

Subject card

Subject name and code	Operations Research, PG_00156760						
Field of study	Informatics and Econometrics						
Date of commencement of studies	October 2024		Academic year of realisation of subject		2026/2027		
Education level	Bachelor's studies		Subject group		Obligatory subject group in the field of study		
Mode of study	full-time studies		Mode of delivery		at the university		
Year of study	3		Language of instruction		Polish Polish		
Semester of study	6		ECTS credits		6.0		
Learning profile	academic		Assessment form		exam		
Conducting unit	Department of Econometrics -> Faculty of Management -> Rector						
Name and surname of lecturer (lecturers)	Subject supervisor		prof. dr hab. Paweł Miłobędzki				
	Teachers						
Lesson types	Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
	Number of study hours	30.0	15.0	15.0	0.0	0.0	60
	E-learning hours included: 0.0						
	Additional information: The lecture will include multimedia presentations, problem-solving activities, and project-based learning methods such as research, implementation, and practical projects.						
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		20.0		70.0	150
Subject objectives	The focus will be on understanding decision-making processes as conditional ones and the mathematical basis for describing them. We will also cover algorithms for optimizing such processes, determining their assumptions, and analysing their usefulness in practice.						

Learning outcomes	Course outcome	Subject outcome	Method of verification
	[IiEL3_U01] The student can comprehensibly, orally and in writing, present and justify advanced economic theories and apply them to explain the functioning of the national economy and its elements. Understands and can explain the content of communications of economic institutions, articles published in the economic press and scientific journals.	The student can clearly explain and validate advanced economic theories, both orally and in writing, and use them to clarify the functioning of economic organisations. He/she can understand announcements from regulators and papers published in industry press and scientific journals, and articulate their content.	[SU2] presentation/project/paper/report [SU3] text preparation/written work [SU4] test/exam - oral or written
	[IiEL3_W04] The student has advanced knowledge of mathematical, statistical, econometric and computer methods of obtaining, processing and analysing data depicting the functioning and development of the national economy and its elements, as well as the phenomena and processes occurring in their environment.	The student is familiar with advanced mathematical, statistical, econometric and IT methods for acquiring, processing and analysing data that exhibit the behaviour of economic organisations and the underlying processes.	[SW4] test/exam - oral or written [SW2] presentation/project/paper/report [SW3] text preparation/written work
	[IiEL3_K02] The student can communicate with the public on computer science and econometrics topics in and outside the workplace, communicate his knowledge and share his skills through various media.	The student can effectively communicate within the university on topics related to computer science and econometrics that are essential for understanding the behaviour of economic organisations, and transmit their knowledge and share skills through various communication channels.	[SK2] presentation/project/paper/report [SK3] text preparation/written work
	[IiEL3_U07] The student can build formal models of complex economic phenomena and processes, estimate them, carry out their verification, and apply them to modelling, forecasting and optimization of the resources of low-complexity economic institutions, their structure and the course of processes in them.	The student can specify a model of an economic organisation, based on knowledge of management, economics and finance, to optimise its behaviour.	[SU2] presentation/project/paper/report [SU3] text preparation/written work
	[IiEL3_W06] The student knows the general principles of business, including the ways of its initiation, the organizational and legal framework, and methods of assessing its effectiveness.	The student understands the fundamental principles of conducting business, methods for starting a business, and the legal framework.	[SW2] presentation/project/paper/report [SW3] text preparation/written work
	[IiEL3_U02] The student is able to acquire basic information about economic processes and phenomena by direct observation, planned experiment or database queries, and collect and process it using modern information technology tools.	The student can gather information about the behaviour of economic organisations and their environment through direct observation, planned experiments, or querying databases, and then process and interpret the collected data using econometric, IT or statistical tools.	[SU2] presentation/project/paper/report [SU3] text preparation/written work
	[IiEL3_K01] The student understands the need to constantly supplement and deepen acquired knowledge; is open to new ideas and teaching methods.	The student consistently enhances and deepens their understanding of how economic organisations function and the underlying conditions, remaining receptive to new ideas and teaching methods in this area.	[SK2] presentation/project/paper/report [SK4] test/exam - oral or written
Subject contents	1. Introduction to operations research: fundamental concepts and practical applications. 2. Linear decision models for optimal production plan, diet, cutting stock, and investment portfolio. 3. Duality in linear decision models. 4. Simplex method. 5. Sensitivity analysis in linear decision models. 6. Work-scheduling problem - Hungarian algorithm. 7. Transportation problems: algorithms for identifying feasible and optimal transportation plans. 8. Zero-sum two-person games (market competition as an example). 9. Noncooperative games and Nash equilibrium (prisoner's dilemma, monopolistic competition). 10. More applications of game theory: tragedy of the commons, fishing limits in the Baltic Sea, Arctic resources exploitation, missile attack problems, and optimal candidate assignment to schools. 11. Dynamic programming: optimal path selection and resource allocation. 12. Non-dynamic programming and greedy algorithms: knapsack problems and optimal loading problems. 13. Project management using network models. 14. Advanced applications of operations research methods (selecting a football club for sponsorship and optimising lost profits in the hotel industry).		

Prerequisites and co-requisites	Elementary knowledge of management theory regarding management processes, fundamentals of algebra, probability theory, and statistics, including concepts related to random variables and their basic distributions.		
Assessment methods and criteria	Subject passing criteria	Passing threshold	Percentage of the final grade
	Tutorial - written test or project assessing the ability to develop a model demonstrating the dynamics of economic organisation and its environment.	51.0%	25.0%
	Laboratory - written test or project demonstrating the ability to use suitable software for modelling the dynamics of economic organisation and its environment.	51.0%	25.0%
	Written or oral examination assessing understanding of theoretical foundations.	51.0%	50.0%
Recommended reading	Basic literature	1. Gajda J., Jadczyk R. (2016), Badania operacyjne. Przykłady zastosowań, Wydawnictwo Uniwersytetu Łódzkiego, Łódź. 2. Kozubski, J.J. (2004), Wprowadzenie do badań operacyjnych, Wydawnictwo Uniwersytetu Gdańskiego, Gdańsk. 3. Kukuła K. (red.) (2007), Badania operacyjne w przykładach i zadaniach, PWN, Warszawa. 4. Sikora W. (red.) (2018), Badania operacyjne, PWE, Warszawa. 5. Straffin P. D. (2004), Teoria gier, Wydawnictwo Naukowe Scholar, Warszawa.	
	Supplementary literature	1. Cormen T.H., Leiserson Ch.E., Rivest R.L., Stein C. (2012), Wprowadzenie do algorytmów, Wydawnictwo Naukowe PWN, Warszawa. 2. Laraki R., Renault J., Sorin S. (2022), Teoria gier. Podstawy matematyczne, Wydawnictwo Naukowe PWN, Warszawa. 3. Lipiec-Zajchowska M. (red.) (2003), Wspomaganie procesów decyzyjnych, tom III. Badania Operacyjne, Wydawnictwo C.H. Beck, Warszawa. 4. Trocki M., Grucza B., Ogonek K. (2003), Zarządzanie projektami, PWE, Warszawa.	
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Example issues/ example questions/ tasks being completed			
Work placement	Not applicable		

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