

**AGH**AGH UNIVERSITY OF SCIENCE  
AND TECHNOLOGY

Module name: Eksploatacja ługownicza w złożach soli kamiennej

Academic year: 2019/2020 Code: GIGR-2-306-GP-s ECTS credits: 3

Faculty of: Mining and Geoengineering

Field of study: Mining Engineering Specjalty: Underground mining

Study level: Second-cycle studies Form and type of study: Full-time studies

Lecture language: English Profile of education: Academic (A) Semester: 3

Course homepage: —

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### Module summary

1. Introduction to the salt mining.
2. Brine properties.
3. Principles of salt cavern location; drilling, construction and well completion.
4. Review of solution mining technologies.
5. Leaching process.
6. Brine field infrastructure.
7. Solution mining for storage caverns construction.
8. Mining problems of storage and waste disposal in salt caverns.
9. Caverns and wells abandonment.
10. Solution mining impact on the land surface.

### Description of learning outcomes for module

MLO code	Student after module completion has the knowledge/ knows how to/is able to	Connections with FLO	Method of learning outcomes verification (form of completion)
Social competence: is able to			
M_K001	The student is aware of and appreciates the role of research in the development and implementation of new techniques and technologies in the field of mining leaching the salt mines and related disciplines (storage in salt caverns). Understands the need for the dissemination of these achievements in the social	IGR2A_K01	Test, Report
Skills: he can			
M_U001	The student has been prepared to solve engineering tasks in mining leaching , manufacturing and execution of brine leaching technology storage chambers.	IGR2A_U04	Test, Report

M_U002	The student is able to plan and choose the methodology of conduct and set of supporting tools (including dedicated algorithms and computer applications), aimed at seeking solutions to tasks related to the production and construction of leaching brine storage chambers	IGR2A_U05	Test, Report
M_U003	The student can draw elements of technological documentation, perform a report presenting the results of their own work on issues relating to the production and execution of brine leaching technique salt chambers.	IGR2A_U06	Test, Report
Knowledge: he knows and understands			
M_W001	The student has expanded knowledge of selected branches of technical sciences useful to formulate, analyze and solve engineering tasks in the field of leaching salt brine production and performance of storage chambers leaching technique.	IGR2A_W06	Test
M_W002	The student has knowledge about current issues related to the production of brine and technique of leaching chambers and storage.	IGR2A_W05	Test
M_W003	The student has the knowledge and awareness of the impact of leaching of salt on the environment.	IGR2A_W01	Test
M_W004	The student has knowledge of new developments in the areas of technology, either directly or indirectly used in the leaching of salt	IGR2A_W02	Test

## Number of hours for each form of classes

Suma	Form of classes										
	Lectures	Auditorium classes	Laboratory classes	Project classes	Conversation seminar	Seminar classes	Practical classes	Fieldwork classes	Workshops	Prace kontrolne i przejściowe	Lektorat
30	15	15	0	0	0	0	0	0	0	0	0

## FLO matrix in relation to forms of classes

MLO code	Student after module completion has the knowledge/ knows how to/is able to	Form of classes										
		Lectures	Auditorium classes	Laboratory classes	Project classes	Conversation seminar	Seminar classes	Practical classes	Fieldwork classes	Workshops	Prace kontrolne i przejściowe	Lektorat
Social competence: is able to												

M_K001	The student is aware of and appreciates the role of research in the development and implementation of new techniques and technologies in the field of mining leaching the salt mines and related disciplines (storage in salt caverns). Understands the need for the dissemination of these achievements in the social	+	+	-	-	-	-	-	-	-	-	-
Skills: he can												
M_U001	The student has been prepared to solve engineering tasks in mining leaching , manufacturing and execution of brine leaching technology storage chambers.	+	+	-	-	-	-	-	-	-	-	-
M_U002	The student is able to plan and choose the methodology of conduct and set of supporting tools (including dedicated algorithms and computer applications), aimed at seeking solutions to tasks related to the production and construction of leaching brine storage chambers	+	+	-	-	-	-	-	-	-	-	-
M_U003	The student can draw elements of technological documentation, perform a report presenting the results of their own work on issues relating to the production and execution of brine leaching technique salt chambers.	+	+	-	-	-	-	-	-	-	-	-
Knowledge: he knows and understands												
M_W001	The student has expanded knowledge of selected branches of technical sciences useful to formulate, analyze and solve engineering tasks in the field of leaching salt brine production and performance of storage chambers leaching technique.	+	+	-	-	-	-	-	-	-	-	-
M_W002	The student has knowledge about current issues related to the production of brine and technique of leaching chambers and storage.	+	+	-	-	-	-	-	-	-	-	-
M_W003	The student has the knowledge and awareness of the impact of leaching of salt on the environment.	+	+	-	-	-	-	-	-	-	-	-
M_W004	The student has knowledge of new developments in the areas of technology, either directly or indirectly used in the leaching of salt	+	+	-	-	-	-	-	-	-	-	-

