AGH UNIVERSITY OF SCIENCE AND TECHNOLOGY

Module name: Mine Water and Environment

Academic year: 2019/2020 Code: GRTZ-1-706-s ECTS credits: 3

Faculty of: Mining and Geoengineering

Field of study: Rewitalizacja Terenów Zdegradowanych Specialty: —

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

Lecture language: English Profile of education: Academic (A) Semester: 7

Course homepage: —

Responsible teacher: dr inż. Różkowski Kazimierz (kazik@agh.edu.pl)

Module summary

During the course, students will gain knowledge about presence of water in mining activities, starting from the stage of a deposit reconnaissance, through operational stage to the reclamation.

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	Students can independently and as part of a team solve the engineering tasks and problems.	RTZ1A_K01, RTZ1A_K02	Involvement in teamwork, Execution of exercises
Skills: he can			
M_U001	Students are able to determine and characterize elementary components of hydrologic cycle.	RTZ1A_U01, RTZ1A_U04	Test, Execution of exercises
M_U002	Students can evaluate water composition and quality.	RTZ1A_U02, RTZ1A_U01	Test, Execution of exercises
M_U003	Students are able to perform basic flow calculations. Students are familiar with the calculations of groundwater flow to basic drainage systems.	RTZ1A_U04, RTZ1A_U03	Test, Execution of exercises
Knowledge: he knows and understands			
M_W001	Students understand the impact of mining activity on water environment. They are aware of problems connected with mine flooding and reclamation.	RTZ1A_W02, RTZ1A_W04	Test, Execution of exercises

M_W002	Students are familiar with hydrogeological properties of rocks.	RTZ1A_W02, RTZ1A_W01	Test
M_W003	Students are provided with fundamental knowledge to understand the hydrologic cycle. They know the essential elements of the water cycle and are able to calculate chosen parameters.	RTZ1A_W02, RTZ1A_W04	Execution of exercises, Participation in a discussion, Test
M_W004	Students understand principles and processes controlling composition of groundwater. They are familiar with chemical evolution of mine waters.	RTZ1A_W02, RTZ1A_W04	Execution of exercises, Test
M_W005	Students are provided with fundamental knowledge of aquifer hydraulics.	RTZ1A_W02, RTZ1A_W01	Test, Execution of exercises
M_W006	Students are familiar with the factors affecting the water inflow to a mine and selected drainage systems.	RTZ1A_W02, RTZ1A_W04	Execution of exercises, Test

Number of hours for each form of classes

	Form of classes										
Suma	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	Students can independently and as part of a team solve the engineering tasks and problems.	-	+	-	-	-	-	-	-	-	-	-
Skills: he can												
M_U001	Students are able to determine and characterize elementary components of hydrologic cycle.	+	+	-	-	-	-	-	-	-	-	-
M_U002	Students can evaluate water composition and quality.	+	+	-	-	-	-	-	-	-	-	-

M_U003	Students are able to perform basic flow calculations. Students are familiar with the calculations of groundwater flow to basic drainage systems.	+	+	-	-	-	-	-	-	-	-	-
Knowledge: he knows and understands												
M_W001	Students understand the impact of mining activity on water environment. They are aware of problems connected with mine flooding and reclamation.	+	-	-	-	-	-	-	-	-	-	-
M_W002	Students are familiar with hydrogeological properties of rocks.	+	-	-	-	-	-	-	-	-	-	-
M_W003	Students are provided with fundamental knowledge to understand the hydrologic cycle. They know the essential elements of the water cycle and are able to calculate chosen parameters.	+	+	-	-	-	-	-	-	-	-	-
M_W004	Students understand principles and processes controlling composition of groundwater. They are familiar with chemical evolution of mine waters.	+	+	-	-	-	-	-	-	-	-	-
M_W005	Students are provided with fundamental knowledge of aquifer hydraulics.	+	+	-	-	-	-	-	-	-	-	-
M_W006	Students are familiar with the factors affecting the water inflow to a mine and selected drainage systems.	+	+	-	-	-	-	-	-	-	-	-

