SYLLABUS

Name: ***Optimization and decision making (MakAu>SI3ODM19)***
Name in Polish:
Name in English: ***Optimization and decision making***

Information on course:

Course offered by department: Faculty of Automatic Control, Electronics and Computer Science
Course for department: Silesian University of Technology

Default type of course examination report:

ZAL

Language:

English

Course homepage:

https://platforma2.polsl.pl/rau1/course/view.php?id=123

Short description:

Introduction of various types of practical optimization problems, analytical methods and algorithms for solving them. Development of skills necessary for application of basic numerical algorithms. Introduction of mathematically based decision making in multistage decision processes. Laboratory exercises aim at developing students' skills in implementing standard methods and algorithms to find solutions of optimization problems

Basic knowledge of calculus and algebra is required for this course (the scope of the course includes calculation of derivatives, partial derivatives, performing calculations with matrices, solving algebraic and differential equations)

Description:

ECTS: 5
Total workload: 125 hours (65 contact hours, 60 students' own work hours)
Forms of contact hours:
Lecture 30h
Laboratory 30h
Other (e.g. test and reports revision and discussion) 5h
Students' own work: preparation for classes, elaboration of measurement results, writing reports, preparation for tests 60h

Lectures:
• Examples of optimization problems; defining optimality criteria
• Modeling of decision processes
• Unconstrained extrema
• Examples of using necessary conditions
• Dynamic programming and its applications
• Constrained optimization
• Necessary conditions for constrained minimum
• Inequality constraints
• Linear programming, simplex algorithm and its applications
• Quadratic programming and its applications
• Zero- and nonzero sum games and their applications in decision making
• Decision trees

Laboratory:
- Univariate optimization methods
- Multivariable optimization
- Linear programming
- Dynamic programming
- Analytical methods of optimization
- Game theory in decision making
- Small practical project

Bibliography:

A. Świerniak, A. Gałuszka, Optimization Methods and Decision Making. Lecture Notes. Wyd. Politechniki Śląskiej, Gliwice 2003.
Z. Ogonowski, J. Smieja, Optimization Methods and Decision Making. (Handbook for students) Art&Kolor, Gliwice, 2001. (available for download at http://www.platforma.polsl.pl/rau1/)
Barron N.E. Game theory. An introduction. Wiley, 2013

Supplementary advanced literature:
• D. Luenberger: Introduction to linear and nonlinear programming, Adison-Wesley, 1973
• U. Helmke, J. Moore: Optimization and dynamical systems, Springer, 1994
• J. Dréo, P. Siarry, A. Pétrowski, E. Taillard, Metaheuristics for Hard Optimization. Methods and case studies, Springer 2006
• HederS. BernardinoHelioJ. C. Barbosa, Artificial Immune Systems for Optimization, Springer 2009

Learning outcomes:

Knowledge: Student knows and understands
(1) methods of mathematical description of optimization problems (K1A_W08)

Skills: Student is able to

(2) choose and apply an appropriate method to solve a givent optimization problem (K1A_U08, K1A_U13)

Assessment methods and assessment criteria:

1. Students must have theoretical knowledge required for the exercise. The level of this knowledge will be evaluated on the basis of written or oral test at the beginning of the lab exercise or results obtained during lab hours.

2. Each subsection must prepare a report containing the front page (the template is available as a separate file in LAB resources), their results, all required calculations and discussion of the results (detailed requirements are given by the tutor). Each report must be submitted using the upload link ("An" exercise is an exception - the report may be submitted in hardcopy) before the next exercise. Otherwise the grade will be lowered. In case of lab taking place during the catch-up term the report must be submitted no later than one week after the exercise. Please note that there is a penalty of -1 point for submitting a corrected report after the first version was not awarded at least 2.5 points

3. The grading procedure for each exercise is given in the exercise description.

4. Students who fail to earn 2.5 points during lab exercise (the rule does not aply to the P exercise) must repeat it during catch-up term. The same rule applies in case of absence (other than justified absence).

5. There is only one catch-up term !!! Students who failed or were absent more than twice cannot obtain credit points for the lab regardless of the cause (unless there are medical reasons – this exception is subject to presentation of official sick leave immediately after illness). In special cases, a second additional term will be available but only for those who need only one exercise to complete the course.

6. The course grade is an arithmetic average of the lab exercise grades and lecture test grades. However, if the exercises are not completed (including report submission) before the exam session begins, the average rule does not apply (The average will be calculated but the final grade will be lower, depending on the date of being awarded the final grades). The final grade is awarded, according to the following rules:

2.5 - 3.29(9) - 3.0 (dost)
3.3 - 3.7(9) - 3.5 (pdost)
3.8 - 4.2(9) - 4.0 (db)
4,3 - 4,7(9) - 4.5 (pdb)
4,8 - 5.0 - 5.0 (bdb)

Students repeating the course may have their positive grades awarded for claboratory exercises copied from the previous semester.

The syllabus is valid from academic year 2024/25 and its content cannot be changed during the semester.

Element of course groups in various terms:

Course group description	First term	Last term
missing group description in English (MakAu>SI3-19)	2020/2021-Z	

Course credits in various terms:

<without a specific program>

Type of credits	Number	First term	Last term
European Credit Transfer System (ECTS)	5	2020/2021-Z	