

Subject card

Subject name and code	Optimal Transportation, PG_00209973						
Field of study	Mathematics						
Date of commencement of studies	October 2025		Academic year of realisation of subject		2026/2027		
Education level	Master's studies		Subject group		Obligatory subject group in the field of study Optional subject group		
Mode of study	full-time studies		Mode of delivery		at the university		
Year of study	2		Language of instruction		Polish		
Semester of study	3		ECTS credits		6.0		
Learning profile	academic		Assessment form		exam		
Conducting unit	Institute of Mathematics -> Faculty of Mathematics, Physics and Informatics -> Rector						
Name and surname of lecturer (lecturers)	Subject supervisor		dr Szymon Myga				
	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	The aim of the course is to introduce the topic of optimal transportation and discuss its applications in machine learning.						

Learning outcomes	Course outcome	Subject outcome	Method of verification
	[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 the subject matter, which is new and naturally interdisciplinary.	[SW4] 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 amount of knowledge needed to navigate modern mathematics freely.	[SK4] test/exam - oral or written
	[MATMU2_W02] knows and understands well the role and importance of the construction of mathematical reasoning	The student knows the basic proofs of the theorems presented.	[SW4] test/exam - oral or written
	[MATMU2_K06] is ready to formulate opinions on basic mathematical issues	The student is able to compare the difficulty of different formulations of the optimal transport problem.	[SK4] test/exam - oral or written
	[MATMU2_U05] can perform proofs in a selected field and, if necessary, also use tools from other areas of mathematics	The student knows the subject matter, which is naturally interdisciplinary.	[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 knows the basics of the theory of metric properties of the spaces of probabilistic measures.	[SU4] test/exam - oral or written
	[MATMU2_U01] can construct mathematical reasoning: prove theorems and refute hypotheses through construction and selection of counterexamples	The student is able to prove the basic properties of the objects discussed.	[SU4] test/exam - oral or written
	[MATMU2_U06] is able to apply methods and examples from a selected field of mathematics in related fields	The student knows the subject matter, which is naturally interdisciplinary.	[SU4] test/exam - oral or written
	[MATMU2_K05] is ready to independently search for information in literature, also in foreign languages	The student knows the basic bibliography of the subject, along with its basic conceptual lexicon.	[SK1] 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 is able to admit to himself what he understands and what he does not understand.	[SK4] test/exam - oral or written
	[MATMU2_W01] knows and understands in-depth the theory of selected areas of mathematics	The student understands the problem of optimal transport and its numerous reformulations.	[SW4] test/exam - oral or written
	[MATMU2_U03] can understand mathematical texts of various types from selected fields of mathematics	The student read the course notes.	[SU4] test/exam - oral or written
	[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 understands the mathematical differences that arise from different formulations of the same idea.	[SK4] 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 use the subject terminology.	[SU4] test/exam - oral or written
Subject contents	1. Monge problem. Kantorovitch problem. 2. Dual problem. 3. Sinkhorn algorithm. 4. Wasserstein metric. 5. Applications. 6. Presenting the English nomenclature for the course.		
Prerequisites and co-requisites	Mathematical analysis, probability.		

Assessment methods and criteria	Subject passing criteria	Passing threshold	Percentage of the final grade
	Assesment of student's attitude	51.0%	0.0%
	Wirtten or oral exam and/or project and/or tests	51.0%	100.0%
Recommended reading	Basic literature	1. Cédric Villani, <i>Topics in optimal transportation</i> , Grad. Stud. Math., 58, American Mathematical Society, Providence, RI, 2003, 2. Filippo Santambrogio, <i>Optimal transport for applied mathematicians</i> . Calculus of variations, PDEs, and modeling Progr. Nonlinear Differential Equations Appl., 87 Birkhäuser/Springer, Cham, 2015. link 3. Gabriel Peyré, <i>Optimal Transport for Machine Learners, Course notes</i> . link	
	Supplementary literature	Gabriel Peyre, Marco Cuturi, et al. <i>Computational optimal transport</i> . Foundations and Trends® in Machine Learning, 11(5-6):355607, 2019.	
	eResources addresses		
Example issues/ example questions/ tasks being completed	not included		
Work placement	Not applicable		

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