AGH UNIVERSITY OF SCIENCE AND TECHNOLOGY

Module name: Fluid Flow Machines

Academic year: 2019/2020 Code: GIGR-2-311-PS-s ECTS credits: 3

Faculty of: Mining and Geoengineering

Field of study: Mining Engineering Specialty: Mineral processing

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: —

Responsible teacher: dr inż. Broda Krzysztof (broda@agh.edu.pl)

Module summary

The lecture discusses the basic issues in the field of fluid flow machines, which accompanying examples solved during the auditorium classes.

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 has the ability to solve problems in the field of using flow machines	IGR2A_K01	Activity during classes
M_K002	The student understands the need for continuous updating of knowledge in the field of flow machines	IGR2A_K03	Activity during classes
Skills: he can			
M_U001	The student can use the information contained in the flow characteristics of the selected machine and pipe, tube or duct system.	IGR2A_U02, IGR2A_U06	Test
M_U002	Student is able to calculate the reaction of a free stream on immovable and movable plates.	IGR2A_U05, IGR2A_U06	Test
M_U003	Student is able to choose a flow machine for an existing installation	IGR2A_U03, IGR2A_U04	Test, Activity during classes
Knowledge: he knows and understands			
M_W001	The student has knowledge of the basic laws governing fluid flow machines.	IGR2A_W03, IGR2A_W01	Activity during classes, Test

M_W002	The student knows the structure and operating principle of typical flow machines	IGR2A_W02, IGR2A_W01	Test
M_W003	The student knows the mechanisms governing the cooperation of flow machines.	IGR2A_W03, IGR2A_W01	Test
M_W004	The student understands the influence of the selection of fluid flow machines on the economic efficiency of the designed installation.	IGR2A_W04, IGR2A_W02	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	The student has the ability to solve problems in the field of using flow machines	+	+	-	-	-	-	-	-	-	-	-
M_K002	The student understands the need for continuous updating of knowledge in the field of flow machines	+	+	-	-	-	-	-	-	-	-	-
Skills: he can												
M_U001	The student can use the information contained in the flow characteristics of the selected machine and pipe, tube or duct system.	-	+	-	-	-	-	-	-	-	-	-
M_U002	Student is able to calculate the reaction of a free stream on immovable and movable plates.	+	+	-	-	-	-	-	-	-	-	-
M_U003	Student is able to choose a flow machine for an existing installation	-	+	-	-	-	-	-	-	-	-	-
Knowledge: he knows and understands												

M_W001	The student has knowledge of the basic laws governing fluid flow machines.	+	+	-	-	-	-	-	-	-	-	-
M_W002	The student knows the structure and operating principle of typical flow machines	+	+	-	-	-	-	-	-	-	-	-
M_W003	The student knows the mechanisms governing the cooperation of flow machines.	+	+	-	-	-	-	-	-	-	-	-
M_W004	The student understands the influence of the selection of fluid flow machines on the economic efficiency of the designed installation.	+	+	-	-	-	-	-	-	-	-	-

Student workload (ECTS credits balance)

Student activity form	Student workload
Udział w zajęciach dydaktycznych/praktyka	30 h
Preparation for classes	30 h
Realization of independently performed tasks	15 h
Examination or Final test	2 h
Summary student workload	77 h
Module ECTS credits	3 ECTS

Additional information

Module content

Lectures

Basic principles of fluid mechanics. Short history and classification of fluid machines. Dynamic forces exerted by fluid on fixed and moving plates. Euler’s basic formula of fluid machines. Principal pump variables. Losses and efficiencies – overall pump efficiency. Head rise. Special speed. Pump characteristics – pump performance curve, system curve, operating point. Effect of operating pumps in series and in parallel. Fans – basic information. Impulse and reaction turbines. Jet engines – ramjet, pulse detonation engine, turbojet, turbofan, turboprop, propfan and rocket – principle of action. Brayton-Joule cycle.

