



Subject card

Subject name and code	, PG_00061710						
Field of study	Environmental Engineering						
Date of commencement of studies	October 2025		Academic year of realisation of subject		2025/2026		
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	Part-time studies		Mode of delivery		at the university		
Year of study	1		Language of instruction		Polish		
Semester of study	1		ECTS credits		6.0		
Learning profile	general academic profile		Assessment form		exam		
Conducting unit	Department Of Sanitary Engineering -> Faculty Of Civil And Environmental Engineering -> Wydziały Politechniki Gdańskiej						
Name and surname of lecturer (lecturers)	Subject supervisor		dr inż. Ryszard Orłowski				
	Teachers						
Lesson types and methods of instruction	Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
	Number of study hours	25.0	0.0	15.0	0.0	0.0	40
	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	40		6.0		105.0	151
Subject objectives	The purpose of the subject is familiarization students with modern methods of design of construction and control of engineering systems when taking into consideration not only some classical design limitations but also optimization and reliability criteria. The other purpose is familiarization students with some general trends of optimal solutions in the area of sanitary engineering systems - knowledge for possible direct utilization in engineering practice.						
Learning outcomes	Course outcome		Subject outcome		Method of verification		
	K7_U12		The criteria for optimal solutions sought by the student are economic, technical or reliability in nature. All these aspects constitute the area in which the student is looking for the optimal solution.		[SU5] Assessment of ability to present the results of task [SU2] Assessment of ability to analyse information		
	K7_W07		Has in-depth, structured, theoretically based knowledge of the trends in optimal solutions of sanitary engineering systems.		[SW2] Assessment of knowledge contained in presentation [SW1] Assessment of factual knowledge		
	K7_W01		Has extended knowledge of mathematical/numerical methods for system optimization, decomposition and coordination of global optimization tasks.		[SW3] Assessment of knowledge contained in written work and projects [SW1] Assessment of factual knowledge		
	K7_W04		In the optimal design of engineering systems, he uses computer modeling of systems and the latest methods and technologies used in system control.		[SW3] Assessment of knowledge contained in written work and projects [SW2] Assessment of knowledge contained in presentation		
	K7_U07		When solving system optimization problems, the student uses, among others: computer simulations (modeling) of the structure or operation of the system.		[SU4] Assessment of ability to use methods and tools [SU1] Assessment of task fulfilment		

Subject contents	<p>LECTURES: Introduction; types of mathematical problems solved by the engineers with respect to systems. Optimal design. Classification of well known mathematical methods used in optimization. Mathematical problem of the analysis type; illustration of the problem for a case of the system of water supply (case of existing system and optimum design a new system by means of analysis of some design variants). The problem of global optimization of sewage system; multilevel optimization solved by the method of decomposition and coordination. Solving the problem at some separate levels, detailed problems. The problem of global optimization of Water Transport and Distribution. System (WTDS); multilevel optimization solved by the method as above. Solving the problem at some separate levels, detailed problems. The problem of optimum, reliable, computer aided dispatcher control of WTDS software (computational models, databases, GIS), environment (telemetry, Internet access). The task of a comprehensive computer-aided dispatcher control of WTDS mode of conduct and diagrams using appropriate hardware and software. Basis of the reliability theory and its appliance for the design of some engineering systems such as sewage and water supply systems. Questions of optimization and reliability in the problems of design and system analysis of spacing and location of storm overflows in the sewage combined system. Reliability problems in design of exemplary objects in outdoor networks of municipal infrastructure (e.g. pump stations, some passages of roadblocks). Reliability problems in design of Installations in building engineering.</p> <p>LABORATORY CLASSES: Solving practical problems from the area of optimization and reliability. The cases study are sanitary installation, sewage and water supply sustems.</p>		
Prerequisites and co-requisites	<p>Passed the basic programs of water supply systems and sewage systems. Passed the basic programs of organization of engineering labour. Basic knowledge of numerical methods; general knowledge of methods of solvig of sets of nonlinear equations.</p>		
Assessment methods and criteria	Subject passing criteria	Passing threshold	Percentage of the final grade
	Written exam	60.0%	70.0%
	Participating in lectures and laboratory exercises	60.0%	30.0%
Recommended reading	Basic literature	<p>1.Kowalik P.: Optymalizacja systemów inżynierii sanitarnej. skrypt, Politechnika Gdańska, Gdańsk, 1988r.</p> <p>2. Findeisen Wł.: Teoria i metody obliczeniowe optymalizacji. PWN, W-wa, 1980 r.</p> <p>3. Praca zbiorowa (pod red. Wł. Findeisena): Analiza systemowa podstawy i metodologia. PWN, W-wa, 1980 r.</p> <p>4. Biedugnis S., Miłaszewski R.: Metody optymalizacyjne w wodociągach i kanalizacji. PWN, W-wa, 1993r.</p> <p>5. Biedugnis S., Cholewiński J.: Optymalizacja gospodarki odpadami. PWN, W-wa, 1992 r.</p> <p>6. Wieczysty A.: Niezawodność systemów wodociągowo - kanalizacyjnych. skrypt, Politechnika Krakowska, Kraków, 1990 r.</p>	
	Supplementary literature	<p>Szymkiewicz R.: Metody numeryczne w inżynierii wodnej, Wydawnictwo Politechniki Gdańskiej, Gdańsk, 2007</p> <p>JAN STUDZISKI, Instytut Badań Systemowych REINHARD STRAUBELREUS GmbH, Berlin OPTYMALIZACJA I STEROWANIE MIEJSKIEJ SIECI WODOCIĄGOWEJ NA PODSTAWIE MODELI MATEMATYCZNYCH</p> <p>Sławczo DENCZEW NIEZAWODNOŚĆ, BEZPIECZEŃSTWO I RYZYKO SYSTEMÓW EKSPLOATACJI WODOCIĄGÓW W ASPEKCIE INFRASTRUKTURY KRYTYCZNEJ</p> <p>Roman MIELCAREK OPTYMALIZACJA KOSZTÓW PRZEPOMPOWNI ŚCIEKÓW</p>	
	eResources addresses	Adresy na platformie eNauczanie:	

Example issues/ example questions/ tasks being completed	<p>The problem of global optimization of sewerage system.</p> <p>The problem of optimization of gravitational-pressure system of effluent transport.</p> <p>The problem of global optimization of water transport and distribution system for water-supply; networks of different shapes.</p> <p>Optimal and reliable, computer aided decision-maker control of the system of water transport and distribution.</p>
Work placement	Not applicable

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