DOCTORAL SCHOOL OF WROCŁAW UNIVERSITY OF SCIENCE AND TECHNOLOGY

SUPERVISOR DECLARING/CONDUCTING COURSE: Prof. Przemyslaw Borkowski
DEPARTMENT: Faculty of Geoengineering, Mining and Geology
SCIENTIFIC DISCIPLINE: environmental engineering, mining and energy

COURSE CARD

Course name in Polish: Niekonwencjonalne technologie urabiania
Course name in English: Unconventional machining and mining techniques
Course language: polish / ~~english~~
University-wide general course type*:
The course is intended for all PhD students: YES / ~~NO~~
1) ~~BASIC COURSE~~
2) SPECIALIST COURSE
3) ~~SEMINAR~~
4) ~~HUMANISTIC COURSE~~
5) ~~LANGUAGE~~

Subject code: IGQ100226W

* delete as applicable

	Lecture	Foreign language course	Seminar	Mixed forms (Lecture+Seminar)
Number of hours of organized classes in university (ZZU)	15			
Grading	Exam			

PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES

1. student has knowledge of current world trends in the design of WATERJET machining technologies with an analysis of applications for practical use, including mining applications.

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COURSE OBJECTIVES

C1 Gaining knowledge in the field of waterjet techniques.
C2 Developing the ability to present scientific content.
C3 Developing the ability to discuss in a group.

PROGRAM CONTENTS

Form of classes		Number of hours
L1	*Subject Unconventional mining techniques. Basic notions.* ***Problems of hydro-jetting surface treatment****, Characteristics of the water jet structure, Effects of jet flow and its shaping, General model of high-pressure water jet treatment, Pro-ecological features of the technology*	1

L2	***Fundamentals of high-pressure water jet surface treatment,*** *Stereometric and kinematic processing characteristics, Water jet dynamics, Air-injection issues, Single water jet machining indexes, Qualitative aspects of surface treatment*	1
L3	***Problems of external surface treatment with high-pressure water jet,*** *Influence of treatment conditions on the linear efficiency of the process, Characteristics of rotating heads, Model of rotating water jet surface treatment, Technological aspects of surface treatment, Qualitative aspects of surface treatment*	1
L4	***Problems of the external surface treatment with a high-pressure water jet - cont.****, Effectiveness analysis of the rotating water jet surface treatment, Physical and technological indicators of the surface treatment, Qualitative aspects of the surface treatment*	1
L5	***Specifics of pipe system cleaning with high-pressure water jet,*** *Basics of contaminant removal process, Hydrodynamic forces of working system, Basics of hydrodynamic stripping and sediment removal, Working head feed velocity, Kinematics of pipeline cleaning with rotating heads, Technological aspects of cleaning process, Characteristics of working equipment, Outline of hydrodynamic cleaning technology on selected examples*	1
L6	***Issues of surface treatment with high-pressure abrasive-water jet****, Kinetics of abrasive grains, Dynamics of abrasive-water jet, Structure of abrasive-water jet,*	1
L7	***Issues in high pressure water jet surface treatment – cont.,*** *abrasive expenditure and suitability, surface treatment model, indices characterizing surface treatment, qualitative aspects of surface treatment,*	1
L8	***Specifics of surface treatment with high-pressure hybrid jet,*** *Thermodynamics of high-pressure hybrid jet, Kinetics of particles in hybrid jet, Dynamics of high-pressure hybrid jet, Structure of hybrid jet,*	1
L9	***Specifics of hybrid high-pressure jet machining -cont.,*** *Performance and suitability of abrasive and ice admixtures, Model of hybrid jet machining, Indices characterizing surface machining, Qualitative aspects of surface machining*	1
L10	***Water jet applications****, Fundamentals of deep well rehabilitation, Conditions for hydro-jetting well cleaning, Outline of deep well rehabilitation technology based on selected example*	1
L11	***Water jet applications - cont.,*** *Fundamentals of leaching explosives from artillery shells*	1
L12	***Outline of prospective hydo-jetting technologies****, Hydro-jetting micronization of brittle materials, including coal processed into new generation fuels; hydro-jetting of copper ore to increase copper yield in the production process*	1
L13	***Outline of prospective waterjet technologies - cont.,*** *global trends of waterjet technologies for mining and minerals processing: uranium ore mining, unconventional mining of ore deposits of small thickness, unconventional mining of rock materials for the construction industry, amber mining*	1
L14	***Outline of prospective hydro-jetting technologies - cont.,*** *Deep-sea mining; Review of mining methods, environmental issues of deep-sea mining (mining code).*	1
L15	***Outline of prospective hydro-jetting technologies - cont.,*** *Deep-sea mining; Supporting nodules haulage systems using high-pressure waterjet technologies, In-situ grinding, application examples*	1
	Total hours	15

TEACHING TOOLS USED
N1. Multimedia lecture N2. Discussion N3. Presentation

ACHIEVED SUBJECT LEARNING OUTCOMES		
Type of learning outcome	Code of learning outcome	Assessment of learning outcome
Knowledge	P8S_WG	has knowledge at an advanced level in relation to the discipline and topics related to the area of research, including the latest research results and scientific achievements

PRIMARY AND SECONDARY LITERATURE

PRIMARY LITERATURE:

[1] Przemysław Borkowski Podstawy wysokociśnieniowych technologii hydrostrumieniowych. Monografia nr 174 Instytut Niekonwencjonalnych Technologii Hydrostrumieniowych. Wydawnictwo Politechniki Koszalińskiej, ISSN 0239-7129. Koszalin, 2010.

[2] Borkowski P.: *Obróbka powierzchni wysokociśnieniową strugą wodno-ścierną.* (monografia: str. 366, rys. 331, tabl. 16). Centrum Technik Proekologicznych. Koszalin, 2002.

[3] Borkowski P.: *Teoretyczne i doświadczalne podstawy hydrostrumieniowej obróbki powierzchni*. (str. 328, rys. 238, tabl. 1). Wydawnictwo Politechniki Koszalińskiej, Monografia nr 106, (ISSN 0239-7129) Koszalin, 2004.

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

Przemysław Borkowski, prof., przemyslaw.borkowski@pwr.edu.pl