surowcami mineralnymi na tle gospodarki światowej, IGSMiE PAN, Kraków
[3] Kasina Z., Metodyka badań sejsmicznych, PAN GSMiE, Kraków 1998
[4] Internet np. www.pgi.gov.pl

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

dr Stanisław Ślusarczyk, stanislaw.slusarczyk@pwr.wroc.pl

MATRIX OF CORRELATION BETWEEN EDUCATIONAL EFFECTS FOR SUBJECT
Geology and Exploration of Mineral Deposits
AND EDUCATIONAL EFFECTS FOR MAIN FIELD OF STUDY
mining and geology
AND SPECIALIZATION
Underground and Surface Mining

SUBJECT EDUCATIONAL EFFECT	Correlation between subject educational effect and educational effects defined for main field of study and specialization	SUBJECT OBJECTIVES	Programme content	Teaching tool number
PEK_W01-PEK_W03	K_W04	C1-C2	Lec 1-Lec 11	N 1
PEK_U01-PEK_U04	K_U06	C2	Proj 1-Proj 4	N 2
PEK_K01	K_K01-K_02	C1-C2		

FACULTY OF GEOENGINEERING, MINING AND GEOLOGY

SUBJECT CARD

Name in Polish: Geostatystyka
Name in English: Geostatistics
Main field of study: mining and geology
Specialization: Underground and Surface Mining
Level and form of studies: 2nd level, full-time
Kind of subject: obligatory
Subject code: GEG1301
Group of courses: NO

	Lecture	Classes	Laboratory	Project	Seminar
Number of hours of organized classes in the University (ZZU)	15		45		
Number of hours of total student workload (CNPS)	60		90		
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		3		
including number of ECTS points for practical (P) classes					
including number of ECTS points for direct teacher-student contact (BK) classes	2		1		

PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES

1.Knowledge and understanding of basic concepts of mathematical statistics (basic distributions of probability, their parameters, random variables with real values and their distribution, independence of random variables, covariance, correlation), and methods of statistical inference (population and sample, basic point and interval estimates, statistical hypothesis testing - basic parametric and non-parametric tests).
2.Ability to conduct statistical analysis of a finite set of real numbers in the area of statistical description and estimation of the basic parameters of probability distribution, placing and verifying parametric and non-parametric hypothesis, independency verification, correlation of two characteristics of a population.
3.Knowledge of the origins and forms of deposit occurrence, deposit parameters, methods of deposit appraisal, classification of natural resources.

SUBJECT OBJECTIVES

C1.The acquisition of knowledge in the area of basic methods of analysis and building a geostatistical model of deposit parameters and also knowledge of selected applications of geostatistics.
C2.Acquisition of skills in the area of estimation and processing a block model of spatial variability of a deposit parameter.

SUBJECT EDUCATIONAL EFFECTS

relating to knowledge:

PEK_W01: Is able to distinguish between types of variability of deposit parameters, describe them in the categories of a regionalised variable, characterize a geostatistical model of variability and indicate the method of analysed parameter estimation

PEK_W02: Knows techniques of building a digital model of spatial variability of deposit parameters (block model) and ways of its processing (quantitative estimates, cross-section generation, projections, maps)

PEK_W03: knows the typical usage of geostatistical methods (optimization of deposit cognition, estimation of parameters and resources of deposits).

relating to skills:

PEK_U01: Is able to classify the probability distribution of deposit parameters and estimate the basic parameters of distribution, verify hypothesis with the Significance or Chi-squared test

PEK_U02: Is able to develop a simple geostatistical model of a quality deposit parameter

PEK_U03: Is able to estimate the average value of a parameter in a given area, with the use of basic methods of weighted average (including kriging)

PEK_U04: Is able to build a spatial block model of a quality parameter and verify the accuracy of the estimation and also verify the correctness of the model with the use of digital visualization techniques

PEK_U05: Is able to estimate resources of a deposit according to the block model of a quality parameter

PEK_U06: Is able to make basic elements of graphic documentation (cross-sections, projections, maps)

PROGRAMME CONTENT		
Form of classes - lecture		**Number of hours**
Lec 1	Introduction to geostatistics. The character of geological data (from test boreholes or current sampling).	2
Lec 2	Basic statistical analysis of a random variable with real values (descriptive statistics, estimation of average value and variance, adjustment of the probability distribution, parametric and non-parametric tests). Covariance and correlation.	2
Lec 3	Regionalised variable. Stationarity of a stochastic process. Geostatistical model of a regionalised variable variability (determined and random component). Trend analysis. Analysis of anisotropy. Empirical variograms and their modelling.	4
Lec 4	Selected methods of regionalised variable estimation and their accuracy (traditional methods, kriging and its variants).	4
Lec 5	The use of geostatistical methods in making records of deposits: •optimizing deposit cognition, •estimation of parameters and resources of a deposit.	2
Lec 6	Test	1
	Total hours	**15**

Form of classes - laboratory		Number of hours
Lab 1	Establishing the rules of laboratory classes. Getting familiar with the Datamine Studio environment. Introduction to the structure of geological data (from test boreholes or current sampling) and assignment of data sets for analysis.	3
Lab 2	Preparation of geological data for spatial modelling. Determination of sample location and identification of sampling density.	3
Lab 3	Standardization of sample length. Determination of basic statistical characteristics of a deposit parameter. Testing hypothesis regarding probability distribution.	3
Lab 4	Determination of the empirical variograms of a deposit parameter in a given area.	3
Lab 5	Choice of a type of theoretical model of variogram. Determination of the functional form of the theoretical variogram for an analysed parameter in a given area (with the least squares method).	3
Lab 6	Evaluation of a theoretical variogram with the cross validation method on the basis of the kriging estimation method.	3
Lab 7	Evaluation of alternative theoretical variogram models (eg. cross validation) for an analysed parameter in a given area.	3
Lab 8	The selection and verification of the block kriging estimation procedure: • Analysis of the dependence of kriging variance on the distance and number of trials. • Determination of an analysed parameter estimation procedure (including a strategy of trial searching).	3
Lab 9	Formation of a model of spatial variability of a deposit parameter (qualitative block model). Analysis of Kriging variance distribution. Making contour maps.	3
Lab 10	Estimating resources (volume, tonnage and average values of quality parameters including intervals of parameter values and geometric criteria). Digital visualization of a quality model. Preparation of maps and cross sections.	3
Lab 11	Formulation of individual sets of data for independent analysis of a qualitative parameter in the alternative lithological layer. Identification of sampling density. Standardization of sample lengths (composites formation). Identification of probability distribution of an analysed parameter.	3
Lab 12	Identification and verification of a theoretical variogram for an analysed parameter in a given area or in the alternative lithological layer. Determination of the analysed parameter estimation procedure.	3
Lab 13	Formation of a model of spatial variability of a deposit parameter (qualitative block model) in the alternative lithological layer. • Analysis of the spatial distribution of the kriging variance. • Resources estimation. • Preparation of maps and cross sections.	3
Lab 14	Completion of unfinished elements of laboratory exercises.	3
Lab 15	Crediting	3
	Total hours	**45**

TEACHING TOOLS USED
N1. Form of lecture - informative lecture with elements of problematic lectures, contents illustrated with multimedia presentations N2. Form of lecture – moderated discussion N3. Laboratory exercises – teacher presentation of exemplary usage of IT tools N4. Laboratory exercises - discussion of methods of analysis N5. Laboratory exercises – individual conducting of research according to instructions N6. Laboratory exercises - a test of knowledge of laboratory research methods N7. Laboratory exercises - participation in e-tests conducted in the computer laboratory. N8. Consultation N9. Own work - preparation for laboratory exercises N10. Written report from the conducted laboratory research N11. Self-education – individual studies and preparation for test

EVALUATION OF SUBJECT EDUCATIONAL EFFECTS ACHIEVEMENTS

Evaluation F – forming (during semester), P – concluding (at semester end)	Educational effect number	Way of evaluating educational effect achievement
F	PEK_W01-PEK_W02 PEK_U01-PEK_U06	F1: Grade from a written or oral test, preparation for laboratory exercises, grade from execution of laboratory research F2: Grade from written reports from laboratory exercises
P	PEK_W01-PEK_W03 PEK_U01-PEK_U03, PEK_U05	P1: Grade from lecture based on results from written test
P	PEK_U01-PEK_U06	P2: Grade from a test from methods of laboratory research – practical exercises in the computer laboratory
P	PEK_W01-PEK_W02 PEK_U01-PEK_U06	P3: Final grade from laboratory (weighted average: F1 + F2 x 0.3 x 0.7) on condition of achieving positive P2 grade

PRIMARY AND SECONDARY LITERATURE

PRIMARY LITERATURE

[1] Isaaks E.H., Srivastawa R.M., An introduction to Applied Geostatistics, Oxford University Press, 1989.

[2] Isobel Clark and Bill Harper, Practical Geostatistics 2000, Clark I., Practical geostatistics. Elsevier Applied Science, London and New York 2000.

[3] Jokiel-Rokita A., Magiera R., Modele i metody statystyki matematycznej w zadaniach, GiS, Wroclaw, 2005

[4] Krysicki W. i in., Rachunek prawdopodobieństwa i statystyka matematyczna w zadaniach, część I i II, PWN 2010.

[5] Mucha J., Metody matematyczne w dokumentowaniu złóż, AGH Krakow, 1994.

[6] Hołodnik K., Materiały do ćwiczeń, Wroclaw University of Technology, 1994-2012

SECONDARY LITERATURE

[1] Datamine Studio Users Guides, Mineral Industries Computing Limited 1983-2002.

[2] Datamine Reference Manuals, Mineral Industries Computing Limited 1983-1998.
[3] Davis J.C., Statistics and Data Analysis in Geology. J. Wiley and Sons, New York 1973 (rok pierwszego wydania, potem min. 1981, 1994, 2002).
[4] Goovaerts, P., Geostatistics for Natural Resources Evaluation. Oxford University Press 1997.
[5] Namysłowska-Wilczyńska B., Geostatystyka. Teoria i zastosowania, Oficyna PWR, 2006.
[6] Smogur Z., Excel w zastosowaniach inżynieryjnych, Helion, 2008.
[7] Webster, R., Oliver, M.A., Geostatistics for Environmental Scientists. John Wiley & Sons, 2000.

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

dr inż. Krzysztof Hołodnik, krzysztof.holodnik@pwr.wroc.pl

MATRIX OF CORRELATION BETWEEN EDUCATIONAL EFFECTS FOR SUBJECT
Geostatistics
AND EDUCATIONAL EFFECTS FOR MAIN FIELD OF STUDY
mining and geology
AND SPECIALIZATION
Underground and Surface Mining

SUBJECT EDUCATIONAL EFFECT	Correlation between subject educational effect and educational effects defined for the main field of study and specialization	SUBJECT OBJECTIVES	Programme content	Teaching tool number
PEK_W01-PEK_W03	K_W01	C1	Lec 1-Lec 6	N1, N2, N8, N9, N11
PEK_U01-PEK_U06	K_U04, K_U09, K_U10	C2	Lab 1-Lab 15	N3-N10

SEMESTER 2

FACULTY OF GEOENGINEERING, MINING AND GEOLOGY

SUBJECT CARD

Name in Polish: Systemy Maszynowe
Name in English: Machinery Systems
Main field of study: mining and geology
Specialization: Underground and Surface Mining
Level and form of studies: 2nd level, full-time
Kind of subject: obligatory
Subject code: MMG2305
Group of courses: NO

	Lecture	Classes	Laboratory	Project	Seminar
Number of hours of organized classes in University (ZZU)	30		15	15	
Number of hours of total student workload (CNPS)	120		30	30	
Form of crediting	Examination		crediting with grade	crediting with grade	
For group of courses mark (X) final course					
Number of ECTS points	4		1	1	
including number of ECTS points for practical (P) classes					
including number of ECTS points for direct teacher-student contact (BK) classes	4		0,5	0,5	

PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES

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

SUBJECT OBJECTIVES

C1 Familiarizing students with advanced methods of calculation and design of transport equipment used in mining.

C2. Familiarizing students with the methods of evaluation of basic machines technical condition and transport equipment based on the vibroacoustic diagnosis.

C3. Ability to make basic decisions on the selection, equipment and machinery operation.

SUBJECT EDUCATIONAL EFFECTS

relating to knowledge:

PEK_W01 The student has knowledge of the use and functionality of cutting machines, transport, handling and piling allowing for specification of requirements for mining engineering systems.

PEK_W02 The student has basic knowledge concerning restrictions on the use and safety of mining equipment

PEK_ W03 The student has basic knowledge concerning the range of diagnosis possibilities for mining elements diagnosis.

relating to skills:

PEK_U01 The student has practical ability to measure the vibration and noise, and detect and recognize a change of state.

PEK_U02 The student has the ability to perform engineering calculations and selection of typical components of a pulling machine.

relating to social competences:

PEK-K01 The student can work in a team and together prepare and conduct a set laboratory task and to prepare the achieved results and to present the effects of the conducted research as a team paper report.