**Student workload (ECTS credits balance)**

Student activity form	Student workload
Udział w zajęciach dydaktycznych/praktyka	30 h
przygotowanie projektu, prezentacji, pracy pisemnej, sprawozdania	20 h
Realization of independently performed tasks	30 h
Examination or Final test	1 h
Contact hours	1 h
Summary student workload	82 h
Module ECTS credits	3 ECTS

**Additional information****Module content****Lectures**

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**Auditorium classes**

1. Principles of calculations in solution mining.
2. Principles of projecting and modeling of cavern leaching (computer program "UbroAsym for Windows - computer simulation of cavern leaching").

**Teaching methods and techniques:**

Lectures: The content presented at the lecture is provided in the form of a multimedia presentation in combination with a classical lecture panel enriched with demonstrations relating to the issues presented.

Auditorium classes: During the auditorium classes, the students on the board solve the problems they have previously asked. The lecturer systematically applies the explanations and moderates the discussion with the group over the given problem.

**Warunki i sposób zaliczenia poszczególnych form zajęć, w tym zasady zaliczeń poprawkowych, a także warunki dopuszczenia do egzaminu:**

In order to complete the course student has to get a positive grade from all parts of the project work (final report) and from the final test.

There is one date of the correction test.

### **Zasady udziału w poszczególnych zajęciach, ze wskazaniem, czy obecność studenta na zajęciach jest obowiązkowa:**

Lectures:

- Attendance is mandatory: No

- Participation rules in classes: Students participate in the classes learning the next teaching content according to the syllabus of the subject. Students should constantly ask questions and explain doubts. Audiovisual recording of the lecture requires the teacher's consent.

Auditorium classes:

- Attendance is mandatory: Yes

- Participation rules in classes: Students joining the exercises are required to prepare themselves in the scope indicated each time by the teacher (eg in the form of task sets). The student's work assessment can be based on oral or written statements in the form of a colloquium, which according to the AGH study regulations translates into a final grade in this form of classes.

### **Method of calculating the final grade**

Final grade is the weighted average of the test and final report positive evaluation.

### **Sposób i tryb wyrównywania zaległości powstałych wskutek nieobecności studenta na zajęciach:**

A student absent from the classes is obliged to complete the knowledge independently on the basis of the bibliography given by the teacher.

### **Prerequisites and additional requirements**

None.

### **Recommended literature and teaching resources**

Kunstman A., Poborska-Młynarska K., Urbańczyk K., 2007 - Solution mining in salt deposits. Ucelniane wydawnictwa Naukowo-Dydaktyczne AGH, Kraków, p.151.

Jeremic M.L., 1994 - "Solution mining" in: Rock mechanics in salt mining. Balkema.

Warren J., 2006 - "Solution mining" in: Evaporites. Sediments, Resources and Hydrocarbons.

### **Scientific publications of module course instructors related to the topic of the module**

POBORSKA-MŁYNARSKA K., 2017 - Katastrofy wodne w górnictwie solnym na świecie - przyczyny, sposoby zwalczania, skutki. Przegląd Górniczy ; t. 74 nr 6, s. 33-41.

POBORSKA-MŁYNARSKA K., 2015 - Współczesne techniki eksploatacji soli kamiennej w kopalniach podziemnych. Przegląd Górniczy ; nr 12, s. 140-146.

KORZENIOWSKI W., POBORSKA-MŁYNARSKA K., SKRZYPKOWSKI K., 2018 - The idea of the recovery of municipal solid waste incineration (MSWI) residues in Kłodawa Salt Mine S.A. by filling the excavations with self-solidifying mixtures . Archives of Mining Sciences = Archiwum Górnictwa ; vol. 63 no. 3, s. 553-565.

### **Additional information**

The principles of planning and modeling of solution salt caverns are based on computer program "UbroAsym for Windows - computer simulation of cavern leaching" demo version.

There is only one term of the correction test.