Cracow University of Technology

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	Wybrane zagadnienia z metod numerycznych
Name of the course in English	Numerical methods – selected topics
Number of the ECTS points	1
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	Paweł S. Hachaj, *doctor hab.*, MSc in Eng. pawel.hachaj@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
5	G	15	0	0	0	0	0

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

Course objectives

Code	Objective description
Objective 1	Introduction to the selected topics in the field of numerical methods, in particular regarding the solution of differential equations and optimization.
Objective 2	Introduction to the concepts useful when applying numerical methods such as: computational complexity, stability, robustness.

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 understands the typical numerical methods applied for the approximate solution of ordinary and partial differential equations	E_W01	Involvement in class activities, written test
EUW2	The doctoral student knows the basics of selected numerical methods used in optimization	E_W01	Involvement in class activities, written test
EUW3	The doctoral student understands the following terms: computational complexity, solution stability, solution robustness.	E_W01 E_W02	Involvement in class activities, written test
OUTCOMES RELATED TO SKILLS			

EUU1	The doctoral student is able to apply their knowledge of computational methods to real engineering problems, in particular regarding the subject of their doctoral dissertation	E_U01	Involvement in class activities, discussion
OUTCOMES RELATED TO SOCIAL COMPETENCES			
EUK1	The doctoral student is able to refer to numerical methods known in the literature, useful for problems related to the implementation of a doctoral dissertation and to justify the methods they use or the lack of the need to use them.	E_K03	Discussion

Course outline

No.	Contents	Learning outcomes for the course	No. of hours
LECTURE/ PRACTICAL CLASS			
W1	Introduction to numerical methods	EUU1, EUK1	5
W2	Numerical solution of differential equations; finite elements, finite differences	EUW1, EUU1, EUK1	5
W3	Numerical optimization	EUW2, EUU1, EUK1	3
W4	Methodological issues: computational complexity, solution stability and sensitivity analysis, solution robustness	EUW3, EUK1	2

The ECTS points statement

WORKING HOURS SETTLEMENT	
Type of activity	Average number of hours (45 min.) dedicated to the completion of an activity type
SCHEDULED CONTACT HOURS WITH THE ACADEMIC TEACHER	
Hours allotted in the syllabus	15
Consultations	1
Examination / course credit assignment	1
HOURS WITHOUT THE PARTICIPATION OF THE ACADEMIC TEACHER	
Independent study of the course contents	3
Preparation of a paper, report, project, presentation, discussion	9
ECTS POINTS STATEMENT	
Total number of hours	29
The ECTS points number	1

Preliminary requirements

No.	Requirements
1	Completion of the module "Mathematics with elements of statistics".

Course credit assignment conditions / method of the final grade calculation

No.	Description
COURSE CREDIT ASSIGNMENT CONDITIONS	
1	Minimum 75% attendance in class.
2	Involvement in class activities

2	Written test
	METHOD OF THE FINAL GRADE CALCULATION
	Credit assigned on the grounds of the result from the written test modified with the points obtained for the involvement in class activities

Additional information

None

The course reading list

1	Bjorck, G., Dahlquist: “Numerical Methods”
2	Ralston: "Introduction to Numerical Analysis"
3	J. Stoer: "Introduction to numerical methods”