STUDY MODULE DESCRIPTION FORM

Name of the module/subject **Optimization methods**	Code **1010341761010340552**

Field of study **Mathematics in Technology**	Profile of study (general academic, practical) **(brak)**	Year /Semester **3 / 6**
Elective path/specialty **-**	Subject offered in: **Polish**	Course (compulsory, elective) **obligatory**

Cycle of study: **First-cycle studies**	Form of study (full-time,part-time) **full-time**

No. of hours Lecture: **30** Classes: **-** Laboratory: **30** Project/seminars: **-**	No. of credits **4**

Status of the course in the study program (Basic, major, other) **(brak)**	(university-wide, from another field) **(brak)**

Education areas and fields of science and art	ECTS distribution (number and %**)**

Responsible for subject / lecturer:

dr Andrzej Maćkiewicz
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Wydział Elektryczny
ul. Piotrowo 3A 60-965 Poznań

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Prerequisites in terms of knowledge, skills and social competencies:

1	**Knowledge**	Multidimensional calculus, Numeric linear algebra.
2	**Skills**	Computer programming in high level languages.
3	**Social competencies**	Ability to work in a group.

Assumptions and objectives of the course:

This course addresses linear programming, quadratic programming and network flows. Both the general theory and characteristics of these optimization problems, as well as
effective solution algorithms, are presented. The simplex algorithm provides
considerable insight into the theory of linear programming and yields an efficient
algorithm in practice. Hence, we study this method in detail in this course.
Whenever possible, the simplex algorithm is specialized to take advantage of the
problem structure, such as in network flow problems. We also present a class of interior
point methods that compare favorably with the simplex method, particularly for
general large-scale, sparse problems, and is therefore described in greater detail.
Finally, theoretical elements of the convex analysis, optimality conditions and duality theory for smooth optimization problems are presented.
This course is followed next by the advanced course of numerical nonlinear optimization.

Study outcomes and reference to the educational results for a field of study

Knowledge:

1. He/She knows numerical methods for approximating optimization problems. - [K_W10]
2. He/She knows the relationships of optimization with other branches of mathematics and with other disciplines of theoretical and applied mathematics. - [K_W07]
3. He/She has deep knowledge in operational research. - [K_W04]

Skills:

1. He/She can construct mathematical models used in operational research. - [K_U16]
2. He/She is able to construct correct numerical algorithms, taking into account their computational complexity. - [K_U20]

Social competencies:

1. Can search for information in literature, also in foreign languages. - [K_K06]
2. He/She can work collaboratively. - [K_K03]

Assessment methods of study outcomes

Homework 30%
Midterm 30%
Final 40%

Course description

The Kuhn-Tucker Conditions and the Simplex Method
The Revised Simplex Method
Newton's Method for Systems of Nonlinear Equations
Interior-Point Methods
Solving Large Linear Programs
KKT Conditions for Quadratic Programming Problems
Linear Complementarity Problems
Approximation and Classification
Linear Programming Models of Network Flow
Integer Linear Programming
Convexity
Nonlinear Programming Models
Karush-Kuhn-Tucker Optimality Conditions
Nonlinear Programming Algorithms (overview)

Basic bibliography:

1. Gass, Saul I., Programowanie liniowe., PWN, 1980.
2. Ferris, Michael C., Mangasarian, Olvi L., i Wright, Stephen J., Linear Programming with MATLAB, SIAM, 2007.

Additional bibliography:

1. Griva, Igor, Nash, Stephen G., i Sofer, Ariela, Linear and Nonlinear Optimization, Second Edition, SIAM, 2009.
2. Nocedal, Jorge i Wright, Stephen J., Numerical Optimization, Second Edition, Springer, 2006.

Result of average student's workload

Activity	Time (working hours)

Student’s workload

Source of workload	hours	ECTS
Total workload	80	4
Contact hours	30	1
Practical activities	30	1