Student workload (ECTS credits balance)

Student activity form	Student workload
Udział w zajęciach dydaktycznych/praktyka	30 h
Preparation for classes	15 h
przygotowanie projektu, prezentacji, pracy pisemnej, sprawozdania	15 h
Realization of independently performed tasks	15 h
Examination or Final test	2 h
Contact hours	1 h
Summary student workload	78 h
Module ECTS credits	3 ECTS

Additional information

Module content

Lectures

Hydrologic cycle, precipitation, evaporation, infiltration, surface runoff, base flow, hydrologic equation. Aquifers and aquitards, unsaturated, saturated zone, groundwater table (2). Hydrogeological properties of rocks: porosity, permeability, water storage capacity, specific yield (1). Groundwater flow. Fundamentals of aquifer hydraulics, flow mapping. Radial flow to wells, interaction of wells. Dewatering systems (2). Processes controlling composition of natural water. Groundwater chemistry (2). Impact of mining activity on water environment. Mine dewatering, dewatering techniques, drawdown, cone of depression. Influence of mine drainage on groundwater flow system (4). Mine water chemistry, acid mine drainage, chemical evolution of mine waters, water treatment (2). Groundwater monitoring (1). Mine flooding and reclamation. (1).

Auditorium classes

Calculations of hydrologic cycle components. Water resources. Aquifer hydraulics. Radial flow to a well, interaction of wells, flow to a drainage trench. Groundwater inflow to a mine. Mine dewatering techniques. Groundwater chemistry. Case studies.

Teaching methods and techniques:

Lectures: Treści prezentowane na wykładzie są przekazywane w formie prezentacji multimedialnej w połączeniu z klasycznym wykładem tablicowym wzbogaconymi o pokazy odnoszące się do prezentowanych zagadnień.
Auditorium classes: Podczas zajęć audytoryjnych studenci na tablicy rozwiązują zadane wcześniej problemy. Prowadzący na bieżąco dokonuje stosowanych wyjaśnień i moderuje dyskusję z grupą nad danym problemem.

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

Attendance at auditorium exercises is mandatory. Students are allowed to approach a final exam of auditorium exercises three times . A positive final grade can be corrected in specified circumstances. Attendance at lectures is recommended.

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

Lectures:
– Attendance is mandatory: No
– Participation rules in classes: Studenci uczestniczą w zajęciach poznając kolejne treści nauczania zgodnie z syllabusem przedmiotu. Studenci winni na bieżąco zadawać pytania i wyjaśniać wątpliwości. Rejestracja audiowizualna wykładu wymaga zgody prowadzącego.
Auditorium classes:
– Attendance is mandatory: Yes
– Participation rules in classes: Studenci przystępując do ćwiczeń są zobowiązani do przygotowania się w zakresie wskazanym każdorazowo przez prowadzącego (np. w formie zestawów zadań). Ocena pracy studenta może bazować na wypowiedziach ustnych lub pisemnych w formie kolokwium, co zgodnie z regulaminem studiów AGH przekłada się na ocenę końcową z tej formy zajęć.

Method of calculating the final grade

The final grade will be calculated as a mean value obtained from lectures and exercises.

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

Attendance at auditorium exercises is mandatory. After the absence student is obliged to attend missed classes with another group or perform additional studies in writing on a topic related to the abandoned classes.

Prerequisites and additional requirements

Prerequisites and additional requirements not specified

Recommended literature and teaching resources

1. Batu V., 1998: Aquifer hydraulics. A Comprehensive Guide to Hydrogeologic Data Analysis. John Wiley & Sons, Inc.
2. Domenico P. A., Schwartz F. W., 1998: Physical and Chemical Hydrogeology. John Wiley & Sons, Inc.
3. Fetter C. W., 1999: Contaminant Hydrogeology. Prentice Hall.
4. Wolkersdorfer C., 2008: Water Management at Abandoned Flooded Underground Mines. Springer.

