

## Course syllabus

binding for the doctoral students of the CUT Doctoral School commencing their studies  
in the academic year 2022/2023

### Information on the course

Name of the course in Polish	Modelowanie komputerowe w inżynierii środowiska i energetyce
Name of the course in English	Computer modeling in environmental and energy engineering
Number of the ECTS points	2
Language of instruction	Polish
Category of the course	Mandatory
Field of education	Engineering and Technology
Discipline of education	Environmental engineering, ,mining and power engineering
Person responsible for the course Contact	Marcin Trojan, <i>doctor hab.</i> , MSc in Eng. , professor of CUT marcin.trojan@pk.edu.pl

### Type of course, number of hours in the study programme curriculum

Semester	Credit type (G / NG)*	Lecture	Practical class	Laboratory	Computer Laboratory	Project class	Seminar
4	G	15	0	0	15	0	0

\*G – graded credit, NG – non-graded credit

### Course objectives

Code	Objective description
Objective 1	Introduction to the finite difference method, finite volume method and the finite element method
Objective 2	Gaining knowledge necessary to independently choose the appropriate method of CFD analysis of the studied problem.

### Learning Outcomes

Code	Description of the learning outcome adjusted to the specific characteristics of the discipline	Learning outcome symbol in the CUT SD	Methods of verification
OUTCOMES RELATED TO KNOWLEDGE			
EUW1	The doctoral student has knowledge of the principle of the finite difference method, finite volume and finite elements.	E_W01 E_W02	Involvement in class activities, presentation
EUW2	The doctoral student has knowledge of the application of the finite difference method, finite volume and finite elements in heat transfer problems.	E_W01 E_W02	Involvement in class activities, presentation

EUW3	The doctoral student has knowledge of computational fluid mechanics, turbulent flow modeling, heat transfer modeling		Involvement in class activities, Presentation, written test
<b>OUTCOMES RELATED TO SKILLS</b>			
EUU1	The doctoral student is able to solve engineering problems using the finite volume method and the finite element method	E_U01	Presentation, discussion
EUU1	The doctoral student is able to solve the problems of three-dimensional steady flow.	E_U01	Presentation, discussion
<b>OUTCOMES RELATED TO SOCIAL COMPETENCES</b>			
EUK1	The doctoral student is able refer to the methods of numerical analysis known in the literature that can be used in the implementation of the doctoral dissertation and is able to justify the models they use.	E_K01 E_K03	Discussion

### Course outline

No.	Contents	Learning outcomes for the course	No. of hours
<b>LECTURE</b>			
W1	Introduction to the finite element method, finite differences, finite volumes	EUW1, EUW2	6
W2	Introduction to computational fluid mechanics	EUW3	6
W3	Discussion of inaccuracies in the obtained solutions	EUW1, EUW2, EUW3	3
<b>COMPUTER LABORATORY</b>			
K1	Established analysis of the temperature field under the boundary conditions of the 1st and 3rd kind. Comparison of the results obtained with FEM with the strict analytical solution.	EUU1	3
K2	Performing calculations of the flow through the 3D area using one of the commercial CFD calculation programs	EUU2	12

### The ECTS points statement

WORKING HOURS SETTLEMENT	
Type of activity	Average number of hours (45 min.) dedicated to the completion of an activity type
<b>SCHEDULED CONTACT HOURS WITH THE ACADEMIC TEACHER</b>	
Hours allotted in the syllabus	30
Consultations	2
Examination / course credit assignment	2
<b>HOURS WITHOUT THE PARTICIPATION OF THE ACADEMIC TEACHER</b>	
Independent study of the course contents	8
Preparation of a paper, report, project, presentation, discussion	8
<b>ECTS POINTS STATEMENT</b>	

Total number of hours	50
The ECTS points number	2

### Preliminary requirements

No.	Requirements
1	Knowledge of differential and integral calculus
2	Knowledge of the English language

### Course credit assignment conditions / method of the final grade calculation

No.	Description
COURSE CREDIT ASSIGNMENT CONDITIONS	
1	75% attendance in class.
2	Presentation of a report of the task assigned
METHOD OF THE FINAL GRADE CALCULATION	
	Credit assigned on the grounds of weighted average of the result of the written test and the report presentation.

### Additional information

The scope of the lecture, including the level of advancement in presentation and modeling, takes into account the initial preparation and knowledge of the subject by doctoral students.
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### The course reading list

1	Taler J., Duda P. - Solving simple and inverse problems of heat conduction, Warsaw, 2003, WNT
2	Chapra Steven C. — Numerical Methods for Engineers, Nowy Jork, 2015, Mc-Graw Hill