

**DOCTORAL SCHOOL OF WROCLAW UNIVERSITY OF SCIENCE AND
TECHNOLOGY**

SUPERVISOR DECLARING/CONDUCTING COURSE: Wojciech Ludwig
DEPARTMENT: of Chemistry
SCIENTIFIC DISCIPLINE: Chemical Engineering

COURSE CARD

Course name in Polish: Fluidyzacja i fontannowanie – nowoczesne metody kontaktu faz
Course name in English: Fluidization and Spouting: Modern Methods of Phase Contact
Course language: Polish/English

The course is intended for all PhD students: YES / NO

1) BASIC COURSE

2) SPECIALIST COURSE (Discipline: Chemical Engineering and Chemical Sciences)

3) SEMINAR

4) HUMANISTIC COURSE

5) LANGUAGE

6) RESEARCH SKILLS

Subject code: CIQ100271W

* delete as applicable

	Lecture	Foreign language course	Seminar	Mixed forms
Number of hours of organized classes in university (ZZU)	30			
Grading	Exam	Exam	Oral presentation	Exam, inspection, evaluation classes

PREREQUISITES RELATING TO KNOWLEDGE, SKILLS, AND OTHER COMPETENCES

1. Basic knowledge of chemical engineering

COURSE OBJECTIVES

C1 Introducing PhD students to the basics of fluidization and spouting processes
 C2 Presentation of the basic parameters describing fluidizing and spouting apparatuses
 C3 Introducing Ph.D. students to the areas of application of fluidized and spouted bed devices

PROGRAM CONTENTS

Form of classes –lecture (Le)		Number of hours
Le1	Introduction to the subject. History of the development of fluidized and spouted bed apparatuses	2
Le2	Characteristics of the fluidization process and various types of fluidization. Fluidization quality criteria.	2

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Le3	Characteristics of fluidized materials. Geldart classification.	2
Le4	Hydrodynamic characteristics of the fluidized bed system: pressure drop, minimum fluidization velocity, and bed expansion.	2
Le5	Hydrodynamic characteristics of the spouted bed system: pressure drop, minimum spouting velocity, bed expansion, fountain height, maximum spoutable bed height, shape of the spout.	2
Le6	Classic modeling methods of the hydrodynamics of fluidized and spouted beds. Gidaspow's model.	2
Le7	Application of computational fluid dynamics (CFD) to modeling of the fluidized and the spouted bed. Euler-Euler and Euler-Lagrange approach.	2
Le8	Heat and mass transfer in fluidized and spouted bed devices.	2
Le9	Basic types of fluidized and spouted bed devices.	2
Le10	Modification of the classic construction of fluidized and spouted bed devices. Spout-fluid apparatuses, devices with draft tubes, multispouts. Pulse and vibrofluidization.	2
Le11	Application of fluidized and spouted bed devices to drying	2
Le12	Application of fluidized and spouted bed devices to coating and granulation	2
Le13	Application of fluidized and spouted bed devices in the power engineering	2
Le14	Application of fluidized and spouted bed devices as chemical reactors	2
Le15	Presentation of work of a batch conical spouted bed apparatus for drying and coating	2
	Total hours	30

TEACHING TOOLS USED

N1. Lecture with multimedia presentation
N2. Demonstration in the laboratory

ACHIEVED SUBJECT LEARNING OUTCOMES

Type of learning outcome	Code of learning outcome	Assessment of learning outcome
Knowledge	P8U_W	Evaluation of learning outcomes is about verifying that the doctoral student knows and understands the world's scientific and creative heritage and its implications for practice.
Knowledge	P8S_WG	Assessment of learning outcomes is about verifying whether the doctoral student knows and understands the main trends in the development of the scientific or artistic disciplines covered in the curricula.

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PRIMARY AND SECONDARY LITERATURE

PRIMARY LITERATURE:

- [1] W. Ludwig, Model matematyczny przepływu dwufazowego gaz - ciało stałe w aparacie fluidyzującym z centralną rurą wznoszącą, Praca doktorska, Politechnika Wrocławska, Instytut Inżynierii Chemicznej i Urządzeń Ciepłych, Wrocław 1997.
- [2] A. Kmieć, Zastosowanie i modelowanie procesów i aparatów ze złożem fluidalnym, Oficyna Wydawnicza Politechniki Wrocławskiej, Wrocław, 2012.

SECONDARY LITERATURE:

- [1] N. Epstein, J. R. Grace, Spouted and Spout-fluid Bed, Fundamentals and Application, Cambridge University Press, 2010.
- [2] C. Strumiłło, „Podstawy teorii i techniki suszenia” Wydawnictwo Naukowo – Techniczne, Warszawa, 1983

SUBJECT SUPERVISOR (NAME AND SURNAME, E-MAIL ADDRESS)

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