PROGRAMME CONTENT		
Form of classes - lecture		**Number of hours**
Lec 1	Scope of the course, teaching purpose, crediting conditions, literature, contact with the teacher. Basic notions, terms and definitions.	2
Lec 2	Advanced calculation of conveyor belts including falling conveyors.	2
Lec 3	Multi-drive conveyor systems. Friction coupling. Uneven loads. Technical methods of load balancing in multi-drive systems. Indirect drives.	2
Lec 4	Dynamic properties of the conveyor belt. Models for design counting. Selection of a belt including dynamic loads and excavation risks	2
Lec 5	Start-up of the conveyor belts. Wave character of stresses spreading. Strengths in the belt. Work of tensioning devices.	2
Lec 6	Soft start-up conveyor belts devices.	2
Lec 7	Safety requirements in conveyor belt transport.	2
Lec 9	Vertical shafts transport characteristics. Excavation safety of pulling devices.	2
Lec 10	Efficiency of pulling devices. Construction, methods of selection and evaluation of the technical condition of shaft pulling ropes.	2
Lec 11	Problems of vertical transport in Polish coal mines, copper ore and other minerals	2
Lec 12	Characteristics and principles of selection of driving wheels and pulleys. The issue of carrier cable slip relative to propellant wheel.	2
Lec 13	Typical failures and damage of mining machines parts - examples. Sources of diagnostic information - a review.	2
Lec 14	Diagnosis of gearing and bearings.	2
Lec 15	Diagnosis of conveyor belts.	2
Lec 16	CMMS IT systems for machinery management.	2
	Total hours	**30**

Form of classes - laboratory		Number of hours
Lab 1	Scope of the course, teaching purpose, crediting conditions, safe and healthy conditions, literature, contact with the teacher. Basic notions, terms, definitions connected to NVH research of mining machinery components. Familiarizing with devices in which the laboratory is equipped with.	2
Lab 2	Vibration and noise measurements as the primary source of information concerning the state of the machine	2
Lab 3	Diagnosis of local devices in gearings and bearings.	2
Lab 4	Distributed fault diagnosis on gearings.	2
Lab 5	The methods of description and analysis of the excavation conditions	2
Lab 6	Diagnostics of machines in changeable excavation conditions	2
Lab 7	Advanced methods of static analysis of diagnostic data Modelling of excavation processes in continuous transport systems.	2
Lab 8	Reports grade of performed laboratory research.	1
	Total hours	**15**

Form of classes - project		Number of hours
Proj 1	Scope of project, conditions of crediting, literature Giving students individual project tasks. Discussion of the draft guidelines concerning the basic calculations of the conveyor belt.	2
Proj 2	Determination of the main technical parameters of the conveyor belt (width and belt speed). Basin angle. Calcu conveyor belt performance.	2
Proj 3	Calculation of the conveyor belt's resistance movement (basic method): - Calculation of particular masses - Calculation of resistance components - Calculation of resistance movement for selected variants of the load path.	4
Proj 4	Calculation of the drive and choosing the right engines. Checking the frictional coupling condition.	2
Proj 5	Calculation of forces in the belt and checking its validity selection.	2
Proj 6	Presentation and defence of ready-made projects by students - discussion.	2
Proj 7	Handing the readymade projects and their assessment.	1
	Total hours	**15**

TEACHING TOOLS USED
N1. Informative lecture with the elements of problem solving lecture. N2. Multimedia presentations. N3. Didactic discussion during the lecture, project. N4. Projects preparation in a report form. N5. Projects presentation and test concerning issues covered by the project N6. Preparation and a report of conducted laboratory research. N7. Duty hours

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
P	PEK_W01-PEK_W03	P1.Final grade of written test.
F, P	PEK_U01	F1- Grade from preparation and laboratory research performance F2 - Grade from a written report and a test from laboratory research methods and knowledge concerning equipment used for research P2 - Final grade from a laboratory (weighted average of F1 - 40% and F2 - 60%).
F, P	PEK_U02	F3 Grade from performance and merits of the project F4 - Assessment of knowledge concerning the subjects' scope of the project. P3 - Final grade from a laboratory (weighted average of F3 - 30% and F4 - 70%)

PRIMARY AND SECONDARY LITERATURE

PRIMARY LITERATURE:

[1] Gładysiewicz L. Przenośniki taśmowe-teoria i obliczenia
[2] Żur T., Hardygóra M. Przenośniki taśmowe w górnictwie
[3] Uberman R. Technologia i organizacja transportu w górnictwie odkrywkowym
[4] Kulczak S. Urządzenia transportowe w górnictwie, cześć IV, Transport szybami pionowymi, skrypt Politechniki Wrocławskiej.
[5] Bartelmus W. Diagnostyka maszyn górniczych, „Śląsk" Publishing 2000r.
[6] Zimroz R. Metody adaptacyjne w diagnostyce maszyn górniczych. Politechnika Wrocławska Publishing House, Wrocław 2010 r.

SECONDARY LITERATURE:

[1] Hansel J., Badania magnetyczne lin stalowych 60 lat rozwoju metody w AGH, KTL, Kraków 2006
[2] J. Beluch, AGH Publishing, Kraków 2008
[3] Antoniak J., Przenośniki taśmowe w górnictwie podziemnym i odkrywkowym. Śląsk University of Technology Publishing, Gliwice 2006,
[4] Franasik k., Żur T.: Mechanizacja podziemnych kopalń. "Śląsk" Publishing, Katowice 1983;
[5] Publications in magazines: Transport Przemysłowy, Górnictwo Odkrywkowe, Zeszyty Naukowe Górnictwo i Geologia

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

prof. dr hab. inż. Lech Gładysiewicz, lech.gladysiewicz@pwr.wroc.pl

MATRIX OF CORRELATION BETWEEN EDUCATIONAL EFFECTS FOR SUBJECT
Machinery Systems
AND EDUCATIONAL EFFECTS FOR MAIN FIELD OF STUDY
mining and geology
AND SPECIALIZATION
Underground and Surface Mining

SUBJECT EDUCATIONAL EFFECT	Correlation between subject educational effect and educational effects defined for main field of study and specialization	SUBJECT OBJECTIVES	Programme content	Teaching tool number
PEK_W01	K_W08	C1, C3	Lec 2-Lec 12	N1, N2, N3,N7
PEK_W02	K_W08	C1, C2, C3	Lec 2-Lec 16	N1, N2, N3,N7
PEK_W03	K_W08	C2	Lec 13-Lec 16	N1, N2, N3,N7
PEK_U01	K_U11	C2	Lab 2-Lab 7	N2, N6, N7
PEK_U02	K_U11	C3	Proj 2-Proj 6	N3, N5, N7

FACULTY OF GEOENGINEERING, MINING AND GEOLOGY

SUBJECT CARD

Name in Polish: Eksploatacja Podziemna
Name in English: Underground Mining Technology
Main field of study: mining and geology
Specialization: Underground and Surface Mining
Level and form of studies: 2nd level, full-time
Kind of subject: obligatory
Subject code: GGG2301
Group of courses: NO

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

PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES

1. The student has knowledge concerning mining as one of the most important areas of technical and human economic activity and an understanding of search, access, and preparation for minerals excavation and extraction.
2. The student has mastered the basic concepts of geology and has systematic knowledge of resources and production of mineral raw materials in Poland.
3. The student can use Microsoft Office to prepare documents in Word and can also work with Excel programme.

SUBJECT OBJECTIVES

C1. Familiarizing students with the issues of underground mining in Poland and in the world.
C2. Presenting and explaining the issues related to the division of excavating systems for different types of deposits and analysis of excavation systems used in underground mines in Poland and in the world.
C3. Preparing students for performance of specific tasks concerning work technology and selection of mining equipment for anchor support project for preparatory and operational excavations in copper mines, the project operating branch in a coal mine along with economic analysis and a project of an operating branch in copper ore mine with economic analysis.

SUBJECT EDUCATIONAL EFFECTS

relating to knowledge:

PEK_W01 The student knows the issues concerning underground deposits excavations of coal, metal ores, rock salt and other mineral resources in Poland and in the world.

PEK_W02 The student has knowledge concerning design, selection and implementation of mining support for mine preparation and exploitation.

PEK_W03 The student knows the issues of machines and equipment technology used in underground mines in Poland and abroad.

PEK_W04 The student has wide knowledge concerning issues of underground mining in Poland and in the world.

PEK_W05 The student knows the issues of mining underground technology in difficult geological and mining conditions, and has knowledge concerning issues of natural hazards in underground mining and ways to combat them.

relating to skills:

PEK_U03 The student can apply knowledge concerning deposits excavation in realising design tasks and can present the results of work in the form of a complete project under the title: "Project of an anchor support for preparatory and operational excavations in copper mines."

PEK_U02 The student can apply knowledge concerning deposits provision in realising of design tasks and present the results of work in the form of a complete project under the title: "Project of an operating branch in copper ore mine".

PEK_U03 The student can apply knowledge concerning deposits provision in realising of design tasks and present the results of work in the form of a complete project under the title: "Project of an operating branch in coal mine".

PEK_U04 The student can choose a proper technology of mine excavations performance and protecting their stability in various geological and mining conditions.

relating to social competences:

PEK_K01 The student understands the meaning of underground deposits excavation and its value for the national and international economy.

PROGRAMME CONTENT

Form of classes - lecture		**Number of hours**
Lec 1	Scope of the course, teaching purpose, crediting conditions, literature, contact with the teacher. Basic notions, definitions connected to underground deposit excavation.	2
Lec 2	Outline of underground deposits excavations of coal, ores, rock salt and other mineral resources in Poland.	2
Lec 3	Outline of underground deposits excavations in the world. Mineral resources market.	2
Lec 4	Support of preparatory excavations - design, selection, execution.	2
Lec 5	Support of exploitation excavations - design, selection, execution.	2
Lec 6	Machines and equipment used in underground mines in Poland and abroad.	2
Lec 7	Division of exploitation systems for different types of deposits.	2
Lec 8	Systems of coal deposits excavations.	2
Lec 9	Technology of underground mining in coal mines in Poland.	2
Lec 10	Technology of underground mining in coal mines abroad.	2
Lec 11	Systems of copper ore deposits excavations for thin and medium thickness	2

	deposit.	
Lec 12	Systems of copper ore deposits excavations for thick deposit.	2
Lec 13	Technology of underground mining in copper ore mines in Poland.	2
Lec 14	Exploitation technology of zinc and lead excavations and also rock salt and other mineral resources in Poland.	2
Lec 15	Technology of underground mining in metal ore mines and also other minerals abroad.	2
	Total hours	**30**

Form of classes - project		**Number of hours**
Proj 1	Organizational matters. Scope of project, conditions of crediting, literature Discussion on the scope of project No. 1 on: "Project of an anchor support for preparatory and operational excavations in copper mines." Assigning students to individual subjects and analysis of project's guidelines	2
Proj 2	Discussion on geological and mining area where excavation is carried out.	2
Proj 3	Discussion on the use of anchor support in mine excavations in the copper mines.	2
Proj 4	Discussion on topics covering anchor support selection and enabling security of mine excavations stability.	2
Proj 5	Discussion on the scope of project No. 2 on: "Project of an operating branch in copper ore mine". Assigning students to individual subjects and analysis of project's guidelines	2
Proj 6	Discussion on algorithms which are used for determination of excavation area geometry.	2
Proj 7	Discussion on issues concerning determination of resources and the time of excavation for exploitation branch.	2
Proj 8	Discussion on issues concerning the parameters of mining excavation face.	2
Proj 9	Analysis of issues concerning mining, excavated material delivery and performing a support in the exploitation branch.	2
Proj 10	Analysis of issues concerning economic analysis of excavations drilling.	2
Proj 11	Discussion on the scope of project No. 3 on: "Project of an operating branch in coal mine". Assigning students to individual subjects and analysis of project's guidelines	2
Proj 12	Discussion on algorithms which are used for determination of excavation area geometry and issues concerning resources determination and the time of exploitation.	2
Proj 13	Analysis of issues concerning mining, excavated material delivery and enabling security of excavation wall and the way of excavated space liquidation. Selection of mechanized wall complex.	2
Proj 14	Analysis of issues concerning economic analysis of excavation wall.	2
Proj 15	Handing back ready projects by the students, grade form performance and projects' defence to achieve a grade (oral or written form).	2
	Total hours	**30**

TEACHING TOOLS USED
N1. N1. Type of lectures - traditional, illustrated with multimedia presentations with the usage of audio-visual equipment, enriched with short educational films concerning technological machine working in underground mining N2. Discussion concerning lectures and projects. N3. Projects preparation in a paper form N4. Projects defence - oral or 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	PEK_U01, PEK_U04	F1 Grade from performing project no. 1 and its merits F1.2 Projects no. 1 oral or written defence. F1 - Final grade from a laboratory (weighted average of F1.1 - 50% and F1.2 - 50%).
F2	PEK_U02, PEK_U04	F2.1 Grade from performing project no. 2 and its merits F1.2 Grade from oral or written defence of project no. 2 F2 - Final grade from the project no. 2 (weighted average of F1.1 - 50% and F1.2 - 50%).
F3	PEK_U03, PEK_U04	F3.1 Grade from performing project no. 3 and its merits F3.2 Grade from oral or written defence of project no. 3 F3 - Final grade from the project no. 3 (weighted average of F3.1 - 50% and F3.2 - 50%).
P1	PEK_U01, PEK_U02, PEK_U03, PEK_U04	P1.Final grade from the project as mean of F1, F2, F3
P2	PEK_W01-PEK_W06	P2 Final grade from a written test.

