Mathematical Programming - course description

General information

Course name	Mathematical Programming
Course ID	11.0-WK-MATD-PM-L-S14_pNadGenG56J7
Faculty	Faculty of Mathematics, Computer Science and Econometrics
Field of study	Mathematics
Education profile	academic
Level of studies	Second-cycle studies leading to MS degree
Beginning semester	winter term 2020/2021

Course information

Semester	2
ECTS credits to win	10
Course type	optional
Teaching language	polish
Author of syllabus	• prof. dr hab. Andrzej Cegielski

Classes forms

The class form	Hours per semester (full-time)	Hours per week (full-time)	Hours per semester (part-time)	Hours per week (part-time)	Form of assignment
Laboratory	30	2	-	-	Credit with grade
Lecture	30	2	-	-	Exam
Class	30	2	-	-	Credit with grade

Aim of the course

The lecture should give a knowledge on methods for constrained minimization, in particular on methods for linear programming and quadratic programming. Furthermore, the lecture contains foundations of multicriterial and nondifferentiable minimization. In the laboratory the students apply an appropriate software.

Prerequisites

Linear algebra 1 and 2, mathematical analysis 1 and 2, foundations of optimization.

Scope

1. Linear programming. Linear programming (LP) problems and problems which can be reduced to LP. Graphic method. Simplex algorithm, I and II phase. Duality in LP and the dual simplex algorithm.
2. Quadratic programming. Methods for equality constraints and for inequality constraints, active set method.
3. Constrained minimization methods. Reduction to unconstrained minimization: penalty function and barrier function. SQP-method.
4. Linear multi-criterial programming. Pareto-optimal solution. Optimal solution with respect to a meta-criterion.
5. Convex nondifferentiable minimization. Fejer monotonicity. Optimality conditions. Subgradient projection method.

Teaching methods

Traditional lecture, classes with exercises, laboratory with application of appropriate software.

Learning outcomes and methods of theirs verification

Outcome description	Outcome symbols	Methods of verification	The class form
Student can construct mathematical models for simple optimization problems; knows and understands the graphic method for two-dimensional optimization problems and basic methods for multi-criterial optimization.	• K_U10	• a test • activity during the classes • an exam - oral, descriptive, test and other	• Lecture • Laboratory • Class
Student Is able to apply basic minimization methods for simple constrained minimization problems and to apply subgradient projection method to simple convex nondifferentiable problems.	• K_W11	• a test • activity during the classes • an exam - oral, descriptive, test and other	• Lecture • Laboratory • Class
Student knows and applies an appropriate software to symbolic calculus and to simple optimization problems.	• K_U13 • K_U15	• a test • activity during the classes • an exam - oral, descriptive, test and other	• Lecture • Laboratory • Class

Outcome description	Outcome symbols	Methods of verification	The class form
Student nnderstands the necessity of an application of mathematical methods in practical problems.	• K_K04	• a test • activity during the classes • an exam - oral, descriptive, test and other	• Lecture • Laboratory • Class

Assignment conditions

1. Checking the activity of the student
2. Written tests
3. Checking the ability of application of an appropriate software
4. Written examination

The final grade consists of the classes grade (30%), the lab's grade (30%) and the examination's grade (40%)

Recommended reading

1. A. Cegielski, Podstawy optymalizacji, skrypt do wykładu
2. W. Findeisen, J. Szymanowski, A. Wierzbicki, Teoria i metody obliczeniowe optymalizacji, PWN, Warszawa, 1980.
3. Z. Galas, I. Nykowski (red.), Zbiór zadań z programowania matematycznego, część I, II, PWN, Warszawa, 1986, 1988.
4. W. Grabowski, Programowanie matematyczne, PWE, Warszawa, 1980.
5. A. Cegielski, Programowanie matematyczne - część 1 - Programowanie liniowe, Uniwersytet Zielonogórski, Zielona Góra, 2002.
6. Badania operacyjne (red. W. Sikora), PWE, Warszawa, 2008.

Further reading

1. M. S. Bazaraa, H. D. Sherali, C. M. Shetty, Nonlinear Programming, Third Edition, J. Wiley&Sons, Hoboken, NJ, 2006
2. D. P. Bertsekas, Nonlinear Programming, Athena Scientific, Belmont, MA, 1995
3. J.E. Dennis, R.B. Schnabel, Numerical Methods for Unconstrained Optimization and Nonlinear Equations, SIAM, Philadelphia 1996.
4. R. Fletcher, Practical Methods of Optimization, Vol I, Vol. II, John Willey, Chichester, 1980, 1981.
5. M. Brdyś, A. Ruszczyński, Metody optymalizacji w zadaniach, WNT, Warszawa, 1985.
6. J. Stadnicki, Teoria i praktyka rozwiązywania zadań optymalizacji, WNT, Warszawa, 2006.

Notes

Modified by dr Alina Szelecka (last modification: 18-09-2020 13:46)