COURSE DESCRIPTION CARD - SYLLABUS

Course name
Numerical methods in fluid mechanics

Course

Field of study
Aerospace Engineering

Year/Semester
1/1

Area of study (specialization)
Aeronautical Engineering

Profile of study
general academic

Level of study
Second-cycle studies

Course offered in
Polish

Form of study
full-time

Requirements
compulsory

Number of hours

Lecture
15

Laboratory classes

Other (e.g. online)

Tutorials
15

Projects/seminars

Number of credit points

2

Lecturers

Responsible for the course/lecturer:
dr inż. Bartosz Ziegler

email : bartosz.ziegler@put.poznan.pl

Responsible for the course/lecturer:

Prerequisites

Basic knowledge in the field of fluid mechanics, thermodynamics and gas dynamics

Basic knowledge of the differential calculus of several variables

Preferred skills for creating meshes and using the Ansys Fluent program (effects of the subject Integrated Systems of Aerospace Design, LiK I, SLP specialization)

Determination to expand knowledge and skills from the first degree of study

Course objective

Teach theoretical foundations of computational fluid mechanics to the extent that allows further student self-education, and enabling him to use open numerical analysis software

Course-related learning outcomes

Knowledge

Extended knowledge in the use of finite volume computational methods of computational fluid dynamics based on the method.

Understands the role of individual physical models (turbulence models, fluid models, phase change models, chemical reactions etc.) available in systems for numerical fluid mechanics.

Has knowledge about the analyzed physical phenomena allowing to estimate the physicality of the results obtained numerically.

Skills

Communicating the results of own analyzes to the environment as well as doubts / problems related to their obtaining. Formulating queries of search engines in English in search of solutions to problems encountered.

Is able to perform numerical analysis, to the extent not presented by the lecturer using only widely available sources, in particular, materials posted on the Internet.

Can understand the scope of didactic material without the help of the subject lecturer, based on information available in the network and literature.

Performing a simple (0 - 1 dimensional) calculation model in order to estimate the analysis result and confront it with the results of the numerical analysis carried out in the specialist program.

Determining analytically the search quantities, e.g. to determine the correct boundary conditions for numerical analysis.

Social competences

Student is aware of the limited scope of information presented during the course and understands the need to significantly deepen the subject in order to make the acquired skills useful.

He can see the deficiencies in his own cognitive abilities and strive for their development.

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

- Written exam

Solving CFD analysis tasks during the class

Programme content

- A reminder of the partial basis of differential equations governing heat and mass flows

- Physical models used for numerical analyzes (fluid models, turbulence, etc.)

- Fundamentals of discretization, linearization and iterative algorithms used in CFD

- Open CFD analysis software

- Defining your own physical models and boundary conditions

Teaching methods

Auditorial lecture, Individual task solving with lecturers help

Bibliography

Basic

J.D. Anderson - COMPUTATIONAL FLUID DYNAMICS. The Basics with Applications

S. C. Chapra, R. P. Canale - Numerical Methods for Engineers

Additional

Breakdown of average student's workload

	Hours	ECTS
Total workload	51	2,0
Classes requiring direct contact with the teacher	36	1,4
Student's own work (literature studies, preparation for tutorials, homework tasks) [1]	15	0,6

[1] delete or add other activities as appropriate