AGH UNIVERSITY OF SCIENCE AND TECHNOLOGY

Module name: Hydraulics of Water Wells

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

Faculty of: Mining and Geoengineering

Field of study: Environmental Engineering 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. Polak Krzysztof (kpolak@agh.edu.pl)

Module summary

Student na zajęciach pozyskuje wiedzę techniczna w zakresie poszukiwania i eksploatacji ujęć wód podziemnych, wiertnictwa hydrogeologicznego oraz techniki pompowej, dokształca się w zakresie języka angielskiego technicznego związanego z tematyką obejmującą treści przekazywanych na wykładach.

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	Student is able to cooporate in a group	IKS1A_K01, IKS1A_K02	Activity during classes, Participation in a discussion, Involvement in teamwork
M_K002	Student is able to analyze monitoring data and assess the impact of water intake on environment	IKS1A_K01	Activity during classes, Case study, Participation in a discussion, Involvement in teamwork
Skills: he can			
M_U001	Student is able to monitor condition of water well and select the appropriate renovation method	IKS1A_U02, IKS1A_U01, IKS1A_U05	Activity during classes, Test, Case study, Participation in a discussion, Execution of exercises
M_U002	Student can interpret the results of hydrogeological investigation and use them to water well design	IKS1A_U02, IKS1A_U05, IKS1A_U04	Activity during classes, Test, Case study, Participation in a discussion, Execution of exercises

M_U003	Student is able to plan and carry out pumping tests in order to parametric assessment the hydraulic condition of filter and interpret the results of pumping tests	IKS1A_U03, IKS1A_U02, IKS1A_U01, IKS1A_U05	Activity during classes, Test, Case study, Participation in a discussion
Knowledge: he knows and understands			
M_W001	Student has got knowledge about hydraulics water intake	IKS1A_W05, IKS1A_W04	Activity during classes, Test, Presentation, Participation in a discussion, Execution of exercises
M_W002	Student has knowledge in the design and construction of well underground water intakes	IKS1A_W05, IKS1A_W04, IKS1A_W02	Activity during classes, Test, Case study, Participation in a discussion, Execution of exercises
M_W003	Student has knowledge in monitoring and assessment of wells condition	IKS1A_W05, IKS1A_W04, IKS1A_W02	Activity during classes, Test, Case study, Participation in a discussion
M_W004	Student knows the ways of revitalization, regeneration and reconstruction wells	IKS1A_W03, IKS1A_W05, IKS1A_W04, IKS1A_W02	Activity during classes, Test, Case study, Execution of exercises

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	Student is able to cooporate in a group	+	+	-	-	-	-	-	-	-	-	-
M_K002	Student is able to analyze monitoring data and assess the impact of water intake on environment	+	+	-	-	-	-	-	-	-	-	-
Skills: he can												

M_U001	Student is able to monitor condition of water well and select the appropriate renovation method	+	+	-	-	-	-	-	-	-	-	-
M_U002	Student can interpret the results of hydrogeological investigation and use them to water well design	+	+	-	-	-	-	-	-	-	-	-
M_U003	Student is able to plan and carry out pumping tests in order to parametric assessment the hydraulic condition of filter and interpret the results of pumping tests	+	+	-	-	-	-	-	-	-	-	-
Knowledge: he knows and understands												
M_W001	Student has got knowledge about hydraulics water intake	+	+	-	-	-	-	-	-	-	-	-
M_W002	Student has knowledge in the design and construction of well underground water intakes	+	+	-	-	-	-	-	-	-	-	-
M_W003	Student has knowledge in monitoring and assessment of wells condition	+	+	-	-	-	-	-	-	-	-	-
M_W004	Student knows the ways of revitalization, regeneration and reconstruction wells	+	+	-	-	-	-	-	-	-	-	-

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	6 h
Realization of independently performed tasks	25 h
Examination or Final test	2 h
Contact hours	1 h
Summary student workload	79 h
Module ECTS credits	3 ECTS

Additional information

Module content

Lectures

1.Well Hydraulics (3)
1.1.Concept of head

1.2.Darcy’s low
1.3.Radial – flow equations
1.4.The principles of flow superposition
1.5.Effects of Boundaries and method of images
1.6.Well head losses
2.Groundwater investigations for locating well sites(2)
2.1.Aquafire properties
2.2.Groundwater resources assessment
2.3.Ground water quality
2.4.Pollution risk assessment and prevention
3.Well types (1)
4.Well construction (2)
5.Drilling methods (1)
6.Principles of well design (1)
7.Well testing (2)
7.1.Planning and design pumping test
7.2.Examples of test and production data evaluation
8.Well monitoring and maintenance (2)
8.1.Factor affecting well system performance
8.2.Monitoring well system performance
9.Methods of well revitalization (1)

