DOCTORAL SCHOOL OF WROCŁAW UNIVERSITY OF SCIENCE AND TECHNOLOGY

SUPERVISOR/TEAM/ DECLARING/CONDUCTING COURSE: Sławomir Pietrowicz
DEPARTMENT: Faculty of Mechanical and Power Engineering W9
SCIENTIFIC DISCIPLINE: Environmental Engineering, Mining and Energy

COURSE CARD

Course name in Polish: Modelowanie procesów cieplno-przepływowych przy wykorzystaniu oprogramowania Ansys
Course name in English: Modelling of thermal- flow processes using Ansys software
Course language Polish / ~~English~~*
University-wide general course type*:
The course is intended for all PhD students: YES / NO
~~1) BASIC COURSE~~
2) SPECIALIST COURSE
3~~) SEMINAR~~
~~4) HUMANISTIC COURSE~~
~~5) LANGUAGE~~

Subject code: IGQ000006W

* 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. Ability to create 3-D geometry in engineering programs.
2. Basic knowledge of partial differential equations.
3. Knowledge in the field of heat exchange and fluid mechanics.

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COURSE OBJECTIVES

C1 - transfer of knowledge about methods of simulation of thermal and flow phenomena
C2 - transfer of knowledge about solutions of partial differential equations using the finite volume method
C3 - education of skills in choosing a numerical mesh to a specific geometry
C4 - education of numerical calculations skills for simple and complex thermal-flow phenomena

PROGRAM CONTENTS

Form of classes – lecture (Lec)		Number of hours
Lec1	Organizational matters. Introduction to Numerical Fluid Dynamics (CFD).	2
Lec2	Description of equations concerning heat transfer and flow phenomena.	2
Lec3	Finite volume method for a steady state thermal conductivity	2
Lec4	Algorithms for calculating pressure and velocity fields in fluid flows.	2
Lec5	Conducting - a simple simulation of steady and transient heat transfer. Generating geometry and mesh and performing preliminary calculations	2
Lec6	Steady and transient flow around the cylinder.	2
Lec7	Influence of mesh density and initial conditions on numerical calculations - Cavity Case.	2
Lec8	One-dimensional diffusion-convective problem - the effect of differential diagrams on a numerical solution.	2
Lec9	Introduction to the modeling of turbulent flows on the example of a channel with a sudden extension - the influence of the turbulence model on the numerical solution	2
Lec10	Modeling of compressible flows.	2
Lec11	Heat transfer in a shell-and-tube heat exchanger. Advanced methods for generating numeric grids in the Ansys Meshing program.	2
Lec12	Multiphase flow - basic concepts and mathematical description	2
Lec13	Multiphase flow - part one	2
Lec14	Multiphase flow - part two	2
Lec15	Multiphase flow - part three	2
	Total hours:	**30**

TEACHING TOOLS USED
N1. Multimedia presentation. N2. Program for generating geometry and numerical mesh, including ANSYS ICEM. N3. Software to carry out simulations, including CFD ANSYS CFX. N4. Consultations

ACHIEVED SUBJECT LEARNING OUTCOMES		
Type of learning outcome	Code of learning outcome	Assessment of learning outcome
Knowledge	P8S_WG	- student has a sound knowledge of basic subjects such as mathematics, physics, chemistry or others - has an advanced knowledge fundamental to a field relevant to his/her research, including the most advanced methods of research and verification of results achieved - has advanced knowledge of directional subjects in a given discipline or in interdisciplinary subjects - has knowledge at an advanced level of discipline and subject matter relevant to the field of research carried out, including the most recent research findings and

		scientific achievements
Skills	P8S_UW	- student has scientific and technological skills relevant to methods and methodology of conducting scientific research and critical evaluation of the results obtained - is able to create and conduct independent research, including outside the educational institution - is able to creatively interpret the results obtained and to search for their application - is prepared to intensify research with commercial potential

PRIMARY AND SECONDARY LITERATURE

PRIMARY LITERATURE:

[1] Patankar S., Numerical Heat Transfer And Fluid Flow, McGraw-Hill, Book Company, 1980.
[2] Versteeg H. K., Malalasekera W., An Introduction to Computational Fluid Dynamics. The Finite Volume Method, 2nd ed., Pearson Education Limited, 2007.
[3] Anderson J. D., Computational Fluid Dynamics. The Basics with Applications., McGraw-Hill Book Company, 1995.
[4] Jaworski Z., Numeryczna mechanika płynów w inżynierii chemicznej i procesowej.

SECONDARY LITERATURE:

[1] Tannehill J. C., Anderson D. A., Pletcher R. H., Computational Fluid Mechanics And Heat Transfer, Taylor & Francis, 1997.
[2] Ferziger J. H., Peric M., Computational Methods For Fluid Dynamics, 3rd ed., Springer, 2007.
[3] Hoffmann K. A., Chiang S. T., Computational Fluid Dynamics, 4th edition, vol. I,II,III, Engineering Education System, 2000

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

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