(*faculty stamp*)

COURSE DESCRIPTION

1.Course title: Principles and applications of the optimization theory	**2. Course code:** WM1
3. Validity of course description: 2020/2021	
4. Level of studies: 1st cycle of higher education	
5. Mode of studies: intramural studies	
6. Field of study: COMPUTER SCIENCE	(RMS)
7. Profile of studies: general academic	
8. Programme: all programmes	
9. Semester: 5	
10. Faculty teaching the course: Institute of Mathematics	
11. Course instructor: dr hab. inż. Edyta Hetmaniok, prof. PŚ	
12. Course classification: course of limited choice	
13. Course status: monographic	
14. Language of instruction: English	

15. Pre-requisite qualifications:

The basic knowledge of the linear algebra, mathematical analysis and differential calculus, as well as the basic knowledge of English language is required.

16. Course objectives:

Purpose of the course is to familiarize the students with the basic methods and algorithms used in creating the mathematical models and solving the problems of mathematical programming. The course is given in English.

17. Description of learning outcomes:

Student who has completed the subject:

Nr	Learning outcomes description	Method of assessment	Teaching methods	Learning outcomes reference code
1.	W01: knows the foundations of the optimization theory.	test	lecture, class, laboratory	K1P_U11 K1P_K01
2.	W02: knows the selected optimization methods and algorithms.	test	lecture, class, laboratory	K1P_U11 K1P_K01
3.	U01: can create the mathematical description of selected phenomena and optimization problems.	test, project	lecture, class, laboratory	K1P_U11 K1P_K01
4.	U02: can choose the appropriate solution method for the given optimization problem.	test, project	lecture, class, laboratory	K1P_U11 K1P_K01
5.	U03: can write the computer procedures in the selected programming language realizing the selected optimization problems.	project	laboratory	K1P_U11 K1P_K01
6.	K01: can search, on her/his own, the information concerning the optimization algorithms in literature, also in foreign languages.	project	class, laboratory	K1P_U11 K1P_K01 K1P_K02

18. Teaching modes and hours

Lecture	Class	Laboratory	Projekt	Seminar
30	15	15		

19. Syllabus description:

Lecture: Basic concepts and theorems of the optimization theory. Extremal values of one-variable, multi-variable and implicit functions. Tasks of mathematical, convex and linear programming problems. Procedures of optimizing the objective functions under the constraints of equality and inequality forms. The dual problem for the convex and linear optimization problems. The duality theorem. Connection between the solutions of the primal and dual optimization problems. Linear programming problem and the methods of its solution (the graphical method, the simplex algorithm). Transportation problem and the transportation algorithm. Selected optimization problems of swarm intelligence.

Class/laboratory: practical realization of the issues, presented during the lectures, on the way of discussing and solving the tasks illustrating the undertaken problems and preparing the computer procedures realizing the selected algorithms.

20. Examination: No

21. Primary sources:

1. R. Grzymkowski, E. Hetmaniok, S. Kiełtyka, *Elementy programowania matematycznego,* Wydawnictwo Pracowni Komputerowej Jacka Skalmierskiego, Gliwice 2010.

2. J. L. Nazareth, *An optimization primer: on models, algorithms, and duality*, New York, Springer, 2004.

3. C. Roos, T. Terlaky, J.-Ph. Vial, *Theory and algorithms for linear optimization: an interior point approach*, Chichester: John Wiley & Sons, Inc., 1997.

4. A. Nowak, *Optymalizacja. Teoria i zadania.,* Wyd. Pol. Śl. Gliwice 2007.

5. H. Gliński, R. Grzymkowski, A. Kapusta, D. Słota, *Mathematica 8*, Wydawnictwo Pracowni Komputerowej Jacka Skalmierskiego, Gliwice, 2012. (selected parts).

22. Secondary sources:

1. A. Antoniou, W-S. Lu, *Practical optimization : algorithms and engineering applications*, New York: Springer, cop. 2007.

2. M. Negnevitsky, *Artificial intelligence : a guide to intelligent systems* - 3rd ed. - Harlow: Addison-Wesley, 2011.

3. Z. Jędrzejczyk, K. Kukuła, J. Skrzypek, A. Walkosz, *Badania operacyjne w przykładach i zadaniach,*PWN Warszawa 2001.

4. J. Stadnicki, *Teoria i praktyka rozwiązywania zadań optymalizacji: z przykładami zastosowań technicznych*, PWN Warszawa 2006.

23. Total workload required to achieve learning outcomes

Lp.	Teaching mode :	Contact hours / Student workload hours
1	Lecture	30/30
2	Classes	15/30
3	Laboratory	15/30
4	Project	/
5	BA/ MA Seminar	/
6	Other	/
	Total number of hours	**60/90**

24. Total hours: 150

25. Number of ECTS credits: 5

26. Number of ECTS credits allocated for contact hours: 5

27. Number of ECTS credits allocated for in-practice hours (laboratory classes, projects): 3

26. Comments:

The assessment rules: theoretical test: 35p., practical test: 35p., project: 30p.

For passing the course it is required to collect 41 points altogether, including at least 10 points for the project and at least 12 points for each of the two tests. The grade will be given according to the following scale:

41-55 p.: sufficient (3.0)

56-70 p.: plus sufficient (3.5)

71-80 p.: good (4.0)

81-90 p.: plus good (4.5)

91-100 p.: very good (5.0)

Approved:

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(date, Instructor's signature)

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(*date , the Director of the Faculty Unit signature)*