University of Gdańsk

Subject card

Subject name and code	Optimization Theory I, PG_00155458						
Field of study	Mathematics						
Date of commencement of studies	October 2024		Academic year of realisation of subject	2024/2025			
Education level	postgraduate studies		Subject group	Optional subject group Specialty subject group			
Mode of study	full-time studies		Mode of delivery	at the university			
Year of study	1		Language of instruction	Polish Polish			
Semester of study	2		ECTS credits	6.0			
Learning profile	academic		Assessment form				
Conducting unit	Instytut Matematyki -> Faculty of Mathematics, Physics and Informatics						
Name and surname of lecturer (lecturers)	Subject supervisor		dr Danuta Jaruszewska-Walczak				
	Teachers						
Lesson types	Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
	Number of study hours	30.0	30.0	0.0	0.0	0.0	60
	E-learning hours included: 0.0						
Learning activity and number of study hours	Learning activity	Participation in didactic classes included in study plan		Participation in consultation hours	Self-study	SUM	
	Number of study hours	60		10.0	80.0	150	
Subject objectives	To knowing students with the theoretical foundations and main applications of optimization theory.						

Learning outcomes

Course outcome	Subject outcome	Method of verification
[MATMU2_W01] knows and understands in-depth the theory of selected areas of mathematics	The student knows and understands the classes of optimization problems, their applications and methods of solving, as well as the problems of approximation and optimization in normalized spaces and in Hilbert spaces	[SW4] test/exam - oral or written
[MATMU2_U07] is able to define his/her interests and develop them; in particular, is able to establish contact with specialists in his/her field, e.g. understand their lectures intended for young mathematicians	The student is able to develop his/her interests in order to be able to construct and solve optimization problems	[SU1] oral statement/conversation/discussion [SU8] observation of student's independent or team work
[MATMU2_U03] can understand mathematical texts of various types from selected fields of mathematics	The student is able to prove selected theorems in the theory of optimization, construct and solve models of optimization problems	[SU4] test/exam - oral or written
[MATMU2_W03] knows and understands in-depth a selected field of theoretical or applied mathematics and is able to understand the formulations of issues in this field that are still at the research stage and knows the connections of issues in this field with other areas of mathematics	The student knows and understands the proofs of theorems and understands the role of reasoning constructions in optimization problems and their applications	[SW4] test/exam - oral or written [SW1] oral statement/conversation/discussion
[MATMU2_U05] can perform proofs in a selected field and, if necessary, also use tools from other areas of mathematics	The student is able to construct and solve selected optimization problems using tools from various branches of mathematics	[SU1] oral statement/conversation/discussion [SU4] test/exam - oral or written
[MATMU2_K06] is ready to formulate opinions on basic mathematical issues	The student is able to formulate opinions on basic optimization problems	[SK1] oral statement/conversation/discussion [SK8] observation of student's independent or team work
[MATMU2_U06] is able to apply methods and examples from a selected field of mathematics in related fields	The student is able to construct and solve models of optimization problems in related fields of science	[SU4] test/exam - oral or written
[MATMU2_U04] is able, at an advanced level and including modern mathematics, to apply and present, orally and in writing, methods of at least one selected branch of mathematics	The student is able to solve optimization problems using various methods of modern advanced mathematics	[SU4] test/exam - oral or written
[MATMU2_W02] knows and understands well the role and importance of the construction of mathematical reasoning	The student knows and understands the proofs of theorems and understands the role of reasoning constructions in optimization problems and their applications	[SW4] test/exam - oral or written [SW1] oral statement/conversation/discussion
[MATMU2_K04] is ready to understand and appreciate the importance of intellectual honesty in one's own and other people's actions; ethical conduct	The student understands and appreciates the importance of intellectual integrity and ethical conduct	[SK8] observation of student's independent or team work
[MATMU2_K05] is ready to independently search for information in literature, also in foreign languages	The student is ready to search for information in scientific studies	[SK8] observation of student's independent or team work
[MATMU2_K02] is ready to precisely formulate questions to deepen his/her understanding of a given topic or find missing elements of reasoning	The student is ready to formulate questions aimed at deepening the understanding of a given topic	[SK1] oral statement/conversation/discussion [SK8] observation of student's independent or team work
[MATMU2_U01] can construct mathematical reasoning: prove theorems and refute hypotheses through construction and selection of counterexamples	The student is able to prove selected theorems in the theory of optimization and refute hypotheses by selecting counterexamples	[SU1] oral statement/conversation/discussion [SU4] test/exam - oral or written
[MATMU2_K01] is willing to acknowledge the limitations of his or her own knowledge and is willing to pursue further education	The student understands the limitations of their own knowledge and the need for lifelong learning	[SK8] observation of student's independent or team work

<table>
<tr><td>Subject contents</td><td>Basic classes of optimization tasks. Application examples.
The problem of linear programming. Dual task. Transport task. The simplex method.
Representation of functionals.
The problem of minimizing functionals defined on subsets of normalized vector spaces. Separation of convex sets.
Approximation and optimization in Hilbert spaces. Optimization in cones. Normal equations.
Orthogonal polynomials and their extreme properties.</td></tr>
<tr><td>Prerequisites and co-requisites</td><td>Knowledge of the basics of mathematical analysis and linear algebra</td></tr>
<tr><td>Assessment methods and criteria</td><td><table>
<tr><th>Subject passing criteria</th><th>Passing threshold</th><th>Percentage of the final grade</th></tr>
<tr><td>observation of student behavior</td><td>100.0%</td><td>0.0%</td></tr>
<tr><td>test</td><td>50.0%</td><td>50.0%</td></tr>
<tr><td>exam</td><td>50.0%</td><td>50.0%</td></tr>
</table></td></tr>
<tr><td>Recommended reading</td><td><table>
<tr><td>Basic literature</td><td>D. G. Luenberger, Teoria optymalizacji. BNI,1974.
E. Pollak, Metody obliczeniowe optymalizacji. MIR, 1974.
M. M. Syslo, N. Deo, J. S. Kowalik, Algorytmy optymalizacji dyskretnej. PWN, 1995.
I. Nykowski, Z.Galas, Zbiór zadań z programowania matematycznego I II PWN 1986.
M. Brdyś, A. Ruszczyński, Metody optymalizacji w zadaniach, WNT 1985.</td></tr>
<tr><td>Supplementary literature</td><td>Not required.</td></tr>
<tr><td>eResources addresses</td><td>Adresy na platformie eNauczanie:</td></tr>
</table></td></tr>
<tr><td>Example issues/ example questions/ tasks being completed</td><td>Not required.</td></tr>
<tr><td>Work placement</td><td>Not applicable</td></tr>
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