PRIMARY AND SECONDARY LITERATURE

PRIMARY LITERATURE

[1] Butra J.: Eksploatacja złoża rud miedzi w warunkach zagrożenia tąpaniami i zawałami, KGHM Cuprum sp. z o.o. CBR, Wrocław 2010

[2] Butra J., Kicki J: Ewolucja technologii eksploatacji złóż rud miedzi w polskich kopalniach, Biblioteka Szkoły Eksploatacji Podziemnej, Kraków 2003

[3] Gwiazda J.: Górnicza obudowa hydrauliczna odporna na tąpania, „Śląsk" Publishing, Katowice 1997

[4] Katalog systemów eksploatacji złóż rud miedzi dla kopalń KGHM Polska Miedź S.A., Lubin 2010

[5] Piechota S.: Technika podziemnej eksploatacji złóż, Skrypt AGH, Kraków 2003

[6] Piechota S.: Technika podziemnej eksploatacji złóż i likwidacji kopalń, Uczelniane Naukowo-Dydaktyczne AGH Publishing, Kraków 2008

[7] Przybyła H.: Organizacja i ekonomika w projektowaniu wybierania węgla, Sląsk Univeristy of Technology Publishing, Gliwice 2007

[8] Siewierski S., Wojno L.: Udostępnianie złóż, cz. I: Sposoby udostępniania złóż, Skrypt Politechniki Wrocławskiej, Wrocław 1980

[9] Siewierski S., Wojno L.: Udostępnianie złóż, cz. II: Szyby, Skrypt Politechniki Wrocławskiej, Wrocław 1982

[10] Siewierski S., Fisher A.: Udostępnianie złóż, cz. III: Wyrobiska komorowe, Skrypt Politechniki Wrocławskiej, Wrocław 1984

[11] Strzałkowski P.: Zarys rozwoju technologii górnictwa podziemnego, Politechnika Śląska Publishing, Gliwice 2011

SECONDARY LITERATURE

[1] Chudek M: Obudowa wyrobisk górniczych, Część 1: Obudowa wyrobisk korytarzowych i komorowych, "Śląsk" Publishing, Katowice 1986

[2] Goszcz A: Elementy mechaniki skał oraz tąpania w polskich kopalniach węgla i miedzi, Biblioteka Szkoły Eksploatacji Podziemnej, Kraków 1999

[3] Goszcz A.: Wybrane problemy zagrożenia sejsmicznego i zagrożenia tąpaniami w kopalniach podziemnych, Biblioteka Szkoły Eksploatacji Podziemnej, Kraków 2004

[4] Kidybiński A., Podstawy geotechniki kopalnianej, „Śląsk" Publishing, Katowice 1982

[5] Kłeczek Z., Geomechanika górnicza, Śląskie Techniczne Publishing, Katowice 1994

[6] Monografia KGHM „Polska Miedź" S.A., Praca zbiorowa, Lubin 1996

[7] Rozporządzenie Ministra Gospodarki z dnia 28 czerwca 2002 r., Załącznik nr 3: Projektowanie, wykonywanie i kontrola obudowy kotwowej w zakładach górniczych wydobywających węgiel kamienny oraz zakładach wydobywających rudy miedzi, cynku i ołowiu (Dz.U.02.139.1169)

[8] Sałustowicz A., Zarys mechaniki górotworu, „Śląsk" Publishing, Katowice 1965

[9] Szlązak J., Szlązak N.: Ratownictwo górnicze, Uczelniane Naukowo-Dydaktyczne AGH Publishing, Kraków 2010

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

dr inż. Daniel Pawelus, daniel.pawelus@pwr.wroc.pl

MATRIX OF CORRELATION BETWEEN EDUCATIONAL EFFECTS FOR SUBJECT
Underground Mining Technology
AND EDUCATIONAL EFFECTS FOR MAIN FIELD OF STUDY
mining and geology
AND SPECIALIZATION
Underground and Surface Mining

SUBJECT EDUCATIONAL EFFECT	Correlation between subject educational effect and educational effects defined for main field of study and specialization	SUBJECT OBJECTIVES	Programme content	Teaching tool number
PEK_W01	K_W07, K_W09	C1	Lec 1-Lec 3, Proj 1, Proj 5, Proj 11, Proj 15	N1, N2, N5
PEK_W02	K_W07, K_W09	C2, C3	Lec 4-Lec 6, Proj 1-Proj 4, Proj 15	N1, N2, N3, N5
PEK_W03	K_W07, K_W09	C2, C3	Lec 6, Lec 9, Lec 10, Lec 13-Lec 15, Proj 4, Proj 8-Proj 10, Proj 13-Proj 15	N1, N2, N3, N5
PEK_W04	K_W07, K_W09	C1, C2, C3	Lec 7-Lec 15, Proj 5-Proj 15	N1, N2, N3, N5
PEK_W05	K_W07, K_W09	C1, C2, C3	Lec 7-Lec 15, Proj 2-Proj 4, Proj 8, Proj 9, Proj 13, Proj 15	N1, N2, N5
PEK_U01	K_U12	C2, C3	Lec 4-Lec 6, Proj 1-Proj 4, Proj 15	N1-N5
PEK_U02	K_U12	C2, C3	Lec 11-Lec 13, Lec 15, Proj 5-Proj 10, Proj 15	N1-N5
PEK_U03	K_U12	C2, C3	Lec 8-Lec 10, Proj 11-Proj 15	N1-N5
PEK_U04	K_U12	C2, C3	Lec 4-Lec 6, Lec 9, Lec 10, Lec 13-Lec 15, Proj 2-Proj 4, Proj 8, Proj 9, Proj 13, Proj 15	N1, N2, N5
PEK_K01	K_K01, K_K02	C1	Lec 1-Lec 3	N1, N2, N5

FACULTY OF GEOENGINEERING, MINING AND GEOLOGY

SUBJECT CARD

Name in Polish: Projektowanie Kopalń Wspomagane Komputerowo
Name in English: Computer-Aided Mine Planning and Design
Main field of study: mining and geology
Specialization: Underground and Surface Mining
Level and form of studies: 2nd level, full-time
Kind of subject: obligatory
Subject code: ING2306
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)	60		90		
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					
including number of ECTS points for direct teacher-student contact (BK) classes	2		2		

PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES

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

SUBJECT OBJECTIVES

C1 Getting known the basics of open-cast and underground mines design
C2 Getting known the concepts and methods of optimization of digital design and planning of mines used in the mining world
C3 Acquisition of skills of computer-aided tools for modelling and design of mining deposits in accordance with current international standards.

SUBJECT EDUCATIONAL EFFECTS

relating to knowledge:

PEK_W01 The student can describe the basics of underground mines design. The student can describe the rules of mine dimensioning and can identify criteria for an operational system selection.

PEK_W02 The student knows the basics of open-cast mines design, can choose an excavation system for the particular type of mine and distinguish concepts of formal documents and regulations for the mine design

PEK_W03 The student can identify the target excavation area in accordance with the criteria of economic viability in three-dimensional modelling

PEK_W04 The student can explain the optimization method of the target open-cast excavation

PEK_W05 The student can formulate and choose the progress direction and different mining plan in various time horizons

relating to skills:

PEK_U01 The student can calculate the parameters of underground excavations for scheduled tasks

PEK_U02 The student can choose appropriate design methods and tools to complete the project of underground excavations according to prepared parameters

PEK_U03 The student can build a digital model of economic deposits according to the alternative criteria and can estimate the value of the mine

PEK_U04 The student can choose appropriate methods and design tools to prepare the project of open-cast excavations according to prepared parameters

PEK_U05 The student can use different software to optimize open-cast excavations and for presentation of results

PEK_U06 The student can interpret the data and develop foundations of excavation calendar plan and use specialized software environment for the implementation of the plan

PEK_U05 The student can presented, in a clear form, the results of a project using numerical summaries, maps, cross-sections, visualization and simulation

relating to social competences:

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

PROGRAMME CONTENT

Form of classes - lecture		**Number of hours**
Lec 1	Structural and quality model of a deposit. Deposits estimation.	2
Lec 2	Objects, methods and design tools of underground mines in spatial modelling	2
Lec 3	Basic data for underground mines design - acquiring, interpreting, evaluating and verification	2
Lec 4	Rules for type and model of the underground mine selection, including the selection of excavation extend and mine operation time	2
Lec 5	Rules of shaft location depending on the size of a mine and the form and structure of a deposit	2
Lec 6	Structure of underground providing excavations and examples of design solutions.	2
Lec 7	Objects, methods and design tools of open-cast mines in spatial modelling	2
Lec 8	An economic model of a deposit. Open-cast mines optimization issues. „Floating cones” and Lerchs-Grossmann algorithms.	2
Lec 9	Design and mine documentation in open-cast mining. Formal requirements and design practice. The rules for updating and archiving documents	2
Lec 10	General principles of design concerning open-cast mines excavating rocks with	2

	the help of explosives. Rules concerning determination of industrial and operative deposits. Analysis methods and tools used in the design	
Lec 11	General principles of design concerning open-cast mines excavating rocks with the help of a bucket ladder excavator. Rules concerning determination of industrial and operative deposits. Analysis methods and tools used in the design	2
Lec 12	General principles of design concerning open-cast mines excavating rocks from underwater surface. Rules concerning determination of industrial and operative deposits. Analysis methods and tools used in the design	2
Lec 13	Digital modelling of a deposit progress. Progress optimization criteria and constraints. A target plan of open-cast mine development.	2
Lec 14	Optimization of medium-term excavation calendar plans based on the target within the excavation progress. Methods and tools to build medium-term production plans.	2
Lec 15	The conceptual work, projects integration in spatial modelling environment. Integration of specialized design issues: geotechnics, shooting, ventilation, environment protection, GIS, development of virtual reality technology	2
	Total hours	**30**

Form of classes - laboratory		**Number of hours**
Lab 1	Construction of a deposit structural model. Interpolation of quality parameter. Deposits estimation. Visualisation	3
Lab 2	Elements of underground mine excavations design	3
Lab 3	Design of underground tunnels. Determination of tunnel excavations and creation of cross-sectional according to design assumptions, excavation network model with an anchor model according to the design assumptions; estimating volume and tonnage	3
Lab 4	Design of underground excavation deposits. Staking-out an excavation axis, excavation network models	3
Lab 5	Design of underground excavation deposits. Deposits estimation. Design documentation: cross-sections, visualizations	3
Lab 6	Design of open-cast excavations. The economic viability criteria. Analysis of design assumptions for an open-cast mine target excavation.	3
Lab 7	An open-cast mine target excavation according to the economic viability criteria. Profiling a floor and the general slope of an excavation. A meshed model of a deposit's surface; resource estimate	3
Lab 8	Enabling excavation and external tailing. Excavation and tailing location. Design of shelves, excavation slopes and transport roads of the excavation and tailing. Models of mesh surface excavation and tailing. Estimating resources in the excavation and tailing volume	3
Lab 9	Graphic projects documentation - plotting. Map creation	3
Lab 10	Economic deposit modelling for variant price formulas economic deposit modelling for variant price and cost formulas; estimation of the target excavation	3
Lab 11	Excavation target according to optimization. Import of block quality model, the construction of an economic model, generation of target excavations according to LG algorithm	3
Lab 12	The Long-term Calendar Plan of Excavation. Generating a target progress of an open-cast mine. Variant selection progress for LCPE	3
Lab 13	The Long-term Calendar Plan of Excavation. Assumptions and limitations of LCPE, variant target variables.	3
Lab 14	LCPE results analysis. Superposition of the ultimate target excavation model	3

	with a progress variant and deposit's quality model. Graphic documentation: maps, cross-sections, visualisations	
Lab 15	Study of virtual reality	3
	Total hours	**45**

TEACHING TOOLS USED
N1. Form of lectures - traditional, multimedia presentations using specialized software and demonstrations of its application "live" N2. Individual development of specialist topics covered during the lecture N3. Discussion concerning lectures and laboratories N4. Individual development of project tasks within the laboratories frames N5. Individual development of electronic reports concerning project tasks within the laboratories frames N6. Evaluation of laboratory tasks reports with multipoint grade of student's work N7. Group analysis of the results obtained during laboratory tasks; preparation of conclusions concerning data dependencies and constraints of mining projects N8. Skill control tests N9. Duty hours in laboratory.

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	PEK_U01, PEK_U02, PEK_U07	Laboratory task assessment "design of underground excavations"
F2	PEK_W03, PEK_U04, PEK_U07	Laboratory task assessment "design of open-cast excavations"
F3	PEK_W05 PEK_U03, PEK_U05-PEK_U07, PEK_K01	Laboratory task assessment "Design of open-cast target excavation"
P1	PEK_U04, PEK_U07, PEK_K01	Control test covering methods and skills of digital design
P2	PEK_W01-PEK_W05, PEK_U01-PEK_U07	Laboratory final grade on condition that the student receives a positive grade P1
P3	PEK_W01-PEK_W02, PEK_W04, PEK_U01-PEK_U02, PEK_U04-PEK_U06	Lecture grade on the basis of the written examination
P		

PRIMARY AND SECONDARY LITERATURE

PRIMARY LITERATURE:

[1] Bęben A., Maszyny i urządzenia do wydobywania kopalin pospolitych bez użycia materiałów wybuchowych, AGH Publishing, Kraków 2008
[2] Bęben A., Maszyny i urządzenia do wybranych technologii urabiania surowców skalnych, Śląsk Publishing
[3] Bęben A., Wydobywanie spod wody kruszyw naturalnych, AGH Publishing, Kraków 2006
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[7] Kołkiewicz W., Szatan M., Pomorski A., Witt A., Modelowanie i optymalizacja odkrywkowych procesów wydobywczych układami technologicznymi o pracy ciągłej, Redakcja Górnictwa Odkrywkowego, Wrocław 1996
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Eksploatacji Podziemnej, Szkoła Górnictwa Odkrywkowego, Wykorzystanie Zasobów Złóż Kopalin Użytecznych, Szkoła Ekonomiki i Zarządzania w Górnictwie
[10] DATAMINE Studio Introductory Tutorial
[11] NPV Scheduler Help

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

dr inż. Witold Kawalec, witold.kawalec@pwr.wroc.pl

MATRIX OF CORRELATION BETWEEN EDUCATIONAL EFFECTS FOR SUBJECT
Computer-Aided Mine Planning and Design
AND EDUCATIONAL EFFECTS FOR MAIN FIELD OF STUDY
mining and geology
AND SPECIALIZATION
Underground and Surface Mining

