GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	Optimisation of Engineering Systems, PG_00059943		
Field of study	Environmental Engineering		
Date of commencement of studies	February 2025	Academic year of realisation of subject	2024/2025
Education level	second-cycle studies	Subject group	Obligatory subject group in the field of study
			Subject group related to scientific research in the field of study
Mode of study	Full-time studies	Mode of delivery	at the university
Year of study	1	Language of instruction	Polish
Semester of study	1	ECTS credits	5.0
Learning profile	general academic profile	Assessment form	exam
Conducting unit	Department of Sanitary Engineering -> Faculty of Civil and Environmental Engineering		
Name and surname of lecturer (lecturers)	Subject supervisor	prof. dr hab. inż. Jacek Mąkinia	
	Teachers		

Lesson types and methods of instruction	Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
	Number of study hours	30.0	0.0	30.0	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	5.0	62.0	127

Subject objectives	The aim of the course is to get acquinted with basic optimization methods in design and operation of environmental systems as well as application of computer simulation for optimization of wastewater treatment systems.

Learning outcomes		Course outcome	Subject outcome	Method of verification
		K7_U12	Analyzes and evaluates the technical and economic performance of wastewater treatment systems using computer simulation.	[SU2] Assessment of ability to analyse information [SU4] Assessment of ability to use methods and tools [SU1] Assessment of task fulfilment
		K7_U07	Formulate an optimization task for a simple environmental engineering system and select an appropriate optimization method. Prepare a computer model of a sewage treatment plant.	[SU2] Assessment of ability to analyse information [SU1] Assessment of task fulfilment [SU4] Assessment of ability to use methods and tools
		K7_W01	Uses mathematical models of wastewater treatment processes to analyze the functionality and optimize wastewater treatment systems. Based on the developed computer model, optimizes the operation of the treatment plant in terms of reducing energy consumption.	[SW1] Assessment of factual knowledge [SW3] Assessment of knowledge contained in written work and projects
		K7_W04	Solves complex engineering problems in environmental engineering using methods and algorithms that take into account optimization criteria. Conducts an analysis of the impact of technological parameters on the energy consumption in wastewater treatment plants.	[SW1] Assessment of factual knowledge [SW3] Assessment of knowledge contained in written work and projects
		K7_W07	The student has advanced knowledge of technologies used for municipal wastewater treatment.	[SW1] Assessment of factual knowledge [SW3] Assessment of knowledge contained in written work and projects

Subject contents	1. Introduction to optimization. The concept of optimization and types of optimization problems.2. Optimization in the decision-making process3. Basic concepts: system, model, simulation, experiment4. General formulation of the optimization problem5. Introduction to network models. Examples of classic optimization problems.6. Introduction to linear programming. Examples of classic optimization problems.7. Examples of optimization problems in sanitary engineering systems (water supply and sewer systems)8. Examples of optimization problems in sanitary engineering systems (wastewater treatment)9. Simulation as an optimization method10. Building a computer model of a wastewater treatment plant. Economic criteria for optimizing the operation of wastewater treatment plants.
Prerequisites and co-requisites	Not applicable.

Assessment methods and criteria	Subject passing criteria	Passing threshold	Percentage of the final grade
		60.0%	15.0%
		55.0%	80.0%
		80.0%	5.0%

Recommended reading	Basic literature	Geem, Z.W., Ayvaz, M.T. (2011). Optimization in Water &Environmental Engineering. W: Optimization in Civil & EnvironmentalEngineering (ed. Z.W. Geem), Old City Publishing, Philadelphia, PA(USA).
	Supplementary literature	Pedregal, P. (2003). Introduction to Optimization. Springer.
	eResources addresses	Adresy na platformie eNauczanie:

Example issues/ example questions/ tasks being completed	
Work placement	Not applicable

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