

## Subject card

Subject name and code	Optimisation of Engineering Systems, PG_00059943							
Field of study	Environmental Engineering							
Date of commencement of studies	February 2024		Academic year of realisation of subject			2023/2024		
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 S		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.							

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K7_W07   The student has advanced knowledge of technologies used for municipal wastewater resulted in written work and project.	Learning outcomes	Course outcome	Subject outcome	Method of verification					
Professional in written work and adjornthms that take into account or engineering using methods and adjornthms that take into account or engineering using methods and adjornthms that take into account or projects and adjornthms that take into account or projects are applicable.   Project or technological parameters on the energy consumption in wastewater treatment processes to analyze the functionality and projects are applicable.   SW3] Assessment of floatual vision of the treatment processes to analyze the functionality and projects are operation of the treatment processes to project on the project of the treatment processes to project on the project of the treatment plant in terms of reducing energy consumption.   SW3] Assessment of factual vision of the treatment plant in terms of reducing energy consumption.   SW4] Assessment of ability to assign environmental plant in terms of reducing energy consumption.   SW4] Assessment of ability to assign environmental plant in terms of reducing energy consumption.   SW4] Assessment of ability to assign environmental plant in terms of reducing energy consumption of the optimization and projects are computer model of a service and advantage and projects are considered as a service of the project of project of project of the project of the project of project of project of project of the project of project of the project of project of the project of the project of the project of the project of project of the pr		K7_W07	knowledge of technologies used for municipal wastewater	contained in written work and projects [SW1] Assessment of factual					
Wastewater treatment processes to analyze the functionality and projects the operation of the treatment plant in the function of the treatment plant in the functional plant in the function of the treatment plant in the functional plant in the		K7_W04	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	contained in written work and projects [SW1] Assessment of factual					
a simple environmental engineering system and select an appropriate optimization method. Prepare a computer model of a sewage treatment plant.		K7_W01	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	contained in written work and projects [SW1] Assessment of factual					
technical and economic performance of wastewater treatment systems using computer simulation.  1. Introduction to optimization. The concept of optimization and types of optimization problems. 2. Optimization in the decision-making process. Basic concepts: system, model, simulation, experiment4. General formulation of the optimization problems. Basic concepts: system, models. Examples of classic optimization problems. 6. Introduction to linear programming. Examples of classic optimization problems for its problems. 7. Examples of optimization problems in sanitary engineering systems (water supply and sewer systems)8. Examples of optimization problems in sanitary engineering systems (water supply and sewer systems)8. Examples of optimization problems in sanitary engineering systems (water supply and sewer systems)8. Examples of optimization problems in sanitary engineering systems (water supply and sewer systems)8. Examples of optimization problems in sanitary engineering systems (water supply and sewer systems)8. Examples of optimization problems in sanitary engineering systems (water supply and sewer systems)8. Examples of optimization method 10. Building a computer model of a wastewater treatment plant. Economic criteria for optimizing the operation of wastewater treatment plants.  Not applicable.  Subject passing criteria Passing threshold Percentage of the final grade 80.0% 5.0% 80.0%		K7_U07	a simple environmental engineering system and select an appropriate optimization method. Prepare a computer model of a	use methods and tools [SU1] Assessment of task fulfilment [SU2] Assessment of ability to					
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. Introduction to intera programming. Examples of classic optimization problems. Introduction to inear programming. Examples of classic optimization problems in sanitary engineering systems (water supply and sewer systems). Examples of optimization problems in sanitary engineering systems (water supply and sewer systems). Examples of optimization problems in sanitary engineering systems (water supply and sewer systems). Examples of optimization problems in sanitary engineering systems (water supply and sewer systems). Examples of optimization problems in sanitary engineering systems (water supply and sewer systems). Examples of optimization problems in sanitary engineering systems (water supply and sewer systems). Examples of optimization problems in sanitary engineering systems (water supply and sewer systems). Examples of optimization in experimental for optimization in experimental problems in sanitary engineering and plants. Economic criteria for optimization of wastewater treatment plants. Economic criteria for optimization optimization of wastewater treatment plants. Economic criteria for optimization of wastewater treatment plants. Economic criteria for optimization optimization in grammatic formation in grammatic for optimization in grammatic formation in grammatic formatic formation in grammatic formation in grammatic formatic formatic formation in grammatic formation in grammatic formatic		K7_U12	technical and economic performance of wastewater treatment systems using computer	fulfilment [SU4] Assessment of ability to use methods and tools [SU2] Assessment of ability to					
Assessment methods and criteria    Subject passing criteria   Passing threshold   Percentage of the final grade	Subject contents	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							
and criteria  80.0% 55.0% 80.0% 15.0%  Recommended reading  Basic literature  Geem, Z.W., Ayvaz, M.T. (2011). Optimization in Water & Environmental Engineering. W: Optimization in Civil & Environmental Engineering (ed. Z.W. Geem), Old City Publishing, Philadelphia, PA(USA).  Supplementary literature eResources addresses  Adresy na platformie eNauczanie:  Example issues/ example questions/ tasks being completed		Not applicable.							
and criteria  80.0% 55.0% 80.0% 80.0% 60.0%  Recommended reading  Basic literature  Geem, Z.W., Ayvaz, M.T. (2011). Optimization in Water & Environmental Engineering. W: Optimization in Civil & Environmental Engineering (ed. Z.W. Geem), Old City Publishing, Philadelphia, PA(USA).  Supplementary literature eResources addresses  Adresy na platformie eNauczanie:  Example issues/ example questions/ tasks being completed	Assessment methods	Subject passing criteria	Passing threshold	Percentage of the final grade					
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Geem, Z.W., Ayvaz, M.T. (2011). Optimization in Water & Environmental Engineering. W: Optimization in Civil & Environmental Engineering (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			60.0%	15.0%					
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Example issues/ example questions/ tasks being completed									
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Work placement Not applicable	Work placement	Not applicable							

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