COURSE DESCRIPTION CARD - SYLLABUS

Course name

Flow-thermal numerical calculations

Course

Field of study
Aerospace Engineering

Year/Semester
3/6

Area of study (specialization)
Onboard systems and aircraft propulsion

Profile of study
general academic

Level of study
First-cycle studies

Course offered in
polish

Form of study
full-time

Requirements

Number of hours

Lecture	Laboratory classes	Other (e.g. online)
	30	
Tutorials	Projects/seminars	

Number of credit points

3

Lecturers

Responsible for the course/lecturer:

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Piotrowo 3 60-965 Poznań

Responsible for the course/lecturer:

Prerequisites

KNOWLEDGE: Has ordered, theoretically founded general knowledge covering key issues in the field of technical thermodynamics, i.e. the theory of thermodynamic transformations, heat flow, heat and cooling machines

SKILLS: Can obtain information from literature, the Internet, databases and other sources. Is able to integrate obtained information, interpret and draw conclusions from them

SOCIAL COMPETENCES: Can inspire and organize the learning process of others

Course objective

The main aim of the course is to extend the knowledge on thermal processes modeling. Students improve their abilities to conduct numerical analysis of flow and heat transfer processes. They are able to identify the main reasons of discrepancy between analytical calculations, experimental results and numerical solution.

Course-related learning outcomes

Knowledge

Has structured, theoretically founded knowledge of data processing for CFD, optimization of numerical simulations, quantitative and qualitative data analysis, data visualization

Has ordered, theoretically founded general knowledge covering key issues in the field of fluid mechanics, in particular aerodynamics, i.e. ideal liquids and gases, viscous Newtonian and non-Newtonian liquids, theory of heat-flow machines

Has structured, theoretically founded knowledge of mathematics used to analyze results, create mathematical models and their adaptation to a numerical code

Skills

Can prepare and present a short verbal and multimedia presentation devoted to the results of an engineering task

Can carry out elementary technical calculations in the field of fluid mechanics and thermodynamics, such as heat and mass balances, pressure losses in flows around technical flying objects and their modules, select parameters of fans, compressors and turbines for flow systems, as well as calculate thermodynamic waveforms heat machines

Is able to conduct a research experiment using measuring equipment, computer simulations, is able to perform measurements, such as measurements of temperature, velocity and flow rate, pressure and forces, as well as interpret results and draw conclusions

Social competences

Can properly prioritize the implementation of tasks specified by him or others based on available knowledge

Understands the need for critical assessment of knowledge and continuous learning

Is aware of the importance and understands the non-technical aspects and effects of engineering activities, including its impact on the environment, and the associated responsibility for the decisions taken

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

Laboratory classes – evaluation of reports prepared on each exercises, presentation of solved technical problem, result discussion with group

Programme content

Theoretical and practical introduction to numerical methods and calculations. Modeling of the heat and mass transfer processes with a use of knowledge from thermodynamics and fluid mechanics. Data analysis. Calculation validation with experimental data. Results discussion.

Teaching methods

Laboratory classes - demonstation of case study with extended explanation and tutorial, followed by student work on solving of the given task

Bibliography

Basic

1. Ansys Fluent User/Theory Guide,

2. Maciej Kryś, Mateusz Pawłucki, CFD dla inżynierów. Praktyczne ćwiczenia na przykładzie systemu ANSYS Fluent, 2020.

Additional

1. Ferziger, Joel H., Peric, Milovan, Street, Robert L., Computational Methods for Fluid Dynamics.

Breakdown of average student's workload

	Hours	ECTS
Total workload	65	3,0
Classes requiring direct contact with the teacher	32	1,5
Student's own work (literature studies, preparation for laboratory classes, preparation for test, making reports, solving technical problems, consultations) [1]	32	1,5

[1] delete or add other activities as appropriate