POZNAN UNIVERSITY OF TECHNOLOGY

EUROPEAN CREDIT TRANSFER AND ACCUMULATION SYSTEM (ECTS)

COURSE DESCRIPTION CARD - SYLLABUS

Course name
Numerical thermomechanics [S2ZE1E>NT]

Course

Field of study
Green Energy

Year/Semester
1/2

Area of study (specialization)
–

Profile of study
general academic

Level of study
second-cycle

Course offered in
English

Form of study
full-time

Requirements
compulsory

Number of hours

Lecture
15

Laboratory classes
30

Other
0

Tutorials
0

Projects/seminars
0

Number of credit points

3,00

Coordinators

dr inż. Wojciech Judt

Lecturers

Prerequisites

The student has a basic knowledge of thermodynamics, fluid mechanics, programming and numerical methods. The student is able to use scientific methods to solve problems, to carry out experiments and to draw conclusions. The student is able to solve specific problems arising when using specialized software. The student is able to solve problems, acquire and improve knowledge and skills individually.

Course objective

The objective of the course is to introduce software tools for numerical solving of problems related to thermodynamics and fluid mechanics. Students acquire the knowledge and skills to model energy conversion processes and determine the differences between simplified analytical calculation results and the numerical solution in the areas of heat, momentum and mass transfer, including combustion processes.

Course-related learning outcomes

Knowledge:
The student has an extended knowledge of methods of computational fluid mechanics and combustion processes.
The student is familiar with the most recent methods of the design and optimization of power machinery and equipment.

The student has knowledge about negative impact of air pollution on natural environment.

Skills:
The student is able to solve research and engineering tasks that require the use of engineering standards and norms and the application of methods specific to the numerical gas dynamics.
The student is able to acquire data from the literature, the Internet, databases and other sources. The student can integrate obtained data, evaluate its usefulness and draw conclusions, form and justify opinions.
The student is able to assess the applicability and use of tools integrated with spatial modelling packages and interpret their results correctly.

Social competences:
The student is ready to critically evaluate his knowledge and perceived content.
The student is prepared to acknowledge the significance of knowledge in solving cognitive and practical problems, and to seek expert opinions when solving problems on his own.
The student understands the need of lifelong learning; he is able to inspire and organize the process of learning of others.

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

1. Lecture - written assessment (test). Pass mark: at least 51% of all possible points. There is a possibility of oral questions in order to increase the obtained grade.
2. Laboratory classes - evaluation of current progress in the form of a report on completed classes and the answer to the questions in the oral form.

Programme content

1. Background: numerical methods for fluid mechanics and gas dynamics
2. Methods of preparing geometries and meshes for the CFD calculations
3. Turbulence modeling for engineering practice
4. Heat transfer modelling with CFD (conduction, convection, radiation)
5. Combustion modeling
6. Methods of results postprocessing, methods of communication of calculation and analysis results

Course topics

none

Teaching methods

1. Lecture - a presentation and a demonstration using a case study as an example.
2. Laboratory classes - demonstation of case study with extended explanation and tutorial, followed by student work on solving of the given task

Bibliography

Basic:
COMPUTATIONAL FLUID DYNAMICS. The Basics with Applications. J.D Anderson

Additional:
Fundamentals of Heat and Mass Transfer. Frank P. Incropera, David P. DeWitt, Theodore L. Bergman, Adrienne S. Lavine
Thermodynamics. RAO, Y. V. C. Rao

Breakdown of average student's workload

	Hours	ECTS
Total workload	75	3,00
Classes requiring direct contact with the teacher	45	2,00
Student's own work (literature studies, preparation for laboratory classes/ tutorials, preparation for tests/exam, project preparation)	30	1,00