STUDY MODULE DESCRIPTION FORM

Name of the module/subject	Code
Linear and quadratic programming	**1010341741010340008**

Field of study	Profile of study (general academic, practical)	Year /Semester
Mathematics in Technology	**general academic**	**2 / 4**
Elective path/specialty	Subject offered in:	Course (compulsory, elective)
-	**Polish**	**obligatory**

Cycle of study:	Form of study (full-time,part-time)
First-cycle studies (Polish Qualifications Framework level six)	**full-time**

No. of hours	No. of credits
Lecture: **30** Classes: **-** Laboratory: **30** Project/seminars: **-**	**3**

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

Education areas and fields of science and art	ECTS distribution (number and %)
The sciences	**3 100%**
Mathematical sciences	**3 100%**

Responsible for subject / lecturer:

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Responsible for subject / lecturer:

Prerequisites in terms of knowledge, skills and social competencies:

1	**Knowledge**	Multidimensional calculus, Numerical linear algebra. [K_W01 (P6S_WG)], [K_W02 (P6S_WG)], [K_W03 (P6S_WG)], [K_W06 (P6S_WG)]
2	**Skills**	Programming of digital machines in high level languages. [K_U01 (P6S_UW)], [K_U02 (P6S_UW)], [K_U04 (P6S_UW)], [K_U09 (P6S_UW)], [K_U13 (P6S_UK)], [K_U15 (P6S_UU)]
3	**Social competencies**	Ability to work in a group. [K_K02 (P6S_KK)] , [K_K03 (P6S_KO)]

Assumptions and objectives of the course:

1. Understanding the characteristics of optimization models, with selected examples
2. Understanding computer algorithms used to solve linear and quadratic programming problems
3. Acquiring the ability to solve selected tasks, through the appropriate record of the mathematical model with the appropriate selection of the algorithm (adequate to the problem being solved)
4. Acquiring the ability to use optimization algorithms for advanced calculations in the field of engineering calculations (as applications of mathematics in technology)

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

Knowledge:

1. Student has extended and in-depth knowledge of various branches of higher mathematics and detailed knowledge of the use of mathematical methods and tools in technical sciences - [K_W01 (P6S_WG)]
2. Student has ordered knowledge of terminology in the field of mathematics and selected issues in the area of science technical related to the field of study, also in a foreign language [K_W03 (P6S_WG)]
3. Student has ordered and theoretically founded knowledge in computer science, including numerical methods; knows at least one software package or programming language [K_W06 (P6S_WG)]

Skills:

1. Student is able to use knowledge in higher mathematics [K_U01 (P6S_UW)]
2. Student is able to build and analyze simple mathematical models [K_U02 (P6S_UW)]
3. Student is able to construct an algorithm for solving a simple engineering task and implement it and test it in a chosen programming environment [K_U04 (P6S_UW)]
4. Student is able to use equipment, tools, etc. in accordance with general requirements and technical documentation; knows how to apply the principles of health and safety at work [K_U09 (P6S_UW)]
5. Student is able to use a foreign language to a degree sufficient to communicate, as well as reading comprehension of mathematical texts, technical documentation and similar documents [K_U13 (P6S_UK)]
6. Student is able to independently plan and implement self-education in order to raise and update their competences [K_U15 (P6S_UU)]

Social competencies:

1. Student is aware of deepening and expanding knowledge to solve newly-created [K_K02 (P6S_KK)]
2. Student is able to think and act in a creative and entrepreneurial way, taking into account safety, work ergonomics and its economic aspects, is aware of the need to initiate activities for the public interest and responsibility for the team's work as well as its individual participants [K_K03 (P6S_KO)]

Assessment methods of study outcomes

1. Homeworks
2. Test

Course description

Update 2018/2019

1. Introduction:
   – Basic Properties of Sets and Functions in Optimization Problems
   – Convex Functions
   – Differentiation of Functions of Several Variables. Differential Properties of Convex Functions
2. Linear Programming Models
3. Linear Programming:
   – Basic Properties of Linear Programming Problems
   – Graphic Method
   – The Simplex Method (primal, dual)
   – Sensitivity analysis and parametric linear programming
   – Transport Models
4. Non-linear Programming
   – Optimality Conditions for Non-Linear Programming Problems
   – Quadratic Programming and Complementarity Problems
   – Computational Methods in Quadratic Programming

Basic bibliography:

1. Gass, Saul I., Programowanie liniowe., PWN, 1980.
2. Dariusz Horla., Metody obliczeniowe optymalizacji w zadaniach., WPP, 2016
3. Z. Jędrzejczyk, K. Kukuła, J. Skrzypek, A. Walkosz: „Badania operacyjne w przykładach i zadaniach, PWN, 2011

Additional bibliography:

1. Ferris, Michael C., Mangasarian, Olvi L., i Wright, Stephen J., Linear Programming with MATLAB, SIAM, 2007.
2. Griva, Igor, Nash, Stephen G., i Sofer, Ariela, Linear and Nonlinear Optimization, Second Edition, SIAM, 2009.
3. Andrzej Nowak., Optymalizacja. Teoria I zadania. Gliwice 2007.
4. Tadeusz Trzaskalik., Wprowadzenie do badań operacyjnych z komputerem, PWE, Warszawa 2007

Result of average student's workload

Activity	Time (working hours)

1. Lectures	30
2. Classes	30
3. Preparing for classes	15
4. Preparing for tests	15
5. Consultations	2

Student's workload		
Source of workload	**hours**	**ECTS**
Total workload	92	3
Contact hours	62	2
Practical activities	30	1