GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	, PG_00061710		
Field of study	Environmental Engineering		
Date of commencement of studies	October 2026	Academic year of realisation of subject	2026/2027
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 -> Faculties of Gdańsk University of Technology		
Name and surname of lecturer (lecturers)	Subject supervisor	prof. dr hab. inż. Jacek Mąkinia	
	Teachers		

Lesson types

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_U07	When solving system optimization problems, the student uses, among others: computer simulations (modeling) of the structure or operation of the system.	[SU1] Assessment of task fulfilment [SU4] Assessment of ability to use methods and tools
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.	[SW2] Assessment of knowledge contained in presentation [SW3] Assessment of knowledge contained in written work and projects
K7_W01	Has extended knowledge of mathematical/numerical methods for system optimization, decomposition and coordination of global optimization tasks.	[SW1] Assessment of factual knowledge [SW3] Assessment of knowledge contained in written work and projects
K7_W07	Has in-depth, structured, theoretically based knowledge of the trends in optimal solutions of sanitary engineering systems.	[SW1] Assessment of factual knowledge [SW2] Assessment of knowledge contained in presentation
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.	[SU2] Assessment of ability to analyse information [SU5] Assessment of ability to present the results of task

Subject contents	Course content – lecture 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. LABORATORY CLASSES: Solving practical problems from the area of optimization and reliability. The cases study are sanitary installation, sewage and water supply sustems.
Prerequisites and co-requisites	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 nonlineary equations.

Assessment methods and criteria

Subject passing criteria	Passing threshold	Percentage of the final grade
Participating in lectures and laboratory exercises	60.0%	30.0%
Written exam	60.0%	70.0%

Recommended reading

Basic literature	1.Kowalik P.: Optymalizacja systemów inżynierii sanitarnej. skrypt, Politechnika Gdańska, Gdańsk, 1988r. 2. Findeisen Wł.: Teoria i metody obliczeniowe optymalizacji. PWN, W-wa, 1980 r. 3. Praca zbiorowa (pod red. Wł. Findeisena): Analiza systemowa podstawy i metodologia. PWN, W-wa, 1980 r. 4. Biedugnis S., Miłaszewski R.: Metody optymalizacyjne w wodociągach i kanalizacji. PWN, W-wa, 1993r. 5. Biedugnis S., Cholewiński J.: Optymalizacja gospodarki odpadami. PWN, W-wa, 1992 r. 6. Wieczysty A.: Niezawodność systemów wodociągowo - kanalizacyjnych. skrypt, Politechnika Krakowska, Kraków, 1990 r.
Supplementary literature	Szymkiewicz R.: Metody numeryczne w inżynierii wodnej, Wydawnictwo Politechniki Gdańskiej, Gdańsk, 2007 JAN STUDZISKI, Instytut Badań Systemowych REINHARD STRAUBELREUS GmbH, Berlin **OPTYMALIZACJA I STEROWANIE MIEJSKIEJ SIECI WODOCIĄGOWEJ NA PODSTAWIE MODELI MATEMATYCZNYCH** Sławczo DENCZEW **NIEZAWODNOŚĆ, BEZPIECZEŃSTWO I RYZYKO SYSTEMÓW EKSPLOATACJI WODOCIAGÓW W ASPEKCIE INFRASTRUKTURY KRY T YCZNEJ** Roman MIELCAREK **OPTYMALIZACJA KOSZTÓW PRZEPOMPOWNI ŚCIEKÓW**
eResources addresses	

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

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