Auditorium classes

1.Locating well site (2)
2.Ground water resources assessment(2)
3.Well construction(2)
4.Well design(3)
5.Design and planning of pumping tests(2)
6.Well monitoring(2)
7.Practical well rehabilitation(2)

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:

Warunkiem uzyskania zaliczenia z ćwiczeń audytoryjnych jest uzyskanie pozytywnej wygłoszonej prezentacji oraz oceny z pracy pisemnej. Studentowi przysługują 2 terminy poprawkowe. Nie ma możliwości poprawiania oceny pozytywnej,

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 is estimated as a weighted average of lectures (0.4) and auditorium (0.6) marks,
Basic of lecturers mark is the arithmetic mean of marks getting for the activity during the classes and the mark obtained for the final test. Pass of lectures is possible on the basis of presence – the minimum attendance is 60%.
Auditorium mark is the arithmetic mean of partial marks obtained for the tests during the semester or the mark obtained for the final test.

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

Student ma możliwość odrabiania zajęć laboratoryjnych z inną grupą realizującą dany zakres materiału po uprzednim umówieniu terminu z prowadzącym.

Prerequisites and additional requirements

Knowledge of English on the communicative level

Recommended literature and teaching resources

Harlan , R. L., Kolm, K. E. i Gutentag, E. D. (1989). Water-well Design and Construction. Amsterdam: Elsevier Science Publishers.
Houben, G. i Treskatis, C. (2007). Water Well Rehabilitation and Reconstruction. USA: The McGraw-Hill Companies.
Misstear, B., Banks, D. i Clark, L. (2006). Water Wells and Boreholes. Chichester, West Sussex, England: John Wiley & Sons Ltd.
Vuković, M. i Soro, A. (1992). Hydraulics of Water Wells. Theory and Application. (D. Miladinov, Tłum.) Littelton, Colorado, USA: Water Resources Publications.

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

1. Causes of decreased discharge and damage to a dewatering well’s gravel coat / Krzysztof POLAK, Karolina KAZNOWSKA-OPALA, Katarzyna PAWLECKA // Mine Water and the Environment ; ISSN Mine Water and the Environment. — 2016 vol. 35 iss. 2, s. 120–127.
2. Comparison of methods used in Poland for the evaluation of dewatering wells / Krzysztof POLAK, Karolina KAZNOWSKA // W: International Mining Forum 2010 : mine safety and efficient exploitation facing challenges of the 21st century : 19–21 September 2010, Huainan, China / eds. Liu Zegong [et al.]. — London : CRC Press Tylor & Francis Group, cop. 2010. — ISBN: 978-0-415-59896-5. — S. 355–360.
3. Improvement of drainage wells efficiency / K. POLAK // W: 24th World Mining Congress proceedings [Dokument elektroniczny] : mining in a world of innovation : October 18–21, 2016, Rio de Janeiro/RJ, Brazil / Instituto Brasileiro de Mineração. — Wersja do Windows. — Dane tekstowe. — Rio de Janeiro: IBRAM, 2016. — S. 123–132.
4. The assessment of susceptibility on drainage in an aquifer on the basis of pumping tests in a lignite mine — Ocena podatności ośrodka wodonośnego na odwodnienie na podstawie próbnych pompowań w kopalni węgla brunatnego / Krzysztof POLAK, Karolina KAZNOWSKA-OPALA, Katarzyna PAWLECKA, Kazimierz RÓŻKOWSKI, Jerzy KLICH // Archives of Mining Sciences = Archiwum Górnictwa ; ISSN 0860-7001. — 2015 vol. 60 no. 1, s. 107–121.
5. The method of wells’ efficiency estimation / Krzysztof POLAK, Jerzy KLICH, Karolina KAZNOWSKA // W: IMWA Congress 2011 : mine water – managing the challenges : proceedings of the 11th congress of the International Mine Water Association : Aachen, Germany, 4–11 September 2011 / eds. Thomas R. Rüde, Antje Freund, Christian Wolkersdorfer ; IMWA, RWTH Aachen University. — Aachen : RWTH Aachen University. Institute of Hydrogeology, 2011.

Additional information

1. Attendance on the auditorium classes is obligatory
2. In the case of delays resulting from the student’s absence (allowed one absence), the student is obligated to participate in the other group classes.
3. There is no possibility of improving the positive mark on the higher mark.
4. The getting a pass can be gained within primary term or one repeat term.