DOCTORAL SCHOOL OF WROCŁAW UNIVERSITY OF SCIENCE AND TECHNOLOGY

SUPERVISOR/TEAM/ DECLARING/CONDUCTING COURSE: prof. dr hab. inż. JAN BUTRA
UNIT DECLARING COURSE: DEPARTMENT: Faculty of Mining Geoengineering and Geology
DISCIPLINE: Environmental Engineering, Mining and Energy

COURSE CARD

Course name in Polish: Nowoczesne technologie w górnictwie
Course name in English: Modern technologies in mining
The course is conducted in <u>Polish</u> / English
The course is intended for all PhD students: <u>YES</u> / NO
1) BASIC SCIENCE COURSE
2) <u>SPECIALIZED COURSE</u>
3) SEMINAR
4) HUMANITIES COURSE
5) LANGUAGE COURSE

Subject code: IGQ100191W

* zaznaczyć właściwe

	Lecture	Foreign language course	Seminar	Mixed forms
Number of hours of organized classes in university (ZZU)	30			
Grading	Exam	Exam	Oral presentation	Exam, inspection, evaluation classes

PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES

1. Knowledge of the broadly understood mining issues.
2. Mastering the basic concepts of geology and geoengineering.

\

COURSE OBJECTIVES

C1. To familiarize doctoral students with the issues of underground exploitation of deposits in Poland and in the world.
C2. Presentation and explanation of issues related to the systematics of mining systems for various types of deposits along with the basic elements of technology.
C3. New technologies in the field of mining, haulage and transport of excavated material, excavation support and assessment of the condition of the rock mass.
C4. Directions for development of deposit exploitation technologies at great depth (1400 -2000 m).
C5. Acquainting with the possibilities of robotics in mining and robotization of monitoring systems.
C6. Understanding the method of discrete elements DEM and fields of its application.

DOCTORAL SCHOOL OF WROCŁAW UNIVERSITY OF SCIENCE AND TECHNOLOGY

PROGRAM CONTENTS

Form of classes – lecture (Lec)		Number of hours
Lec1	Introduction - basic concepts, definitions related to underground mining. The global market of mineral resources.	2
Lec2	Underground mining of hard coal, metal ores, rock salt in Poland against the backdrop of global exploitation.	2
Lec3,4	Classification of mining systems for various types of deposits with elements of mining technology.	4
Lec5,6	New technologies in the field of rock mass condition assessment and natural hazard prevention.	4
Lec7	New solutions of housing of mining excavation.	2
Lec8	Technologies of deep deposits mining (1400 m and more).	2
Lec9	Unconventional technologies of underground mining.	2
Lec10	Inspection robotics and robotization of mining processes.	2
Lec11, 12	Monitoring Systems and Predictive Maintenance analytics in mining.	4
Lec13,14	Improvement of mining equipment and machines with the use of discrete modeling.	4
Lec15	Summary of the issues discussed.	2
	Total hours:	**30**

TEACHING TOOLS USED

N1. Informative lecture - illustrated with multimedia presentations, enriched with short educational films in the field of machine work technology in underground mining plants.
N2. Problem lecture - illustrated with multimedia presentations

ACHIEVED SUBJECT LEARNING OUTCOMES

Type of learning outcome	Code of learning outcome	Assessment of learning outcome
Knowledge	P8S_WG	Student has knowledge at an advanced level of discipline and subject matter relevant to the field of research carried out, including the most recent research findings and scientific achievements

PRIMARY AND SECONDARY LITERATURE

PRIMARY LITERATURE:

[1] Butra J .: Exploitation of the copper ore deposit under the threat of rock bumps and roof falls, KGHM Cuprum sp. o.o. CBR, Wroclaw 2010.

[2] Butra J., Kicki J: Evolution of the technology of mining of copper ore deposits in Polish mines, Library of the School for Underground Exploitation, Cracow 2003.

[3] Piechota S .: Underground mining technique, AGH UST, Krakow 2003.

[4] Piechota S .: The technique of underground exploitation of deposits and mine closures, AGH University of Science and Technology, Cracow 2008.

[5] Przybyła H .: Organization and economics in coal mining design, Publisher of the Silesian University of Technology, Gliwice 2007.

[6] Strzałkowski P .: Outline of the development of underground mining technology, Publisher of the Silesian University of Technology, Gliwice 2011.

[7] Cheluszka P. Outline of robotics in mining and other industrial applications, Publisher of the Silesian University of Technology, 2020.

[8] Zimroz R. Adaptive methods in diagnostics of mining machine drive systems, Publisher of the Wroclaw University of Science and Technology, 2010

[9] Barszcz T., Advanced methods for condition monitoring of machinery in distributed online monitoring and diagnostic systems, AGH, Cracow 2008

[10] Matuttis, Hans-Georg; Chen, Jian. Understanding the discrete element method: simulation of non-spherical particles for granular and multi-body systems. John Wiley & Sons, 2014.

[11] DEM Solutions, EDEM 2.6 Theory Reference Guide. Edinburgh, 2014

SECONDARY LITERATURE:

[12] Chudek M: Housing of mining excavations, Part 1: Housing of corridor and chamber workings, "Śląsk" Publishing House, Katowice 1986.

[13] Goszcz A: Elements of rock mechanics and rock bursts in Polish coal and copper mines, Library of Underground Mining School, Cracow 1999.

[14] Goszcz A .: Selected problems of seismic hazard and rock bursting threat in underground mines, Library of the Underground Mining School, Cracow 2004.

[15] Kłeczek Z.: Mining geomechanics, Silesia Technical Publishing, Katowice 1994.

[16] Monograph of KGHM "Polska Miedź" S.A., Collective work, Lubin 1996.

[17] Walker P., Doroszuk B., Król R., Analysis of ore flow through longitudinal belt conveyor transfer. Operation and Reliability - Maintenance and Reliability. 2020, vol. 22, nr 3, s. 536-543.

[18] Specialist literature (magazines and conference materials - provided by the teacher).

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

Prof. JAN BUTRA, PhD, DSc, **jan.butra@pwr.edu.pl**