SUBJECT EDUCATIONAL EFFECT	Correlation between subject educational effect and educational effects defined for main field of study and specialization	SUBJECT OBJECTIVES	Programme content	Teaching tool number
PEK_W01	K_W07	C1	Lec 3-Lec 6	N1-N3
PEK_W02	K_W07	C1	Lec 9-Lec 12	N1-N3
PEK_W03	K_W07	C1	Lec 7, Lec 11	N1-N3, N4, N6-N7
PEK_W04	K_W06, K_W07	C2	Lec 1, Lec 8, Lec 13-Lec 14	N1-N3, N4, N6-N7
PEK_W05	K_W06, K_W07	C2	Lec 4-Lec 6, Lec 10-Lec 14	N1-N3
PEK_U01	K_W07	C1	Lec 3-Lec 6	N1-N3
PEK_U02	K_W07, K_U09	C3	Lec 2, Lab 1-Lab 5	N3-N9
PEK_U03	K_U09	C2, C3	Lec 1, Lec 8, Lab 10	N3-N7, N9
PEK_U04	K_U09	C3	Lec 7, Lab 1, Lab 6-Lab 9	N3-N9
PEK_U05	K_U09	C2, C3	Lec 13-Lec 14, Lab 11	N3-N9
PEK_U06	K_U09	C2, C3	Lec 14, Lab 11-Lab 13	N3-N9
PEK_U07	K_U09, K_U10	C3	Lec 15, Lab 14-Lab 15	N3-N9
PEK_K01	K_W07, K_U09	C1, C2, C3	Lec 1-Lec 15, Lab 1-Lab 15	N2-N5, N7-N8

FACULTY OF GEOENGINEERING, MINING AND GEOLOGY

SUBJECT CARD

Name in Polish: Automatyka Przemysłowa
Name in English: Industrial Automation
Main field of study: mining and geology
Specialization: Underground and Surface Mining
Level and form of studies: 2nd level, full-time
Kind of subject: obligatory
Subject code: ELG2301
Group of courses: NO

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

PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES

knowledge:

1. The student has basic knowledge concerning electrical engineering from the point of view of its usage in the mining industry,
2. The student has basic knowledge of the mathematical basics of probabilistic models necessary for the understanding of probability and statistics in science having engineering character.

skills:

1. The student can use laboratory test methods for sinusoidal alternating current circuits with RLC elements, power measurement in single-and three-phase systems, and electrical motor research.
2. The student is able to develop statistical data and to interpret the experimental results.

social competences:

1. The student understands the need and knows the possibilities of lifelong learning, improving professional, personal and social skills.

SUBJECT OBJECTIVES

C1-Familiarizing students with basic knowledge necessary to understand the theoretical basis for automatic linear systems.
C2-Familiarizing students with automation and control of some industrial, technological processes.
C3 - Creating ability to analyse simple controls used in practical automatic control systems.
C4 - Familiarizing students with exploitation properties of electric motors and the research of automatic components and controlled / uncontrolled frequency converters.

SUBJECT EDUCATIONAL EFFECTS

relating to knowledge:

PEK_W01 - The student knows basic rights and the theoretical basis for automatic control and is able to characterize and describe the scope of automation line systems.
PEK_W02 - The student is able to describe the transfer function of simple automation systems and calculate their response to a pulse function and a stroke unit.
PEK_W03 - The student knows the principles of operation and characteristics of the basic linear parts of automation (proportional, integrating, differentiating and delaying) and can identify and define them.
PEK_W04 - The student is able to choose the linear regulators to meet practical needs and properly verify their performance.
PEK_W05 - The student can use the stability criteria of Hurwitz and Nyquist in order to assess the stability of linear systems of automatic control systems.

relating to skills:

PEK_U01 - The student is able to carry out the study of simple relay (analogue and digital) control components.
PEK_U02 - The student has the ability to undertake measurements of controlled and uncontrolled frequency converters.
PEK_U03 - The student is able to carry out tests on the effectiveness of automatic control and starting of induction electrical motors.
PEK_U04 - The student is able to take action to improve the safety of electro-energetic equipment operation.

relating to social competences:

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

PROGRAMME CONTENT

Form of classes - lecture		**Number of hours**
Lec 1	Familiarizing with the subject, requirements and method of assessment.	1
Lec 1-3	Basic notions, scope of automatics theory. Line automatics systems and their classification, transfer function of simple systems, pulse function response and a stroke unit.	4
Lec 3-4	The transmittance spectrum, frequency response and its types, phase equations, relationship between descriptions.	3
Lec 5-6	Elements of linear automatic control systems, definitions, descriptions and characteristics of proportional integrating inertial and non-intertial parts, differentiating oscillating and delaying, combining linear control components.	3
Lec 6-7	Stability of linear systems, the definition of stability, pulse and stroke response, phase equation. Stability criteria by Hurwitz and Nyquist, for systems without feedback and with feedback.	2
Lec 7-8	Automatic control, linear voltage regulators of a continuous fill, P-controller, I, PI, PD, PID controllers, characteristics and ways of practical implementation of comprehensive automation systems.	2
	Total hours	**15**

Form of classes - laboratory		Number of hours
Lab 1	Presentation of the health and safety regulations and internal regulations binding in the laboratory. Assignment of crediting rules. Getting known with the laboratory. Discussion of the electrical and mechanical measurements principles using analogue and digital devices.	2
Lab 2	The study of analogue and digital relay control components.	2
Lab 3	Measurements of controlled and uncontrolled frequency converters.	2
Lab 4	The study of automatic control and start of a three-phase squirrel cage motor.	2
Lab 5	The study of automatic control and start of a three-phase ring motor.	2
Lab 6	Measurements and testing the effectiveness of fire protection.	3
Lab 7	Crediting and laboratory follow-ups.	2
	Total hours	**15**

TEACHING TOOLS USED
N1 - Lecture with audio-visual technology, multimedia presentations, and transparencies. N2 - Measurement laboratory conducted in the traditional manner with groups of students.

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
Lecture		
P1	PEK_W01, PEK_W02, PEK_W03, PEK_W04, PEK_W05.	Crediting in a written form.
P=P1		
Laboratory		
F1	PEK_U01, PEK_U02, PEK_U03, PEK_U04,	Checking and assessment of laboratory preparation
F2	PEK_U01, PEK_U02, PEK_U03, PEK_U04,	Activity during laboratory classes
F3	PEK_U01, PEK_U02, PEK_U03, PEK_U04,	Reports grade of performed laboratory research.
P=0,4*F1+0,3F2+0,3*F3		

PRIMARY AND SECONDARY LITERATURE

PRIMARY LITERATURE:

[1] Greblicki W., Teoretyczne podstawy automatyki, PWr. Pub. 1998
[2] Kaźmierkowski M., Wójcik A., Układy sterowania i pomiarów w elektronice przemysłowej, WKŁ, 1996.

SECONDARY LITERATURE:

[1] Węgrzyn S., Podstawy automatyki, PWN, 1980

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

Grzegorz Wiśniewski, grzegorz.wisniewski@pwr.wroc.pl

MATRIX OF CORRELATION BETWEEN EDUCATIONAL EFFECTS FOR SUBJECT
Industrial Automation
AND EDUCATIONAL EFFECTS FOR MAIN FIELD OF STUDY
mining and geology
AND SPECIALIZATION
Underground and Surface Mining

SUBJECT EDUCATIONAL EFFECT	Correlation between subject educational effect and educational effects defined for main field of study and specialization	SUBJECT OBJECTIVES	Programme content	Teaching tool number
PEK_W01	K_W12	C1	Lec 1, Lec 2	N1
PEK_W02	K_W12	C2	Lec 2, Lec 3	N1
PEK_W03	K_W12	C2, C3	Lec 4	N1
PEK_W04	K_W12	C3, C4	Lec 4, Lec 6	N1
PEK_W05	K_W12	C1, C3	Lec 5	N1
PEK_U01	K_U15	C1	Lab 2	N2
PEK_U02	K_U15	C3	Lab 3	N2
PEK_U03	K_U15	C4	Lab 4, Lab 5	N2
PEK_U04	K_U15	C4	Lab 1, Lab 6, Lab 7	N2
PEK_K01	K_K01	C1, C2, C3, C4	Lab 2, Lab 3, Lab 4, Lab 5, Lab 6	N1, N2

FACULTY OF GEOENGINEERING, MINING AND GEOLOGY

SUBJECT CARD

Name in Polish: Geotechniczne Zabezpieczenie Eksploatacji
Name in English: Rock Engineering in Mines
Main field of study: mining and geology
Specialization: Underground and Surface Mining
Level and form of studies: 2nd level, full-time
Kind of subject: obligatory
Subject code: GGG2304
Group of courses: No

	Lecture	Classes	Laboratory	Project	Seminar
Number of hours of organized classes in University (ZZU)	30			15	
Number of hours of total student workload (CNPS)	30			60	
Form of crediting	Examination			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					
including number of ECTS points for direct teacher-student contact (BK) classes	1			1	

PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES

1. The student knows basic laws and principles of engineering mechanics and strength of materials.
2. The student has knowledge of methods and procedures for characterizing the basic properties of soils and rocks;
3. The student knows the fundamental laws of soils and rocks mechanics and rock mass mechanics;
4. The student has knowledge of the constitutive models of continuous body: distinguishes various elastic models, plastic, adhesive, and strength hypotheses.
5. The student demonstrates understanding of role and significance of the parameters describing geological conditions in underground and open-cast mines, to assess the quality of rock;
6. The student has basic knowledge concerning measurement methods used in geomechanics: MES, MRS, MEO.
7. The student has knowledge concerning the distribution of stresses in a rock mass in the vicinity of underground excavations and can document it using appropriate calculations.
8. The student has knowledge concerning the distribution of stresses in embankments / slopes and in their undersoil and the student can document it using appropriate calculations.
9. The student can fluently use both Microsoft Office, AutoCad, and also has a practice in the usage of standard software for numerical modelling of the rock mass.

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SUBJECT OBJECTIVES

C1 - The essence of geotechnics as a field of knowledge which identifies and explains the causes and effects of various physical and geomechanical phenomena occurring around the underground excavations and also in the slopes of open-cast mine excavations;
C2 - Getting know the types of threats from rock mass and geotechnical methods to ensure safe excavation using open-cast and underground methods.
C3 - Getting know observation methods and concluding about the state of the rock mass surrounding the underground and open-cast excavations and the technical methods leading to its stabilization.
C4 - Getting know geomechanics rights and its calculating tools for determining the state of stress and strain around the excavation and, consequently, assess the stability of the rock mass on the basis of well-defined functions - safety measures;
C5 - Familiarizing students with a variety of techniques for subsoil and rock enhancement;
C6 - Learning the problems of design / selection of earth and rock slopes geometry using limit equilibrium methods;
C7 - Introduction to the issue of structures cooperation on a surface with deforming mine subsoil;
C8 - Familiarizing students with some ways of reliability theory methods as applied to sediment ponds dams.

SUBJECT EDUCATIONAL EFFECTS

relating to knowledge:

PEK_W01 - The student has the ability to use the principles of geomechanics to conclude about changes in the state of rock mass as a result of excavation;
PEK_W02 - The student has advanced knowledge in order to observe the phenomena occurring in the rock mass and basing on these parameters conclude about the danger and how appropriately protect underground excavations, open-casts and ground structures;
PEK_W03 - The student understands that the state of danger concerning instability of underground and open-cast excavation is variable in time and depends on various system parameters such as: material type, degree of cracking, the actual excavation geometry, excavation progress, characteristics of the initial strains, etc.;
PEK_W04 - The student understands the nature of the interaction between buildings and mining basin,

relating to skills:

PEK_U01 - Through visual observations the student can confidently assess the quality of soils/rocks surrounding the underground excavation or an open-cast mine and at the same time is able to offer the right form of its protection;
PEK_U02 - For real underground geological and mining conditions the student can choose the most appropriate method of stability analysis and successfully implement it;
PEK_U03 - The student possessed the ability to use computer technology (mainly FEM) to model the rock mass behaviour disturbed by excavation and to identify the places and types of related risks.

relating to social competences:

PEK_K01 - The student can work in a team and has the ability to present the results of her/his work as a paper report.
PEK_K02 - The student can present her/his case to the public and is able to justify it.