Auditorium classes

An introduction to pumps and turbines. Impulsive and reaction forces when the fluid flows over the vane. Pumps operating in a pipe system. Pumps operated in combination. Basic energy considerations. Pump performance characteristics. Dimensionless parameters and similarity laws.

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:

Exercises in the field of covered material will be solved on the exercises lecture. The forms of checking the knowledge can be checked during classes or colloquium at the end of the semester. The lecturer decides about the mode of conducting them activities. The lecturer can ask students to do the independent work
solutions at home, in order to better understand the issue and prepare for classes. Each student receives from the teacher a topic to develop a short presentation in English language, which is presented in class. Completion of classes based on the average grades from activity during classes (answers, tests, colloquium) and presentation.

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

Final mark based on the grade from the exercises (classes).

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

In the absence of a student, it is required to supplement the arrears on their own and pass the exercises.
Auditory exercises:
- Only one unjustified absence from the exercises is permissible.
- One absence justified and unjustified in classes requires the student independently learning the material being processed in this class.
- More than one absence (justified) during classes requires the student to be independent to learn the material processed in this class and to pass it in the form determined by and at the time appointed by him, but not later than in the last week of the duration classes.

Prerequisites and additional requirements

Knowledge of fluid mechanics

Recommended literature and teaching resources

J.A.Roberson, J.J.Cassidy, M.H.Chaudhry ; Hydraulic Engineering; Jon Wiley & Sons, Inc. 1995
Gundlach W.R., Podstawy maszyn przepływowych i ich systemów energetycznych, Wydawnictwo Naukowo-Techniczne 2008.
Dymaczewski Z., Oleszkiewicz J.A., Sozański M.M., Poradnik eksploatatora oczyszczalni ścieków, PZITS 1997.

Walden H., Stasiak J., Mechanika cieczy i gazów w inżynierii sanitarnej, Arkady Warszawa 1971.
Janiak M., Krzyżaniak G., Urządzenia mechaniczne w inżynierii środowiska. Cz.2. Pompy, wentylatory, sprężarki. Politechnika Poznańska 1999.
Świtalski P., ABC techniki pompowej.

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

Propozycja stałociśnieniowej regulacji wydajności pomp wirowych — A proposal of constant-pressure regulation of impeller pumps efficiency / Marian MIKOŚ, Michał KARCH // Mechanizacja i Automatyzacja Górnictwa ; ISSN 0208-7448. — 2011 R. 49 nr 2, s. 28–31.
Komputerowe wspomaganie układu regulacji energooszczędnej pracy pompy wirowej — Computer assistance provided to the regulation system of the impeller pump’s energy-efficient performance / Marian MIKOŚ, Michał KARCH // Aparatura Badawcza i Dydaktyczna ; ISSN 1426-9600. — 2011 t. 16 nr 2, s. 49–54. — Bibliogr. s. 54
Głowica prerotacyjna do kształtowania pola prędkości cieczy w obszarze ssawnym pompy wirowej — Pre-rotation head in shaping liquid velocity field in the vortex pump suction area / Marian MIKOŚ, Michał KARCH // Gospodarka Wodna ; ISSN 0017-2448. — 2011 R. 71 nr 12, s. 508–511. — Bibliogr. s. 511.
Propozycja energooszczędnego sposobu regulacji pomp wirowych — The proposal of the energy-efficient way of the impeller pump regulation / Marian MIKOŚ, Michał KARCH // Górnictwo i Geoinżynieria / Akademia Górniczo-Hutnicza im. Stanisława Staszica, Kraków ; ISSN 1732-6702. — Tytuł poprz.: Górnictwo (Kraków). — 2011 R. 35 z. 4, s. 71–77. — Bibliogr. s. 77
oraz według listy publikacji zamieszczonych na stronie Biblioteki Głównej AGH (baza http://www.bpp.agh.edu.pl/).

Additional information

During the semester, as far as possible, some of the classes may take place on the premises of plants producing or using flow machines.