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

1. Motyka J., Różkowski K., Szuwarzyński M., 1999: Wstępna charakterystyka zmian składu chemicznego wody z kopalni rud cynku i ołowiu „Trzebionka” podczas zatapiania wyrobisk. Współczesne problemy hydrogeologii, t. IX. Infomax s.c., Warszawa – Kielce: 251-257.
2. Motyka J., Różkowski K., 2002: Orgin of nitrates in water inflows in Pb-Zn ore mines. Razowska – Jaworek L., Sadurski A. (red.), Nitrates in groundwater. A. A. Balkema Publishers, London: 27 – 35.
3. Różkowski K., 2004: Regionalna charakterystyka chemizmu wód podziemnych Górnośląskiego Zagłębia Węglowego. Kompleks wodonośny krakowskiej serii piaskowcowej. Różkowski A. (red.) Środowisko hydrogeochemiczne karbonu produktywnego Górnośląskiego Zagłębia Węglowego. Wydawnictwo Uniwersytetu Śląskiego, Katowice.
4. Czop M., Hjelmar O., Motyka J., Różkowski K., Szuwarzyński M., 2005: Zagrożenie środowiska wodnego ekstremalnie zasadowymi odciekami zgromadzonymi w kamieniołomie „Górka” w Trzebini. Hydrogeologia obszarów zurbanizowanych i uprzemysłowionych, t. 2. Wydział Nauk o Ziemi Uniwersytetu Śląskiego, Sosnowiec: 34 – 41.
5. Czop M., Guzik M., Motyka J., Pacholewski A., Różkowski K., 2009: Warunki hydrogeologiczne złoża wapieni i margli Latosówka – Rudniki w Rudnikach koło Częstochowy. Biuletyn Państwowego Instytutu Geologicznego, Hydrogeologia, z. IX/1, nr 436. PIG-PIB, Warszawa: 69 – 76.
6. Różkowski A., Różkowski K., 2010: Geogenic and mining factors controlling the gorundwater conditions of the Cracow Sandstone Series (CSS). W: Zuber A., Kania J., Kmiecik E. (red.): XXXVIII IAH Congress, Groundwater quality sustainability, Krakow 12–17 September 2010 abstract book, Vol. 2.
7. Polak K., Różkowski K., Cała M., 2010: Water reclamation in open-pit by utilization of groundwater and wells. W: 2. Internationaler Bergbau und Umwelt Sanierungs Congress, 1–3 September 2010, Dresden.
8. Różkowski K., Polak K., Cała M., 2010: Wybrane problemy związane z rekultywacja wyrobisk w kierunku wodnym. Górnictwo i Geoinzynieria, R. 34 z. 4, s.: 517 – 525.
9. Różkowski A., Różkowski K., 2011: Wpływ działalności górnictwa węglowego na kształtowanie się środowiska wodnego Górnośląskiego Zagłębia Węglowego w wieloleciu. Biuletyn Państwowego Instytutu Geologicznego nr 445, Hydrogeologia z. XII/2.
10. Galiniak, Różkowski, Bik, 2012: Chemical characteristic of water from spontaneous inundated areas within reclaimed part of “Sieniawa” lignite deposit exploaited on underground and open pit way. W: Grześkowiak A., Nowak B., Grzonka B. (eds), Anthropogenic and natural transformation of lakes, vol. 6. Wyd. IMGW-PIB, Poznań, s.77-85.

Additional information

Attendance at auditorium exercises is mandatory. After the absence student is obliged to attend missed classes with another group or perform additional studies in writing on a topic related to the abandoned classes. Students are allowed to approach a final exam of auditorium exercises three times . A positive final grade can be corrected in specified circumstances. Attendance at lectures is recommended.