PROGRAMME CONTENT		
Form of classes - lecture		**Number of hours**
Lec 1	The essence of geotechnics as a field of knowledge which identifies and explains the causes and effects of various physical and geomechanical phenomena occurring around the underground excavations.	2
Lec 2	Geotechnical conditions of exploitation. Characteristics of soils and rocks materials.	2
Lec 3	Types of underground structures, their distribution, procedures and restrictions on its use. Dangers control.	2
Lec 4	Counting schemes of underground structures. Cooperation between underground structures and rock mass. Underground methods of behaviour measurement and rock mass classification.	2
Lec 5	Soil escarpments and sizing methods of slopes and escarpments of open-cast mine excavations. Piling: technology, sizing and safety.	3
Lec 6	Rock slopes, methods of its sizing and analysis rules of their stability.	2
Lec 7	The stability of ground structures and methods of testing the subsoil stability. Techniques for subsoil enhancement;	3
Lec 8	Landslides. Research of landslide areas and measures to control it.	2
Lec 9	Flows in the rock mass. Open-cast mine dewatering. Dewatering technologies. Risks and damages caused by dewatering.	2
Lec 10	Analysis of sediment ponds functioning risk.	2
Lec 11	Terms of cooperation of rigid structures located on the surface with the mining subsoil.	2
Lec 12	Terms of cooperation of deformable structures located on the surface with the mining subsoil.	2
Lec 13	Evaluation of structures resistance to mining deformations.	2
Lec 14	Terms of cooperation of underground line constructions, such as pipelines, with deforming mine subsoil.	2
	Total hours	**30**

Form of classes - project		**Number of hours**
Proj 1	Presentation of the project's essence, crediting conditions, and giving recommended literature. Providing students with individual design topics and discussion of the next stages of project under the title: "The analysis of the slope stability of natural soil in different hydrogeological conditions."	2
Proj 2	Discussion of geological and mining conditions and their most important parameters; Determination of the counting geotechnical parameters of the ground.	2
Proj 3	Preparation of counting algorithm alternatively by means of Fellenius or Bishop method. Discussion of the importance of water presence in the slope and its static and dynamic impact on the level of security.	2
Proj 4	Presentation of a computer program SLIDE and its application in the analysis of slope stability.	2
Proj 5	Presentation of the control calculations samples of the slope stability for the selected student projects, using computer software (i.e. SLIDE).	2
Proj 6	Presentation of ready-made projects and their defence in the presence of other students.	2
Proj 7	Handing the project to the teacher. Performance grade and oral test concerning the project's merits. Crediting.	3
	Total hours	**15**

TEACHING TOOLS USED
N1. Informative lecture with the elements of problem solving lecture. N2. Multimedia presentations. N3. Didactic discussion considering the lecture and the project. N4. Projects preparation in a report form. N5. Projects presentation and test concerning issues covered by the project N6. Computer counting and their immediate presentation on a screen and detailed description. N7. 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
P	PEK_W01-PEK_W03, PEK_U01, PEK_U02	P1.Final grade of written test.
F, P	PEK_U03, PEK_K01, PEK_K02	F1 Grade from performance and merits of the project F2- written test grade or presentation of issues covered in the project P2 = (0,4 F1 + 0,6 F2) - Final grade from the project

PRIMARY AND SECONDARY LITERATURE

PRIMARY LITERATURE:

[1] Abramson L.W., T.S. Lee, Sunil Sharma, B.M. Boyce. Slope Stability and Stabilization Methods. Wiley, 2002
[2] Chudek M., Obudowa wyrobisk górniczych, część I, Obudowa wyrobisk korytarzowych i komorowych. "Śląsk", Katowice 1986.
[3] Dmitruk S., H. Suchnicka. Geotechniczne zabezpieczenie wydobycia. PWr Publishing, Wrocław 1976
[4] Gałczyński S., Podstawy budownictwa podziemnego, PWr. Publishing House, Wrocław 2001
[5] Gergowicz Z., Geotechnika górnicza. Skrypt PWr., Wrocław 1974.
[6] Hoek E., Kaiser P.K., W.F. Bawden. Support of Underground Excavations in Hard Rock. Funding by Mining Research Directoriate and Universities Research Incentive Fund (www.rockscience.com/)
[7] Hoek E. Rock Engineering. (www.rockscience.com/)
[8] Kidybiński A., Podstawy geotechniki kopalnianej. "Śląsk" ,Katowice 1982.
[9] Kliche C.A. Rock Slope Stability. SME, 1999.
[10] Kral L. Elementy budownictwa przemysłowego. T. 2, PWN 1984
[11] Piechota S. Podstawy górnictwa kopalin stałych, AGH Publishing, Kraków 1996,
[12] Ryncarz T. Zarys fizyki górotworu, Śląskie Publishing Techn., Katowice 1993.
[13] Sałustowicz A., Zarys mechaniki górotworu, "Śląsk", Katowice 1968.
[14] Ulusay R., Hudson J. A. The complete ISRM suggested methods for rock characterization, testing and monitoring: 1974-2006, Commission on Testing Methods, ISRM, Ankara 2007
[15] Wiłun Z., Zarys geotechniki, Komunikacji i Łączności Publishing, Warszawa 1987.

SECONDARY LITERATURE:

[1] Bieniawski Z. T., Engineering Rock Mass Classifications. Wiley & Sons, Intersc. publication.

NY 1989
[2] Borecki M.,Chudek M., Mechanika górotworu. "Śląsk", Katowice 1972.
[3] Butra J. Eksploatacja złoża rud miedzi w warunkach zagrożenia tąpaniami i zawałami. KGHM Cuprum Publishing, Wrocław 2010
[4] Franasik K., Mechanika górotworu - Zwalczanie zagrożeń od zawałów i tąpań w kopalniach rud miedzi. Skrypt PWr. Wrocław 1978.
[5] Hoek E., Brown E. T., Underground Excavations in Rock. Institution of Mining and Met., London 1980.
[6] Kisiel I., Mechanika techniczna tom VII - Mechanika skał i gruntów. PWN, Warszawa 1982.
[7] Sałustowicz A., Mechanika górotworu, Górniczo-Hutnicze Publishing, Katowice 1955.
[8] Thiel K., Mechanika skał w inżynierii wodnej. PWN, Warszawa 1980,
[9] Praca zbiorowa: Materiały konferencyjne Zimowych Szkół Mechaniki Górotworu i Geoinżynierii, PWr and AGH Publishings
[10] NORMS:
PN-98/B-02481 – Geotechnika. Terminologia podstawowa. Symbole literowe i jednostki miar.
PN-98/B-02479 – Geotechnika. Dokumentowanie geotechniczne. Zasady ogólne.
PN-83/B-03010 – Ściany oporowe. Obliczenia statyczne i projektowanie.
PN-81/B-03020 – Posadowienie bezpośrednie budowli. Obliczenia statyczne i projektowanie.
PN 88/B-04481 – Grunty budowlane. Badania próbek gruntu.
PN-74/B-04452 – Grunty budowlane. Badania polowe.
PN - G- 04200 - Kopaliny. Próbki geologiczne. Ogólne wytyczne pobierania.
PN - G- 04301 - Skały zwięzłe. Pobieranie i przygotowanie próbek do badań własności mechanicznych i technologicznych.
PN - G- 04302 - Skały zwięzłe. Oznaczenie wytrzymałości na rozciąganie metodą poprzecznego ściskania
PN - G- 04303 - Skały zwięzłe. Oznaczanie wytrzymałości na ściskanie z użyciem próbek foremnych.
PN - G- 04304 - Skały zwięzłe. Oznaczanie wytrzymałości na ścinanie proste.
PN - G- 04305 - Skały zwięzłe. Oznaczanie wytrzymałości na zginanie z użyciem próbek foremnych
PN - G- 04306 - Skały zwięzłe. Oznaczanie wytrzymałości na zginanie z użyciem próbek w postaci krążka.
PN - G- 04351 - Grunty skaliste i nieskaliste. Oznaczanie gęstości właściwej szkieletu gruntowego metodą próżniową
BN - 80/8704-15 - Oznaczanie wskaźnika wytrzymałości przy punktowym obciążeniu próbki
PN - G- 05016 - Szyby górnicze. Obudowa. Obciążenia
PN - G- 05020 - Podziemne wyrobiska korytarzowe i komorowe. Obudowa sklepiona. Zasady projektowania i obliczeń statycznych.
PN - G- 05600 - Podziemne wyrobiska korytarzowe i komorowe. Obudowa powłokowa. Zasady projektowania i obliczeń statycznych.

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

dr hab. inż. Witold Pytel, prof. PWr, wpytel@cuprum.wroc.pl

MATRIX OF CORRELATION BETWEEN EDUCATIONAL EFFECTS FOR SUBJECT
Rock Engineering in Mines
AND EDUCATIONAL EFFECTS FOR MAIN FIELD OF STUDY
mining and geology
AND SPECIALIZATION
Underground and Surface Mining

SUBJECT EDUCATIONAL EFFECT	Correlation between subject educational effect and educational effects defined for main field of study and specialization	SUBJECT OBJECTIVES	Programme content	Teaching tool number
PEK_W01	K_W03, K_W11	C3, C4	Lec 1-Lec 2, Lec 9	N1-N3, N6, N7
PEK_W02	K_W09, K_U13	C2, C3	Lec 6-Lec 9, Lec 13-Lec 15	N1-N3, N7
PEK_W03	K_W03	C2, C3, C6, C8	Lec 4-Lec 5, Lec 10	N1-N3, N6, N7
PEK_W04	K_W10, K_U13	C7	Le11-Le14	N1-N3
PEK_U01	K_W11, K_U14	C2-C3	Lec 2, Lec 4, Lec 8-Lec 9, Proj 1-Proj 4	N1-N5, N7
PEK_U02	K_U05, K_U14	C4-C5	Lec 9-Lec 11, Proj 1-Proj 4	N1-N5, N7
PEK_U03	K_U09	C4, C8	Proj 5-Proj 6	N6
PEK_K01	K_K01, K_K02	C1	Proj 6, Proj 7	N5

FACULTY OF GEOENGINEERING, MINING AND GEOLOGY

SUBJECT CARD

Name in Polish: Monitorowanie Zmian Górotworu i Ochrona Powierzchni
Name in English: Rock Mass Changes Monitoring and Mining Area Surface Protection
Main field of study: mining and geology
Specialization: Underground and Surface Mining
Level and form of studies: 2nd level, full-time
Kind of subject: obligatory
Subject code: GKG2301
Group of courses: NO

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

PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES

1. The student has basic knowledge concerning mathematical analysis necessary to understand mathematical issues of engineering character.
2. The student has an elementary knowledge of the wider issues of underground mining as one of the most important areas of technical and human economic activity
3. The student knows the basic concepts of deposits geology and hydrogeology, knows how to present and describe the lithological profile in major excavation regions.
4. The student has basic knowledge concerning the surveying construction and geotechnical and geophysics

SUBJECT OBJECTIVES

C1 Passing knowledge and familiarizing students with the legal requirement to classify mining areas into categories depending on the risks and way of documenting impacts of underground and open-cast excavation mining on the land surface and the rock mass.
C2 Acquisition of knowledge and skills in the process of mining optimization in terms of minimizing its impact on the surface structures and underground infrastructure.
C3 Getting know design methods of measurement and control networks, types of observation, the accuracy and the use of integrated systems for monitoring objects at risk.

SUBJECT EDUCATIONAL EFFECTS

relating to knowledge:

PEK_W01 The student has basic knowledge concerning the protection of mining areas, distinguishing the nature of the direct and indirect deformations resulting from underground mining and open-cast, and its impact on surface and underground infrastructure necessary to describe the quantity and quality of surface deformation and rock mass on the basis of surveys and evaluation of their credibility.

PEK_W02 The student has the necessary knowledge to classify mining areas and buildings into categories according to the type of risk and their monitoring.

PEK_W03 The student has knowledge concerning mining and construction prevention in order to minimize the impacts of mining on surface buildings and underground infrastructure.

relating to skills:

PEK_U01 The student can individually identify, designate and interpret effects of underground and opencast excavation on the surface and underground infrastructure.

PEK_U02 The student has the ability to select monitoring systems based on the size of the rock mass expected deformation.

PEK_U03 The student knows the principles concerning integrated systems design for rock mass deformation monitoring in terms of safety use of facilities at risk.

relating to social competences:

PEK_K01 The student is aware of the impact of mining on the environment

PEK_K02 The student can use and share his knowledge at the stage of design of mining excavations in the context of ground and structures protection.

PROGRAMME CONTENT		
Form of classes - lecture		**Number of hours**
Lec 1	Characteristics of underground and open-cast mining influence on the components of the natural environment, division, impact zone	2
Lec 2-3	The role of surveying and GPS satellite in the monitoring process of mining areas surface deformation.	4
Lec 4-5	Problem of geodetic deformation measurements reliability, algorithm of connecting relative and absolute observations.	4
Lec 6-7	Measurement and control system to monitor the rock mass deformation. Measurements of the rock mass deformation of engineering and natural structures (geodynamic polygons) - examples	4
Lec 8-9	Determining the values of deformation from geodetic observations, analysis and geometric interpretation.	4
Lec 10-11	Classification of mining areas into categories due to the deformation of continuous, discontinuous and bumps mining types.	4
Lec 12-13	Classification of buildings into categories: resistance, simplified inventory, protecting objects against mining damage	4
Lec 14-15	Determination of safety pillars for surface facilities on mining areas on the example of coal and copper ore mining	4
	Total hours	**30**

Form of classes - laboratory		Number of hours
Lab 1	Giving students individual exercise tasks. Discussion of guidelines for exercise No. 1 on “Development of control and measurement network design for monitoring changes in the rock mass in the area of mine based on a digital map." Graphical presentation of the network design.	2
Lab 2	Description of measurements aim, selection of the measurement methods, type of equipment and time of measurement. Report development No. 1	2
Lab 3	Giving students individual exercise tasks. Analysing tips to the project No. 2 regarding: “Determining the values of deformation from geodetic observations, analysis and geometric interpretation”. Performing calculations of deformation values.	2
Lab 4	Geometrical analysis of obtained values deformations (values figures). Classification of a site to the appropriate mining area category. Report development No. 2.	2
Lab 5	Giving students individual exercise tasks. Analysing tips to the project No. 3 regarding: "An assessment of surveying credibility based on regular surveying measurements results of the selected structure."	2
Lab 6	Statistical analysis of the horizontal and vertical displacements of cyclic surveying of the selected structure. Determination of average measurement errors.	2
Lab 7	Assessment of surveying credibility. Report development No. 3.	3
	Total hours	**15**

TEACHING TOOLS USED
N1. Informative lecture with the elements of problem solving lecture. N2. Multimedia presentations with the usage of audio-visual equipment N3. 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
P1	PEK_W01-PEK_W03	passing final written test from the given scope of material
P2	PEK_U01-PEK_U03	F1 Grade from performance and merits of the laboratory F2- Grade from defence (presentation) matters contained in the laboratory reports P2 - Final grade from a laboratory (weighted average of F1 - 70% and F2 - 30%)

PRIMARY AND SECONDARY LITERATURE
SUBJECT SUPERVISOR (NAME AND SURNAME, E-MAIL ADDRESS)
prof. dr hab. inż. Stefan Cacoń, (stefan.cacon@pwr.wroc.pl **mgr inż. Andrzej Dudek, (andrzej.dudek@pwr.wroc.pl)**

