AGH UNIVERSITY OF SCIENCE AND TECHNOLOGY

Module name: Fluidization and Solid-Gas Systems

Academic year: 2019/2020 Code: STCH-2-203-ET-s ECTS credits: 3

Faculty of: Energy and Fuels

Field of study: Chemical Technology Specialty: Energy Transition-KIC

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

Lecture language: English Profile of education: Academic (A) Semester: 2

Course homepage: —

Responsible teacher: prof. nadzw. dr hab. inż. Ściążko Marek (msc@agh.edu.pl)

Module summary

Following module has a strongly reasearch character. Students are obliged to solve practical problems connected to utilization of fluid beds in energy sector (gasification or combustion process).

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	Will able to cooperate with a team of other students to prepare a solution to the given problem.	TCH2A_K01	Involvement in teamwork
Skills: he can			
M_U001	Will be able to acquire, critically evaluate and creatively process information on gas-solid systems aerodynamics	TCH2A_U01	Execution of a project, Test
M_U002	Will be able to formulate and describe fluidization process arrangement and specific component’s function, particularly in high velocity fluidization. Will be able to calculate main process parameters using numerical techniques and engineering software.	TCH2A_U05	Execution of a project
Knowledge: he knows and understands			
M_W001	Will be able to formulate and describe fluidization process arrangement and specific component’s function, particularly in high velocity fluidization. Will be able to calculate main process parameters.	TCH2A_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
45	30	0	0	15	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	Will able to cooperate with a team of other students to prepare a solution to the given problem.	-	-	-	+	-	-	-	-	-	-	-
Skills: he can												
M_U001	Will be able to acquire, critically evaluate and creatively process information on gas-solid systems aerodynamics	-	-	-	-	-	-	-	-	-	-	-
M_U002	Will be able to formulate and describe fluidization process arrangement and specific component’s function, particularly in high velocity fluidization. Will be able to calculate main process parameters using numerical techniques and engineering software.	-	-	-	+	-	-	-	-	-	-	-
Knowledge: he knows and understands												
M_W001	Will be able to formulate and describe fluidization process arrangement and specific component’s function, particularly in high velocity fluidization. Will be able to calculate main process parameters.	-	-	-	-	-	-	-	-	-	-	-

Student workload (ECTS credits balance)

Student activity form	Student workload
Udział w zajęciach dydaktycznych/praktyka	45 h
Preparation for classes	15 h
przygotowanie projektu, prezentacji, pracy pisemnej, sprawozdania	30 h
Summary student workload	90 h
Module ECTS credits	3 ECTS

Additional information

Module content

Lectures

1. Introduction to the Phenomenon of Fluidization
2. Industrial applications of Fluidized Beds
3. Fluidization and Mapping of Flow Regimes
4. Fluidized Bubbling Bed Modeling
5. Solid Vertical Transport in Gas Phase
6. High Velocity Fluidization
7. Particle–to-Gas Heat and Mass Transfer
8. The RTD and Size Distribution of Solids in Fluidized Beds
9. The Design of Noncatalytic Gas-Solids Reactors

Project classes

Each student will be provided with a set of pdfs containing lectures and technical data concerned with fluidization phenomenon. Students are then required to use the data for the process calculation and specific problems solution. The students will use MathCad engineering code for this practical activity.

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.
Project classes: Studenci wykonują zadany projekt samodzielnie, bez większej ingerencji prowadzącego. Ma to wykształcić poczucie odpowiedzialności za pracę w grupie oraz odpowiedzialności za podejmowane decyzje.

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

Nie określono

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.
Project classes:
– Attendance is mandatory: Yes
– Participation rules in classes: Studenci wykonują prace praktyczne mające na celu uzyskanie kompetencji zakładanych przez syllabus. Ocenie podlega sposób wykonania projektu oraz efekt końcowy.

Method of calculating the final grade

Grading:
Evaluation is a shared responsibility between the teacher and the student. The purpose of the evaluation is to demonstrate how well the student has learned specific course materials, the principles, concepts and terms relevant to the fluidization field, and to determine the students' ability to apply that knowledge to specific engineering problems.
Grading formula: FG=PMWFlectest• w• PMGlectest+ PMWFpwork• w• PMGpwork
Where:
•FG-final grade
•PMWFlectest – Lecture test weighting factor – 0,6
•PMGlectest – Grade of achieved LOs relevant to lecture test
•PMWFpwork – Project delivered work weighting factor – 0,4
•PMGpwork – Grade of achieved LOs relevant to project delivered work
w – student's activity; w=1; attending at least 80% of lectures, w = 0,7 more than 50% and less than 80%, w = 0,3 for more than 50% unjustified absences.
All LO weighting factors associated with part of the module (PM) equal 1.

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

Nie określono

Prerequisites and additional requirements

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Recommended literature and teaching resources

Daizo Kunii, Octave Levenspiel. Fluidization Engineering, Butterworth-Heinemann, 2nd Edition

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

Marek Ściążko, Studium aerodynamiki cyrkulacyjnego reaktora fluidalnego w szczególności do pirolizy węgla, Wydawnictwo P. Śląskiej, Gliwice 2001

Grzegorz Tomaszewicz, Marek Sciążko, Leszek Stępień, Coal gasification – scaling into pressurised CFB system, publikacja konferencyjna CFB 12 (2017)

M. Ściążko, A. Sobolewski, G. Tomaszewicz, A. Czaplicki, K. Słowik, M. Tomaszewicz, CO2-enhanced coal gasification in CFB reactor, publikacja konferencyjna CFB 11 (2015)

Additional information

The overall assessment consist of two steps:
1. Assessment of fulfilling of module learning outcomes and OLOs.
2. Assessment and grading of the quality of students work.
EIT OLOs assessed in the industrial internship:
• Making value judgments and sustainability competencies (EIT OLO 1)
• Entrepreneurship skills and competencies (EIT OLO 2)
• Creativity skills and competencies (EIT OLO 3)

• Research skills and competencies (EIT OLO 5)

- Intellectual transforming skills and competencies (EIT OLO 6)

The Method of assessments indicated in point description of learning outcomes for modulen icludes assessment of learning outcomes and OLOs