Selected problems of thermal-flow processes

Faculty of	**Mechanical and Power Engineering**
Name in English	**Selected problems of thermal-flow processes**
Name in Polish	**Wybrane zagadnienia procesów cieplno-przepływowych**
Main field of study	**Power Engineering**
Specialization	**-**
Level of studies	**II level**
Form of studies	**full-time**
Kind of subject	**obligatory**
Subject code	**W09ENG-SM2334**
Group of courses	**NO**

	Wykład	Ćwiczenia	Laboratorium	Projekt	Seminarium
Number of hours of organized classes in University (ZZU)	15		15		
Number of hours of total student workload (CNPS)	25		25		
Form of crediting	Grade		Grade		
For group of courses mark final course with (X)					
Number of ECTS points	1		1		
including number of ECTS points for practical (P) classes			1		
including number of ECTS points for direct teacher-student contact (BU) classes	0,68		0,76		

PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES

1.	Ability to create 3D geometry in engineering programs.
2.	Knowledge of heat transfer and fluid mechanics

SUBJECT OBJECTIVES

C1	transfer of knowledge about methods of simulation of thermal-flow phenomena
C2	transfer of knowledge on performing and interpreting results of simulations of selected thermal and flow processes
C3	developing skills in selecting appropriate models of multiphase flows
C4	developing skills in performing numerical calculations for models with the implemented radiation model and FSI

SUBJECT LEARNING OUTCOMES

relating to knowledge:	
PEU_W01	has knowledge of equations describing heat transfer and fluid movement
PEU_W02	has a view on the phenomenon of turbulence and its models
PEU_W03	has knowledge of methods of numerical solving of heat exchange issues
PEU_W04	be familiar with the methods of numerical solution of inverse problems
PEU_W05	has knowledge of multiphase processes such as condensation and evaporation
PEU_W06	can model radiation-related processes
PEU_W07	has a basic knowledge of the FSI method
relating to skills:	
PEU_U01	can generate geometries and numerical grids

PEU_U02	has the ability to choose the appropriate flow model in multiphase flows
PEU_U03	can perform numerical calculations of steady and transient heat conduction
PEU_U04	can perform numerical calculations of mixing substances in mixers
PEU_U05	can model processes with speeds for which the Mach number is greater than 1

PROGRAMME CONTENT

Form of classes - lecture		Number of hours
Lec1	Organizational issues. Introduction to a heat transfer.	1
Lec2	Solving heat transfer problems	2
Lec3	Mass transfer, turbulence and conjugate heat and mass transfer	2
Lec4	Multiphase flows and discrete phase flows	2
Lec5	Condensation and boiling	2
Lec6	Radiation heat transfer	2
Lec7	Fluid structure interaction FSI	2
Lec8	Final test	2
Total hours		15

laboratory		Number of hours
La1	Organizational issues	1
La2	Transient heat transfer.	2
La3	Modeling of heat transfer by radiation.	2
La4	Modeling of multiphase flows.	2
La5	Modeling of condensation / boiling processes.	2
La6	Modeling of flow containing solid particles.	2
La7	Modeling of the mixing process in a mixer.	2
La8	Modeling of turbine blade flow.	2
Total hours		15

TEACHING TOOLS USED	
N1	Multimedia presentation.
N2	A program for generating geometry and numerical grids, among others ANSYS ICEM or SpaceClaim Geometry.
N3	The program for conducting simulations, among others CFD ANSYS CFX.
N4	Office hours

EVALUATION OF SUBJECT EDUCATIONAL EFFECTS ACHIEVEMENT

Evaluation (F– forming (during semester), C– concluding (at semester end)	Educational effect number	Way of evaluating educational effect achievement
F1	PEU_U01- PEU_U03	Report from Lab 2
F2	PEU_U01- PEU_U03	Report from Lab 3
F3	PEU_U01- PEU_U04	Report from Lab 4
F4	PEU_U01- PEU_U04	Report from Lab 5
F5	PEU_U01- PEU_U04	Report from Lab 6
F6	PEU_U01- PEU_U04	Report from Lab 7
F7	PEU_U01- PEU_U04	Report from Lab 8
P1	PEU_W01- PEU_W07	Final test

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.
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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