MATRIX OF CORRELATION BETWEEN EDUCATIONAL EFFECTS FOR SUBJECT
Rock Mass Changes Monitoring and Mining Area Surface Protection
AND EDUCATIONAL EFFECTS FOR MAIN FIELD OF STUDY
mining and geology
AND SPECIALIZATION
Underground and Surface Mining

SUBJECT EDUCATIONAL EFFECT	Correlation between subject educational effect and educational effects defined for main field of study and specialization	SUBJECT OBJECTIVES	Programme content	Teaching tool number
PEK_W01 PEK_W02 PEK_W03	K_W10 , K_W15	C1, C2	Lec 1-Lec 15	N1-N 2
PEK_U01 PEK_U02	K_U13	C3	Lab 1-Lab 7	N1-N 3
PEK_K01 PEK_K02	K_K01, K_K02	C1-C3	Lab 1-Lab 7	N1-N 3

SEMESTER 3

FACULTY OF GEOENGINEERING, MINING AND GEOLOGY

SUBJECT CARD

Name in Polish: Prawo Geologiczno–Górnicze i Ratownictwo
Name in English: Geological and Mining Law and Mine Rescue Work
Main field of study: mining and geology
Specialization: Underground and Surface Mining
Level and form of studies: 2nd level, full-time
Kind of subject: obligatory
Subject code: PRG3301
Group of courses: NO

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

PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES

SUBJECT OBJECTIVES

C1 The aim of the course is having extended knowledge concerning the Geological and Mining Law relating to its location against European law directives, the rules of products admission for use in ZG and environmental issues concerning mining activities.
C2 The aim of course is to have extended knowledge of mine rescue and first aid, rules of rescue operations conduct, creating fire prevention plan and use of computer systems in emergency
C3 The aim of the course is to master the skill of obtaining information from legal system, legal literature and other sources, and the development of information on current mining law, and their use in practice to make evaluations and reviews

SUBJECT EDUCATIONAL EFFECTS

relating to knowledge:

PEK-W01 The student knows mining and geological law in an extend that allows them to assess their qualification for being a person of mining management and especially concerning exploitation conduct in natural hazards

relating to skills:

PEK-U01 The student is able to formulate general rules for the conduct of rescue and adopt rules of creating rescue plan, first aid and also fire prevention plan. The student can apply computer system for supporting rescue operations

PEK-U02 The student can independently develop components of safety work documents required by the provisions of the geological and mining law

relating to social competences:

PEK-K01 The student understands the need for formulation and communication to the public-including by means of mass media - information and opinions concerning mining performance and other aspects of engineer-miner; the student shall endeavour to provide such information and opinions in a way commonly understood, presenting different points of view

PROGRAMME CONTENT		
Form of classes - lecture		**Number of hours**
Lec 1	European directives on mining	2
Lec 2	Allowing products for use in mining	2
Lec 3	Geological and Mining Law and environment protection	2
Lec 4	Waste dumping in underground excavations	1
Lec 5	Mine rescue organization in Poland	2
Lec 6	General rules for the conduct of rescue action	2
Lec 7	Rescue and first aid plan	2
Lec 8	Fire prevention plan.	2
	Total hours	**15**

Form of classes - class		**Number of hours**
Cl 1	Conducting the rescue action with the use of computer-aided system of running action - FIRE System	2
Cl 2	Conducting the rescue action with the use of computer-aided system of running action - FIRE System	2
Cl 3	Conducting the rescue action with the use of computer-aided system of running action - FIRE System	2
Cl 4	First aid - general rules.	2
Cl 5	First aid - respiratory and circulatory arrest, shock	2
Cl 6	First aid - injuries, poisoning	2
Cl 7	First aid - frostbites, burns	2
Cl 8	First aid - fractures, skull injuries	1
	Total hours	**15**

Form of classes - seminar		Number of hours
Sem 1	Introduction to the seminar, handing out topics of speeches for individual students. The speeches deal with the current Geological and Mining Law problems discussed during the lectures, and the legal issues arising from the regulatory provisions of the Geological and Mining Law Act.	1
Sem 2-7	Presentations of the seminar participants in the form of 20-25 minute presentations and groups discussion on the content and form of speeches.	14
	Total hours	**15**

TEACHING TOOLS USED
N1. Type of lectures - traditional, illustrated with multimedia presentations with the usage of audio-visual equipment N2. classes conducted with the use of modern computer systems N2. Presentations of the seminars participants should be illustrated with multimedia presentations, using the digital documentation

EVALUATION OF SUBJECT EDUCATIONAL EFFECTS ACHIEVEMENT

Evaluation (F – forming (during semester), P – concluding (at the end of semester)	Educational effect number	Way of evaluating educational effect achievement
P1	PEK_W01	Written test from the material covered at the lecture
P2	PEK_U01	Crediting test - written.
P3	PEK_U01, PEK_K01	student's presentation in analysed by the group, the result of the discussion are transferred into grades. Grades are concerning 1. merits of presentations, 2. formal side of presentations 3. discussion activity It is taken into consideration in the final grade of the seminar Final grade is a weighted average of these three grades, accordingly with 0,6, 0,2 and 0,2.

PRIMARY AND SECONDARY LITERATURE

PRIMARY LITERATURE:

[1] Lipiński – Prawo geologiczne i górnicze – komentarz. Amber Publishing, 2003
[2] Prawo geologiczne i górnicze – SITG Publishing, 2011
[3] Radecki - Ochrona środowiska w prawie geologicznym i górniczym
[4] Cehak K., Olszówka A.: Ratownictwo górnicze, Śląsk Publishing
[5] Gawliczek. J. Ratownictwo górnicze w kopalniach głębinowych, Śląsk Publishing
[6] Kuchejda J.: Przegląd Górniczy Śląsk Publishing

SECONDARY LITERATURE:

[1] The Internet webpages: Sejmu RP, MŚ, MG I WUG
[2] Journal of Law 2011, 2012
[3] Internetowy System Informacji Prawnej Sejmu RP
[4] Bezpieczeństwo pracy i ochrona środowiska w górnictwie – miesięcznik WUG
[5] Biuletyn informacyjny z zakresu ratownictwa górniczego - CSRG
[6] Ratownictow Górnicze – kwartalnik CSRG

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

dr inż. Marek Sikora, marek.sikora@pwr.wroc.pl;
dr inż. Jacek Urbański, jacek.urbanski@pwr.wroc.pl

MATRIX OF CORRELATION BETWEEN EDUCATIONAL EFFECTS FOR SUBJECT
Geological and Mining Law and Mine Rescue Work
AND EDUCATIONAL EFFECTS FOR MAIN FIELD OF STUDY
mining and geology
AND SPECIALIZATION
Underground and Surface Mining

SUBJECT EDUCATIONAL EFFECT	Correlation between subject educational effect and educational effects defined for main field of study and specialization	SUBJECT OBJECTIVES	Programme content	Teaching tool number
PEK_W01	K_W14	C1	Lec 1-Lec 7	N1
PEK_U01	K_U18	C2	Cl 2-Cl 7	N2
PEK_U02	K_U21	C3	Sem 2-Sem 7	N3
PEK_K01	K_K02	C2	Lec 1-Lec 7 Sem 2-Sem 7	N1, N3

FACULTY OF GEOENGINEERING, MINING AND GEOLOGY

SUBJECT CARD

Name in Polish: Systemy Przeróbcze
Name in English: Processing Systems
Main field of study: mining and geology
Specialization: Underground and Surface Mining
Level and form of studies: 2nd level, full-time
Kind of subject: obligatory
Subject code: GGG3307
Group of courses: YES

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

SUBJECT OBJECTIVES

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

PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES

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

SUBJECT EDUCATIONAL EFFECTS

relating to knowledge:

PEK_W01 The student has general knowledge of technologies used in refining, and processing mineral resources
PEK_W02 The student gets to know the principle of mathematical modelling of tailings operations and problems of experimentation to determine model parameters of an operation.

PEK_W03 The student gets to know the criteria and algorithms of optimization (*off-line*) of complex systems of technological operations
PEK_W04 The student gets to know the examples of commercial and training functions of software for the analysis of tailings systems (JKSimMet, ModSim, WTP)
PEK_W05 The student gets to know how to perform simulation calculations of systems of qualitative and quantitative operations using calculating tools available in the spreadsheet (functions, VBA)
PEK_W06 The student gets to know how to perform simulation calculations of processes of qualitative and quantitative operations using calculating tools available in the spreadsheet (functions, VBA)

relating to skills:
PEK_U01 - The student can perform basic calculations of simple models tailings operations: crushing and classification and evaluating their performance
PEK_U02 - The student can perform an individual/ group task to optimize a simple feedback system of mining operations and / or tailings
PEK_U03 - The student can develop and present the results of his project work (paper report, multimedia presentation of sample analysis of mineral system in processing and waste

relating to social competences:
PEK_K01 - The student has created attitude of critical overview of the available knowledge on the course.

PROGRAMME CONTENT		
Form of classes - lectures		**Number of hours**
Lec 1	Scope of lecture, crediting conditions, literature overview. Profile characteristics of the course and the aims and methods of education. Linking the course problems with the course profile and educational programs of other courses of particular specialty and the field of study.	2
Lec 2	The basic structures of mining, coal preparation and processing systems on the example of the construction materials industry, mining ore and coal, metallurgy, waste management.	2
Lec 3	Types and systematics of operations, information operations model, the concept of system and process operations, performance, efficiency, reliability, productive hours.	2
Lec 4	Methods and tools for the analysis of complex systems operations. Spreadsheet as a calculation tool (functions, VBA)	2
Lec 5	Modelling crushing operations, crushing machine models, methods and problems of experimentation.	2
Lec 6	Modelling of classification procedure (separation), classifier / separator models, methods and problems of experimentation.	2
Lec 7	Methods of simulation of the quantitative operations processes (mass flow in systems, tanks, and machines)	2
Lec 8	Knowledge control - test.	1
	Total hours	**15**

Form of classes - project		Number of hours
Proj 1	Introduction to the project: assumptions, aims, form, schedule.	2
Proj 2	Checking the initial knowledge of the students in auditorial mode.	2
Proj 3	Solving simple calculation using a spreadsheet (functions, calculus matrix).	2
Proj 4	Duty hours and exercises checking the knowledge of mathematical statistics (grain size) and the ability to operate on sets.	2
Proj 5	Handing out tasks and explanation for individual work (system analysis operations: different structures, different technologies, and different models). Variable catalogue of exercises, adjusted to current students level of knowledge and skills of).	2
Proj 6	Algorithmization and programming of tasks examples concerning the grain analysis in VBA - exercises on auxiliary examples.	6
Proj 7	Individual work: the construction of models of a given operation, individual duty hours.	6
Proj 8	Individual work: analysis (optimization) of given operation systems according to qualitative, quantitative and economics criteria, monitoring the performance, individual duty hours	6
Proj 9	Presentation/project defence of ready-made projects by students. Project settlement (course crediting). Partial crediting.	2
Proj 10	(to be continued) Presentation/project defence of ready-made projects by students, including repeats. Project settlement (course crediting). Partial crediting.	2
	Total hours	**30**

TEACHING TOOLS USED
N1 Informative lecture with the elements of problem solving lecture.
N2 Multimedia presentations.
N3 Didactic discussion considering the lecture and the project.
N4 Projects preparation in a report form.
N5 Written exam (knowledge test)
N6 Checking the progress of project
N7 Presentation and project defence.
N8 Duty hours

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

PRIMARY AND SECONDARY LITERATURE

PRIMARY LITERATURE:

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

SECONDARY LITERATURE:

[1] Czasopisma branżowe:
   a. Górnicwo Odkrywkowe (IGO-Wrocław Pub.
   b. Przegląd Górniczy (NOT Pub., Katowice)
   c. Rudy i Metale Nieżelazne (NOT Pub., Katowice)
   d. Górnictwo i Geoinżynierii (AGH Pub., Kraków),
   e. Przegląd Geologiczny (PIG Pub. Warszawa).
   f. Cuprum (ZBR Cuprum-KGHM Pub., Wrocław)
   g. Gospodarka surowcami mineralnymi, Komitet Zrównoważonej Gospodarki Surowcami PAN, Sigmie PAN Publishing, Kraków
   h. Górnictwo i Geologia, Prace Naukowe Instytutu Górnictwa Politechniki Wrocławskiej, Politechnika Wrocławska Publishing House, Wrocław.
   i. Physicochemical Problems of Mineral Processing, Politechnika Wrocławska Publishing House, Wrocław.
   j. Minerals Engineering, Elsevier Pub.
[2] Portale: www.Informine.com, www.teberia.pl, http://www.dbc.wroc.pl/dlibra

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

dr hab. inż. Jerzy Malewski, prof. ndzw., jerzy.malewski@pwr.wroc.pl

MATRIX OF CORRELATION BETWEEN EDUCATIONAL EFFECTS FOR SUBJECT
Processing Systems
AND EDUCATIONAL EFFECTS FOR MAIN FIELD OF STUDY
mining and geology
AND SPECIALIZATION
Underground and Surface Mining

SUBJECT EDUCATIONAL EFFECT	Correlation between subject educational effect and educational effects defined for main field of study and specialization	SUBJECT OBJECTIVES	Programme content	Teaching tool number
PEK_W01	K_W13	C1	Lec 1	N1-N3
PEK_W02	K_W13	C1, C2	Lec 1, Lec 2	N1-N3
PEK_W03	K_W13	C3	Lec 3	N1-N3
PEK_W04	K_W13	C3	Lec 4, Lec 5	N1-N3
PEK_W05	K_W13	C3	Lec 6, Lec 7	N1-N3
PEK_W06	K_W13	C3	Lec 6, Lec 8	N1-N3
PEK_U01	K_U16	C1-C3	Proj 1-Proj 4	N1-N3
PEK_U02	K_U16	C3	Proj 5-Proj 8	N1-N3
PEK_U03	K_U16	C4	Proj 9-Proj 12	N1-N3
PEK_K01	K_K01	C1-C4	Proj 1-Proj 12	N1-N3

FACULTY OF GEOENGINEERING, MINING AND GEOLOGY

SUBJECT CARD

Name in Polish: Bezpieczeństwo i Higiena Pracy
Name in English: Occupational Safety and Health
Main field of study: mining and geology
Specialization: Underground and Surface Mining
Level and form of studies: 2nd level, full-time
Kind of subject: obligatory
Subject code: GGG3308
Group of courses: NO

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

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.

