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	Optymalizacja konstrukcji
Name of the course in English	Optimization of structures
Number of the ECTS points	1
Language of instruction	Polish
Category of the course	Choosable
Field of education	Engineering and technology
Discipline of education	Mechanical engineering
Person responsible for the course Contact	Prof. Bogdan Bochenek, *doctor habilitatus* bogdan.bochenek@pk.edu.pl

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

Semester	Credit type (G / NG)*	Lecture	Practical classes	Laboratory	Computer Lab	Project Class	Seminar
2, 3, 4, 5	G	15	0	0	0	0	0

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

Course objectives

Code	Objective description
Objective 1	Introducing the doctoral students to the basic concepts and methods in the field of engineering optimization

Learning outcomes

Code	Description of the learning outcome adjusted to the specific characteristics of the discipline	Learning outcome symbol in the CUD DS	Methods of verification
OUTCOMES RELATED TO KNOWLEDGE			
EUW1	The doctoral student knows the basic formulations of the problem of optimal design of engineering structures.	E_W01, E_W02	Involvement in class activities.
EUW2	The doctoral student knows the basic methods of solving the problems of optimal design of engineering structures.	E_W01, E_W02	Involvement in class activities.

	OUTCOMES RELATED TO SKILLS		
EUU1	The doctoral student can formulate the problem of optimal design of engineering structures.	E_U01	A presentation, discussion.
EUU2	The doctoral student knows how to choose the appropriate method to solve the problem of optimal design of engineering structures.	E_U01	A presentation, discussion.
	OUTCOMES RELATED TO SOCIAL COMPETENCES		
EUK1	The doctoral student is ready to use the acquired knowledge and its critical assessment in the field of formulating and solving optimal design problems.	E_K01, E_K03	Discussion.

Course outline

No.	Contents	Learning outcomes for the course	No. of hours
	LECTURE		
W1	Formulating problems of optimization. Objective function, decision variables, constraints. The problems of optimal engineering design. Dimension optimization, shape optimization, topological optimization.	EUW1, EUW2, EUU1, EUU2, EUK1	2
W2	Selected gradient algorithms. Methods of sequential approximation. The method of moving asymptotes.	EUW1, EUW2, EUU1, EUU2, EUK1	4
W3	Selected non-gradient algorithms. Biologically and physically inspired methods.	EUW1, EUW2, EUU1, EUU2, EUK1	6
W4	The cellular automaton method in topological optimization.	EUW1, EUW2, EUU1, EUU2, EUK1	3

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 AN ACADEMIC TEACHER	
Hours allotted in the syllabus	15
Consultations	1
Examination / course credit assignment	2
HOURS WITHOUT THE PARTICIPATION OF AN ACADEMIC TEACHER	
Independent study of the course contents	8
Preparation of a paper, a report, a project, a presentation, a discussion	4
ECTS POINTS STATEMENT	
Total number of hours	30
The ECTS points number	1

Preliminary requirements

No.	Requirements
1	There are no preliminary requirements.

Course credit assignment conditions / method of the final grade calculation

No.	Description

COURSE CREDIT ASSIGNMENT CONDITIONS	
1	Presentation on the subject matter related to the classes.
METHOD OF THE FINAL GRADE CALCULATION	
Grade for the presentation and discussion.	

Additional information

Content illustration using Matlab computing environment.

The course reading list

1	Ostwald M., *Podstawy optymalizacji*, Poznań, 2005, Wydawnictwo Politechniki Poznańskiej.
2	Haftka R.T., Gurdal Z., *Elements of structural optimization*, Dordrecht, 1992, Kluwer Academic Publishers.
3	Haug E.J., Arora J.S., *Applied optimal design. Mechanical and structural systems.*, New York-Chicester-Brisbane-Toronto, 1979, John Wiley & Sons
4	Martins J.R.R.A, Ning A., *Engineering design optimization*, electronic edition: January 2020.