University of Gdańsk

Subject card

Subject name and code	Mathematical Models in Economics, PG_00161302		
Field of study	Mathematical Modeling and Data Analysis		
Date of commencement of studies	October 2023	Academic year of realisation of subject	2025/2026
Education level	Bachelor's studies	Subject group	Optional subject group
Mode of study	full-time studies	Mode of delivery	at the university
Year of study	3	Language of instruction	Polish
Semester of study	6	ECTS credits	6.0
Learning profile	academic	Assessment form	credit
Conducting unit	Institute of Mathematics -> Faculty of Mathematics, Physics and Informatics -> Rector		
Name and surname of lecturer (lecturers)	Subject supervisor	dr Marek Hałenda	
	Teachers	dr Marek Hałenda	

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 present the mathematical foundations of economic theories and an introduction to mathematical modelling of economic processes.

Learning outcomes

Course outcome	Subject outcome	Method of verification
[MMiADL3_U08] is able to plan a way to solve a given problem and make a correct record of this solution, providing accurate and precise justifications for the correctness of their reasoning	Is able to provide solutions to simple mathematical economics tasks along with a justification for their correctness.	[SU4] test/exam - oral or written
[MMiADL3_U07] can comprehensively, in speech and in writing, formulate definitions and theorems and present correct mathematical reasoning regarding the issues learned	Verifies basic properties and proves simple facts about the mathematical foundations of economics.	[SU4] test/exam - oral or written
[MMiADL3_W08] knows and understands well the role and importance of proof in mathematics, as well as the concept of the significance of assumptions	Knows and understands the basic concepts, theorems, and mathematical methods used in consumer choice theory and production theory.	[SW4] test/exam - oral or written
[MMiADL3_K02] is ready to precisely formulate questions to deepen his/her own understanding of a given topic or to find missing elements of reasoning	Is ready to formulate precise questions that serve to deepen one's understanding of a topic or to find missing elements of reasoning.	[SK8] observation of student's independent or team work

<table>
<tr><td>Subject contents</td><td>1. Preference relation, optimal basket, utility function.
2. Consumer demand function, comparative statics, price change effect, income effect.
3. Demand as a solution to the utility maximization problem, characterization using Lagrange multipliers, marginal rate of substitution, indirect utility function.
4. Weak axiom of revealed preferences, compensated law of demand.
5. Expense minimization problem, consumer expenditure function, compensated Hicks demand, compensated law of demand.
6. Slutsky equations, substitution matrix.
7. Production, production sets and their types, production function.
8. Dual-argument production function, technical equipment of labor.
9. Problem of maximizing the firm's profit function, firm supply.
10. Properties of profit and supply, Hotelling's lemma, law of supply.
11. Problem of minimizing the firm's costs, cost function, average costs, marginal cost.
12. Properties of the cost function, Shepard's lemma.
13. Simple and complex lotteries.
14. Utility function, axioms of continuity and independence.
15. Expected utility function, Allais paradox.
16. Von Neumann-Morgenstern theorem.
17. Risk aversion, risk propensity, risk neutrality. The certainty equivalent of the lottery.
18. Statement of subject-related nomenclature in English.</td></tr>
<tr><td>Prerequisites and co-requisites</td><td>Calculus, basics of probability.</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>test</td><td>51.0%</td><td>50.0%</td></tr>
<tr><td>exam</td><td>51.0%</td><td>50.0%</td></tr>
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<tr><td>Recommended reading</td><td><table>
<tr><td>Basic literature</td><td>n/a</td></tr>
<tr><td>Supplementary literature</td><td>n/a</td></tr>
<tr><td>eResources addresses</td><td></td></tr>
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<tr><td>Example issues/ example questions/ tasks being completed</td><td>n/a</td></tr>
<tr><td>Work placement</td><td>Not applicable</td></tr>
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