SUBJECT OBJECTIVES

C1 - To familiarize students with the principles of occupational risk assessment in accordance with PN-N-18002

C2 - To familiarize students with the estimation of principles of occupational risk assessment and also the determination of admissibility with the use of STER software and the RISC SCORE method.

SUBJECT EDUCATIONAL EFFECTS

relating to knowledge:

PEK_W01 - Possesses general knowledge of rules of occupational risk assessment formulation.

PEK_W02- Possesses knowledge of evaluating and determining the admissibility of occupational risk.

PEK_W03 - Possesses general knowledge of corrective and preventive actions regarding hazards of typical work posts in the mining industry.

relating to skills:

PEK_U01 - Is able to identify hazards of harmful, dangerous and nuisance factors of typical work posts in the mining industry.

PEK_U02 - Is able to estimate and determine risk acceptability with methods according to STER software and the RISC SCORE method.

PEK_U03 – Is able to plan corrective and preventive actions for hazards of typical work posts in the mining industry.

relating to social competences:

PEK_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		
Form of classes - lecture		**Number of hours**
Lec 1	Definition of occupational risk. Legal basics of occupational risk assessment. Risk assessment methods. Course of occupational risk assessment.	2
Lec 2	Information necessary for occupational risk assessment. Identification of harmful, dangerous and nuisance factors in the work environment.	2
Lec 3	Estimation of occupational risk assessment and determination of admissibility.	2
Lec 4	Corrective and preventive actions. Familiarizing 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.	2
Lec 5	Dangerous factors - Identification and assessment of risks.	2
Lec 6	Nuisance factors in occupational risk assessment: psychological burden, static burden, monotype.	2
Lec 7	Methods of occupational risk assessment: STER software, the RISC SCORE method.	2
Lec 8	Presentation of prepared risk assessments, written test	1
	Total hours	**15**

Form of classes - laboratory		**Number of hours**
Lab 1	Occupational risk assessment with the use of STER software for two work posts – description of work post, identification of hazards	3
Lab 2	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, vibration, chemical agents)	3
Lab 3	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
Lab 4	Occupational risk assessment with the use of STER software for two work posts – estimation of occupational risk and determination of admissibility for	3

	nuisance factors (psychological burden, static burden, monotype)	
Lab 5	Occupational risk assessment for a selected work post with the use of the RISC SCORE method	2
Lab 6	Presentation of executed exercises, test	1
	Total hours	**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. N5 Computer presentation of executed occupational risk assessments. N6 Consultation.

EVALUATION OF SUBJECT EDUCATIONAL EFFECTS ACHIEVEMENTS

Evaluation F – forming (during semester), P – concluding (at semester end)	Educational effect number	Way of evaluating educational effect achievement
P1	PEK_W01-PEK_W03	Informative lecture with elements of problematic lectures, multimedia presentations, didactic discussions during lectures, final grade from a written exam covering the entire material.
P2, F1	PEK_U01-PEK_U0 3 PEK_K01	Preparation of risk assessments in the form of a computer presentation, consultations, final grade from a test and presentation.

PRIMARY AND SECONDARY LITERATURE

PRIMARY LITERATURE:

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

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

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

SECONDARY LITERATURE:

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

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

dr inż. Zbigniew Nędza, zbigniew.nedza@pwr.wroc.pl

MATRIX OF CORRELATION BETWEEN EDUCATIONAL EFFECTS FOR SUBJECT
Occupational Safety and Health
AND EDUCATIONAL EFFECTS FOR MAIN FIELD OF STUDY
mining and geology
AND SPECIALIZATION
Underground and Surface Mining

SUBJECT EDUCATIONAL EFFECT	Correlation between subject educational effect and educational effects defined for the main field of study and specialization	SUBJECT OBJECTIVES	Programme content	Teaching tool number
PEK_W01	K_ W18	C1, C2	Lec 1-Lec 7	N1-N3, N6
PEK_W02	K_ W18	C1, C2	Lec 3-Lec 7	N1-N3, N6
PEK_W03	K_ W18	C1, C2	Lec 4	N1-N3, N6
PEK_U01	K_ U21	C1, C2	Lec 4, Lec 8	N4-N6
PEK_U02	K_ U21	C1, C2	Lab 1-Lab 5	N4-N6
PEK_U03	K_ U21`	C1, C2	Lab 1-Lab 5	N4-N6
PEK_K01	K _K01	C1, C2	Lab 1-Lab 6	N1-N6

FACULTY OF GEOENGINEERING, MINING AND GEOLOGY

SUBJECT CARD

Name in Polish: Wentylacja i Pożary
Name in English: Mine Ventilation and Fires
Main field of study: mining and geology
Specialization: Underground and Surface Mining
Level and form of studies: 2nd level, full-time
Kind of subject: obligatory
Subject code: GGG3309
Group of courses: NO

	Lecture	Classes	Laboratory	Project	Seminar
Number of hours of organized classes in University (ZZU)	15			30	
Number of hours of total student workload (CNPS)	30			30	
Form of crediting	Examination			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					
including number of ECTS points for direct teacher-student contact (BK) classes	1			0,5	

PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES

1. The student has basic knowledge concerning mathematical analysis necessary to understand mathematical issues in science of engineering character.
2. The student has basic knowledge of technical thermodynamics.
3. The student has knowledge concerning mining, mainly of provision and underground deposits excavation, and knows how to fight against natural hazards.
4. The student has basic knowledge concerning mine ventilation and fire in the air thermodynamic changes, binding rules in the mine ventilation, air distribution rules in the networks of ventilation, ventilation problems during underground fire and conducting firefighting action.
5. The student can use word processing programs and spreadsheets (with elements of programming) in the preparation of documents, calculation and while performance of multimedia presentations.
6. The student understands the need and knows the possibilities of lifelong learning (3-rd studies, post-graduate studies, courses) improving professional, personal and social skills

SUBJECT OBJECTIVES

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

SUBJECT EDUCATIONAL EFFECTS

relating to knowledge:
PEK_W01 - The student has elementary knowledge concerning the ventilation of mines in terms of natural hazards.
PEK_W02 - The student has knowledge concerning methods used in the study of safety and economics in real ventilation networks.
PEK_W03 - The student has knowledge concerning the impact of physical-thermal rock mass properties and mining operations conducted and which has influence on climate in mine and predicting thermal conditions in the excavations.
PEK_W04 - The student has knowledge concerning the cooling processes used in mine air conditioning, used thermodynamic factors and heat dissipation capabilities, particularly from underground air-conditioning equipment.
PEK_W05 - The student has knowledge concerning used in Polish and international mining, air conditioning solutions and knows the trends in their development.

relating to skills:
PEK_U01 - The student is able to carry out the safety and economics analysis of ventilation network.
PEK_U02 - The student can, using computational tools, determine the escape road for crew from places which are at risk of underground fire.
PEK_U03 - The student is able to perform balance calculations of air conditioning systems.
PEK_U04 - The student is able to compile air conditioning projects of mining regions.
PEK_U05 – The student can analyse local and central air conditioning solutions used in the Polish mines and abroad taking into consideration their advantages and disadvantages.

relating to social competences:
PEK_U01 - The student can develop and present the results of his project work as spread sheets, paper report, and multimedia presentation.
PEK_K02 - The student is aware of the environmental hazards caused by the major fans noise, greenhouse gases and dust as a result of mine ventilation.
PEK_K03 - The student is aware of the influence of thermodynamic factors used in mines air conditioning on the greenhouse effect and ozone hole.

PROGRAMME CONTENT		
Form of classes - lecture		**Number of hours**
Lec 1	Rules of mines ventilation in terms of natural hazards. Safe and economic analysis of the actual network ventilation with the use of computer technology.	2
Lec 2	Protecting people while underground fire. Possibilities of computer generated hazardous area at a different fire location. Determination of escape routes in case of fire.	2
Lec 3	Factors affecting climate conditions in mine excavations: the impact of air pressure changes, operating machinery, quantities and humidity, thermal properties of rocks. Energy balance in the rock mass and mining excavation, heat conductance equation.	2
Lec 4	Methods for predicting air temperature in mine excavations which are ventilated separately and with the use if streamlined ventilation.	2
Lec 5	Cooling processes in mines air conditioning. Development trends of conditioning mines - the use of ice. Reducing pressure in air conditioning systems. Heat dissipation capabilities from the underground air conditioning installations. Refrigerants and coolants and their impact on the environment.	3
Lec 6	Solutions of local and central air conditioning in mines.	2
Lec 7	Calculations balance of air conditioning systems. Air conditioning solutions used in mines abroad.	2
	Total hours	**15**

Form of classes - project		**Number of hours**
Proj 1	Scope of design exercises, crediting conditions, literature Giving students individual project tasks. Analysing tips to design exercises regarding: 1) "Determination of escape routes in case of fire. 2) Solution of air conditioning of long wall or pillar-chamber mining unit.	2
Proj 2	Analysis of the danger zone for selected crew's positions (branches) through a system of "Fire".	4
Proj 3	Determination of the crew escape routes depending on the place of underground fire appearance.	4
Proj 4	Forecasting thermal and moisture conditions in the excavations which deliver the air to the area and in the area.	4
Proj 5	Climate assessment in the region. Determining the extent of air conditioning. The adoption of the air conditioning concept.	4
Proj 6	Appointment of necessary cooling capacity and its distribution in the excavations. The choice of air conditioning machine (s).	4
Proj 7	Calculation of the required pipe insulation. Determination of pressure loss in pipes. The choice of a compression pump.	4
Proj 8	Solution of heat dissipation from MK to air consumed currents by the means of, specified in assignment, device (evaporator refrigerator, cooling tower, or a washing chamber). Implementation of the unit's heat balance, before and after air conditioning.	4
	Total hours	**30**

TEACHING TOOLS USED
N1. Type of lectures - traditional, illustrated with multimedia presentations N2. Didactic discussion during lecture and project. N3. 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
P1	PEK_W01-PEK_W05	Final grade of written test.
P2	PEK_U01-PEK_U05 PEK_K01-PEK_K03	Final grade from the project in a paper form and its defence

PRIMARY AND SECONDARY LITERATURE

PRIMARY LITERATURE

[1] Wacławik J.: Wentylacja kopalń tom I i II, AGH Pub., Kraków 2010.
[2] Roszkowski J., Pawiński J., Strzemiński J.: Przewietrzanie kopalń, ŚWT Pub., Katowice 1995.
[3] Strumiński A.: Zwalczanie pożarów w kopalniach głębinowych, Śląsk Pub., Katowice 1996.
[4] Wacławik J., Cygankiewicz J., Knechtel J.: Warunki klimatyczne w kopalniach głębokich, PAN, Kraków 1998
[5] McPherson M. J.: Subsurface Ventilation and Environmental Engineering, Published by Chapman & Hall, London 1993.
[6] Gutkowski K. M.: Chłodnictwo i klimatyzacja, WNT, Warszawa 2003

SECONDARY LITERATURE

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

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

dr inż. Franciszek Rosiek, franciszek.rosiek@pwr.wroc.pl

MATRIX OF CORRELATION BETWEEN EDUCATIONAL EFFECTS FOR SUBJECT
Mine Ventilation and Fires
AND EDUCATIONAL EFFECTS FOR MAIN FIELD OF STUDY
mining and geology
AND SPECIALIZATION
Underground and Surface Mining

SUBJECT EDUCATIONAL EFFECT	Correlation between subject educational effect and educational effects defined for main field of study and specialization	SUBJECT OBJECTIVES	Programme content	Educational effect number
PEK_W01	K_W16	C1	Lec 1	N1, N2, N3
PEK_W02	K_W16	C2	Lec 1	N1, N2, N3
PEK_W03	K_W16	C4	Lec 3, Lec 4	N1, N2, N3
PEK_W04	K_W16	C5	Lec 5	N1, N2, N3
PEK_W05	K_W16	C6	Lec 5	N1, N2, N3
PEK_U01	K_U19	C2	Lec 1	N1, N2, N3
PEK_U02	K_U19	C3	Lec 2	N1, N2, N3
PEK_U03	K_U19	C5	Lec 7	N1, N2, N3
PEK_U04	K_U19	C5	Lec 7	N1, N2, N3
PEK_U05	K_U19	C6	Lec 6	N1, N2, N3
PEK_K01	K_K01	C1	Proj 1-Proj 8	N3
PEK_K02	K_K02	C2	Lec 1	N3
PEK_K03	K_K02	C5	Lec 5	N3

FACULTY OF GEOENGINEERING, MINING AND GEOLOGY

SUBJECT CARD

Name in Polish: Zarządzanie Finansami
Name in English: Finance Management
Main field of study: mining and geology
Specialization: Underground and Surface Mining
Level and form of studies: 2nd level, full-time
Kind of subject: obligatory
Subject code: ZMG3301
Group of courses: YES

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

PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES

1. Possesses basic knowledge of mining exploitation systems, technological and organizational systems in mining.
2. Possesses basic knowledge of mathematical analysis which is necessary for the understanding of mathematical issues in sciences of an engineering and economic nature.
3. Possesses basic knowledge and skills in the area of using probability theory models and mathematical statistics.
4. Possesses knowledge in the area of the basics of free-market economics and economics in mining.
5. Is able to use Excel spreadsheet.
6. Understands the need and knows the possibilities of permanent self-education and improving professional, personal and social skills.

