DOCTORAL SCHOOL OF WROCŁAW UNIVERSITY OF SCIENCE AND TECHNOLOGY

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

COURSE CARD

Course name in Polish: Numeryczna mechanika płynów - nowoczesne narzędzie projektowania
Course name in English: Computational fluid dynamics – a modern design tool
Course language Polish / ~~English*~~
University-wide general course type*: Yes/ No
1) basic course
~~2) specialist course~~
~~3) seminar~~
~~4) humanistic course~~
~~5) language~~

Subject code: CIQ100096W

* 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
Number of ECTS points	**0**			

PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES

1. Knowledge of mathematics at the level, that allows the understanding of the equations of momentum, heat and mass transfer for one and multiphase systems during laminar and turbulent flow
2. Knowledge of basics of the momentum, heat and mass transfer

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COURSE OBJECTIVES

C1. Introducing PhD students to the basics of CFD methods and their application areas
C2. Gain basic knowledge about the equations describing momentum, heat and mass transfer during the laminar flow
C3. Introducing PhD students to the basic models of the turbulent flow
C4. Introducing PhD students to the basic models of the multiphase flow
C5. Introducing PhD students to the basic numerical methods used to solve transport equations for different flows
C6. Presentation of CFD modelling software and computer hardware selection criteria

PROGRAM CONTENTS

Form of classes – lecture (Lec)		Number of hours
Lec1	Introducing to CFD methods, areas of their application, their advantages and disadvantages	2
Lec2	Derivation of the equation of the momentum transport during laminar, one phase flow of Newtonian liquid	2
Lec3	Turbulence definition, different ways of turbulent flow describing	2
Lec4	Turbulence models, description of the near wall zone	2
Lec5	Basics of numerical methods used for solving of the momentum, heat and mass transfer equations The near-wall modelling	2
Lec6	Spatial discretization schemes and pressure calculation, Boundary condition description	2
Lec7	Numerical mesh	2
Lec8	Methods for evaluation and improving the quality of numerical mesh	2
Lec9	Introduction to multiphase models	2
Lec10	VOF and Level Set models	2
Lec11	Euler-Euler models	2
Lec12	Euler-Lagrange models	2
Lec13	Selection of the multiphase model	2
Lec14	Review of CFD modelling software	2
Lec15	Selection of computer hardware for CFD calculations	2
	Total hours:	**30**

TEACHING TOOLS USED

N1. Lecture with multimedia presentation
N2. Computer simulation

ACHIEVED SUBJECT LEARNING OUTCOMES

Type of learning outcome	Code of learning outcome	Assessment of learning outcome
Knowledge	**P8S_WG**	PhD student has well-established knowledge of basic subjects: mathematics, physics, chemistry or other. The PhD student has knowledge at an advanced level for a field related to the area of scientific research, including the latest research methods and verification of achieved results.

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PRIMARY AND SECONDARY LITERATURE

PRIMARY LITERATURE:

[1] Z. Jaworski, Numeryczna mechanika płynów w inżynierii chemicznej i procesowej, Wydawnictwo EXIT, Warszawa 2005.

SECONDARY LITERATURE:

[1] J. D. Anderson, Computational Fluid Dynamics: The Basics with Application, McGraw-Hill, New York 1995
[2] http://www.bakker.org/dartmouth06/engs150/
[3] Ansys Fluent Help
[4] Comsol Multiphysics Help

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

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