SUBJECT OBJECTIVES

C1. Acquisition of basic knowledge about the role and the main principles of financial management in a company including aspects of application.
C2. Acquiring the ability to interpret data contained in financial statements of a company, to analyse its financial condition, prepare simple financial models of an investment and apply advanced methods to assess the efficiency of an investment.
C3. The acquisition of competencies of thinking and acting in a creative and enterprising way.
C4. Strengthening economic activity attitudes and making decisions including criteria of economic enterprises.

SUBJECT EDUCATIONAL EFFECTS

relating to knowledge:

PEK_W01 Possesses knowledge of the content and mutual relations of balance, income and loss statements and also cash flow statements.
PEK_W02 Knows how to present company financial data in statutory financial statements and knows their variants.
PEK_W03 Possesses basic knowledge of the ratio analysis method of financial statements.
PEK_W04 Knows the ways of classifying costs in an enterprise, knows the basic concepts of cost accounting.
PEK_W05 Knows concepts of the present and future values of cash flows and annuities.
PEK_W06 Knows basic and advanced methods of assessing the effectiveness of an investment (NPV, IRR, MIRR, PI, DPBP, PBP, ARR) and their application ranges.
PEK_W07 Knows the rules about creating a financial model of an investment during inflation and risk conditions.
PEK_W08 Possesses basic knowledge about the dependence of an investment rate of profit and risk.

relating to skills:

PEK_U01 Is able to interpret and use information contained in statutory financial statements
PEK_U02 Knows how to perform a ratio analysis and basic financial statements at a basic level.
PEK_U03 Is able to use cost data presented in various systems of cost registration, is able to calculate the technical cost of production.
PEK_U04 Is able to use basic methods of management accounting when making short-term decisions.
PEK_U05 Is able to calculate the future and present value of money for a number of payments and solve accounting tasks in the field of money value over time.
PEK_U06 Is able to create a financial model of simple investment (using a calculating spreadsheet) and assess the cost effectiveness with the use of known methods.
PEK_U07 Is able to perform sensitivity analysis and scenario analysis using the financial model of an investment.
PEK_U08 Is able to assess the level of investment risk and estimate the expected rate of profit on an investment.

relating to social competences:

PEK_K01 Is able to think and act in a systematic, creative and enterprising way.
PEK_K02 Possesses an economic attitude, making decisions based on available financial information and forecasts.

PROGRAMME CONTENT		
Form of classes - lecture		**Number of hours**
Lec 1	Elements of financial statements of companies. Basic concepts. Statutory financial statements.	2
Lec 2	Costs for reporting purposes - classification of costs in the breakdown of costs by type, subject and functional configurations and calculation configurations. The technical cost of production. Income and loss statements in calculation and comparative variants.	2
Lec 3	Cost and cash flow. Variants of cash flow statements.	1
Lec 4	Ratio analysis of a company's financial statements. Assessment of the financial condition and results of a company. Financial and operational leverage.	3
Lec 5	Cost calculation for management purposes. Financial short-term decision making.	2
Lec 6	Time value of money. Calculation of the future and present value of annuities. Calculation of a mortgage rate.	1
Lec 7	Revision of basic methods of assessing the effectiveness of an investment. Advanced methods (Modified Internal Rate of Return - MIRR, discounted payback period of an investment return - DPBP, profitability index PI, accounting rate of profit). Division of methods into static and dynamic methods. Advantages and disadvantages of each method. Scope of application.	2
Lec 8	The rate of interest. The rate of profit of an investment and risk. Estimating the expected rate of profit of an investment (capital asset pricing model CAPM). Assessment of risk of an investment. Evaluation of the profitability of an investment including risk and inflation.	2
	Total hours	**15**

Form of classes - class		**Number of hours**
Cl 1	Simplified registration of business operations – solving problems.	2
Cl 2	Classification of costs in an enterprise - tasks. Calculation of technical production costs. Two variants of profit and loss statements - tasks.	2
Cl 3	Statutory financial statements - tasks	2
Cl 4	Calculation of financial ratios based on statutory financial statements - task: Power stations. Discussion on obtained results.	3
Cl 5	Tasks for the calculation of future and current annual payments (ie, mortgage rates). Forecasting cash flows of investments.	2
Cl 6	Tasks of management accounting - short-term decision making.	2
Cl 7	The investment rate of profit and risk - tasks. The use of the capital asset pricing model (CAPM)	2
	Total hours	**15**

Form of classes - laboratory		Number of hours
Lab 1	Simplified business registration operations of an enterprise. Creating a balance sheet, income and loss statements and cash flow statements based on registered operations.	4
Lab 2	Calculation of financial ratios based on the annual statutory financial statements of a mining company. Interpretation of indicators.	2
Lab 3	Tasks from field of cost accounting. Statistical methods which are used to separate fixed and variable costs.	2
Lab 4	Calculating the rate of profit of an investment with the use of a calculation spreadsheet (NPV, IRR, MIRR, PI, DPBP, PBP, ARR). Interpretation of results - discussion.	3
Lab 5	Creating a financial model of an investment (task - Mining CSU)	2
Lab 6	Sensitivity analysis and scenario analysis with the use of the financial model of an investment.	2
	Total hours	**15**

TEACHING TOOLS USED
N1. Interactive lecture with a slide show and discussion. N2. Laboratory exercises: individual problem solving using a calculation spreadsheet. N3. Exercises: Problem solving in groups. Presentation of results on the board. Discussion on obtained results. N4. Consultations. N5. Individual work – solving homework. N6. Individual work – individual literature studies.

EVALUATION OF SUBJECT EDUCATIONAL EFFECTS ACHIEVEMENTS

Evaluation F – forming (during semester), P – concluding (at semester end)	Educational effect number	Way of evaluating educational effect achievement
F1	PEK_W01-PEK_W08 PEK_K01-PEK_K02	Discussion during classes, assessment of individual solutions of laboratory tasks
F2	PEK_U01-PREK_U08 PEK_K01-PEK_K02	Grade from task solutions obtained by students during laboratories and classes
P1	PEK_W01-PEK_W08 PEK_U01-PEK_U08 PEK_K01-PEK_K02	Written exam
P2	PEK_W01-PEK_W08 PEK_U01-PEK_U08 PEK_K01-PEK_K02	Grade from individual task solutions sent by students after each laboratory class

PRIMARY AND SECONDARY LITERATURE

PRIMARY LITERATURE:

[1] Brigham E.: Podstawy zarządzania finansami. Polskie Wydawnictwo Ekonomiczne, Warsaw 1997

[2] Czekaj J., Dresler Z.: Podstawy zarządzania finansami firm. PWN Warsaw1996

[3] Jaruga A., Sobańska J., Kopczyńska L. Szychta A.: *Rachunkowość dla menedżerów*. Towarzystwo Gospodarcze RAFIB, Łodz 1996.

[4] Jonson H.: Ocena projektów inwestycyjnych. Maksymalizacja wartości przedsiębiorstwa. Wyd. K.E. Liber, Warsaw 2000.

[5] Nowak E.: Rachunek kosztów przedsiębiorstwa. Wydawnictwo Ekspert, Wroclaw 2001

[6] Sierpińska M., Jachna T.: Ocena przedsiębiorstwa według standardów światowych, PWN Warsaw 1994.

[7] Świderska G. K.(red): Rachunkowość zarządcza. (praca zbiorowa) Wyd. Poltext, Warsaw 1997

SECONDARY LITERATURE:

[1] Jajuga K., Jajuga T., 2006. Inwestycje. Instrumenty finansowe, aktywa niefinansowe, ryzyko finansowe, inżynieria finansowe, Wydawnictwo Naukowe PWN, Warsaw

[2] Jonson H.: Koszt kapitału. Klucz do wartości firmy. Wyd. K.E. Liber, Warsaw 2000

[3] Turyna J., Pułaska-Turyna B.: Rachunek kosztów i wyników. Wyd. Finans-Servis, Warsaw 1997.

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

dr inż. Gabriela Paszkowska, gabriela.paszkowska@pwr.wroc.pl

MATRIX OF CORRELATION BETWEEN EDUCATIONAL EFFECTS FOR SUBJECT
Finance Management
AND EDUCATIONAL EFFECTS FOR MAIN FIELD OF STUDY
mining and geology
AND SPECIALIZATION
Underground and Surface Mining

SUBJECT EDUCATIONAL EFFECT	Correlation between subject educational effect and educational effects defined for the main field of study and specialization	SUBJECT OBJECTIVES	Programme content	Teaching tool number
PEK_W01	K_W17	C1	Lec 1	N1, N4, N6
PEK_W02	K_W17	C1	Lec 1, Lec 2, Lec 3	N1, N4, N6
PEK_W03	K_W17	C1	Lec 4	N1, N4, N6
PEK_W04	K_W17	C1	Lec 2	N1, N4, N6
PEK_W05	K_W17	C1	Lec 6	N1, N4, N6
PEK_W06	K_W17	C1	Lec 7	N1, N4, N6
PEK_W07	K_W17	C1	Lec 7, Lec 8	N1, N4, N6
PEK_W08	K_W17	C1	Lec 8	N1, N4, N6
PEK_U01	K_U20	C2	Cl 1-Cl 3, Lab 1-Lab 2	N2-N5
PEK_U02	K_U20	C2	Cl 3-Cl 4, Lab 2	N2-N5
PEK_U03	K_U20	C2	Cl 2, Lab 3	N2-N5
PEK_U04	K_U20	C2	Cl 6, Lab 3	N2-N5
PEK_U05	K_U20	C2	Cl 5	N2-N5
PEK_U06	K_U20	C2	Cl 5, Lab 4-Lab 5	N2-N5
PEK_U07	K_U20	C2	Lab 6	N2-N5
PEK_U08	K_U20	C2	Cl 7, Lab 6	N2-N5
PEK_K01	K_K01	C3, C4	Lec 1-Lec 8, Lab 1-Lab 6, Cl 1-Cl 7	N1-N6
PEK_K02	K_K01	C3, C4	Lec 1-Lec 8, Lab 1-Lab 6, Cl 1-Cl 7	N1-N6

FACULTY OF GEOENGINEERING, MINING AND GEOLOGY

SUBJECT CARD

Name in Polish: Zarządzanie Środowiskiem
Name in English: Environment Management
Main field of study: mining and geology
Specialization: Underground and Surface Mining
Level and form of studies: 2nd level, full-time
Kind of subject: obligatory
Subject code: OSG3310
Group of courses: YES

	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)	30				30
Form of crediting	crediting with grade				crediting with grade
For a group of courses mark (X) for the final course	X				
Number of ECTS points	1				1
including number of ECTS points for practical (P) classes					
including number of ECTS points for direct teacher-student contact (BK) classes	1				0,5

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 EDUCATIONAL EFFECTS

relating to knowledge:

PEK_W01 - Possesses systematic knowledge of the origins of environmental management systems, review and standardization of environmental management systems.

PEK_W02 - Possesses knowledge of the possibilities and practical applications of tools supporting the implementation of the environmental management system.

PEK_W03 - Knows basic formal and legal regulations regarding the implementation and functioning of management systems, tools and instruments of environmental management.

PEK_W04 - Possesses knowledge for rational and sustainable management of environmental components.

relating to skills:

PEK_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.

PEK_U02 – Is able to use methods and appropriate IT tools in system management of environmental components.

relating to social competences:

PEK_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 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.	6

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**
Sem 1	The scope and form of an essay and presentation, terms of crediting and literature. Assignment of seminar topics for individual students.	2
Sem 2 Sem 3 Sem 4 Sem 5 Sem 6 Sem 7 Sem 8	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 EFFECTS ACHIEVEMENTS

Evaluation F – forming (during semester), P – concluding (at semester end)	Educational effect number	Way of evaluating educational effect achievement
F1- Grade from content value of an essay	PEK_U01, PEK_U02, PEK_K01	Text and graphical form of essay
F2 – Grade from presentation and issues included in an essay	PEK_U01, PEK_U02, PEK_K01	Presentation of essay
F3 – Grade from a written or oral test	PEK_W01, PEK_W02, PEK_W03, PEK_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 inż. Urszula Kaźmierczak, urszula.kazmierczak@pwr.wroc.pl
dr inż. Justyna Górniak-Zimroz, justyna.gorniak-zimroz@pwr.wroc.pl

MATRIX OF CORRELATION BETWEEN EDUCATIONAL EFFECTS FOR SUBJECT
Environment Management
AND EDUCATIONAL EFFECTS FOR MAIN FIELD OF STUDY
mining and geology
AND SPECIALIZATION
Underground and Surface Mining

SUBJECT EDUCATIONAL EFFECT	Correlation between subject educational effect and educational effects defined for the main field of study and specialization	SUBJECT OBJECTIVES	Programme content	Teaching tool number
PEK_W01	K_W15 K_U18	C1, C3	Lec 1, Lec 3	N1, N2, N3, N6
PEK_W02		C6	Lec 11, Lec 12	N1, N2, N3, N6
PEK_W03		C4	Lec 2, Lec 4, Lec 5, Lec 6	N1, N2, N3, N6
PEK_W04		C1-C6	Lec 7, Lec 8, Lec 9, Lec 13, Lec 14	N1, N2, N3, N6
PEK_U01	K_U01	C1-C6	Sem 1-Sem 8	N2, N3, N4, N5, N6
PEK_U02	K_U01 K_U18	C6	Lec 11, Lec 12	N1, N2, N3, N6
PEK_K01	K_K01	C1-C6	Sem 1-Sem 8	N2, N3, N4, N5, N6