GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	MODELING IN SANITARY ENGINEERING, PG_00061717		
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	Optional subject group 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	3.0
Learning profile	general academic profile	Assessment form	assessment
Conducting unit	Department of Geotechnical and Hydraulic Engineering -> Faculty of Civil and Environmental Engineering -> Faculties of Gdańsk University of Technology		
Name and surname of lecturer (lecturers)	Subject supervisor	dr hab. inż. Piotr Zima	
	Teachers		

Lesson types

Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
Number of study hours	15.0	0.0	10.0	0.0	0.0	25

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	25	3.0	52.0	80

Subject objectives

Mastering the basics of mathematical modeling and basic numerical techniques used in sanitary engineering. Practical aspects of modeling in sanitary engineering.

Learning outcomes

Course outcome	Subject outcome	Method of verification
K7_W01	The student formulates the problem of solving differential equations with ordinary and partial derivatives describing selected problems in the field of sanitary engineering. It describes the solution of an engineering problem using a structural algorithm. Uses basic numerical methods to solve problems. He knows how to take into account practical aspects at this stage of modeling.	[SW1] Assessment of factual knowledge
[K7_W12] has knowledge of contemporary and useful principles on data acquisition, filtration, processing and analysis	The student is able to obtain information on the development of numerical methods used in sanitary engineering and is able to apply them in practice.	[SW1] Assessment of factual knowledge
K7_U06	Student is able to formulate a problem in the field of mathematical description of the phenomenon and select the appropriate numerical or analytical methods to solve it on a practical level	[SU4] Assessment of ability to use methods and tools [SU2] Assessment of ability to analyse information
[K7_U05] can rely on scientific sources for modern methods and technologies, and propose trends in the development of methods and rules for acquiring, filtering, processing and analyzing data	The student is able to obtain information on the development of numerical methods used in sanitary engineering. He knows the practical aspect of their use.	[SU4] Assessment of ability to use methods and tools [SU2] Assessment of ability to analyse information

<table>
<tr><td>Subject contents</td><td>Course content – lecture
LECTURE

Solving systems of algebraic linear equations. Methods for solving nonlinear equations and systems of nonlinear equations. Interpolation and approximation. Solving ordinary differential equations: initial problem and boundary problem. Methods of numerical solution of the initial problem: single-step methods, explicit and implicit multi-step methods. Solving systems of ordinary differential equations. Solving differential equations with partial derivatives. Classification of equations. Formulating a problem solution. Finite difference method, approximation of first and second order derivatives.

LABORATORY

Solving ordinary differential equations describing selected issues in the field of sanitary engineering. Practical aspect of modeling - simulation of rainwater outflow in the HEC-RAS program</td></tr>
<tr><td>Prerequisites and co-requisites</td><td>Knowledge of basic computer operation and operating system. Knowledge of subjects: Mathematics, Fundamentals of computer science and Hydraulics.</td></tr>
<tr><td>Assessment methods and criteria</td><td><table>
<tr><th>Subject passing criteria</th><th>Passing threshold</th><th>Percentage of the final grade</th></tr>
<tr><td></td><td>60.0%</td><td>50.0%</td></tr>
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<tr><td>Recommended reading</td><td><table>
<tr><td>Basic literature</td><td>1. Szymkiewicz R.: Matematyczne modelowanie przepływów w rzekach i kanałach, Wyd. Naukowe PWN Warszawa 2000.

2. Szymkiewicz R.: Metody numeryczne w inżynierii wodnej. Wyd. Politechniki Gdańskiej, 2012.</td></tr>
<tr><td>Supplementary literature</td><td>1. FortunaZ., Macukow B., Wąsowski J,: Metody numeryczne. WNT Warszawa 1982.</td></tr>
<tr><td>eResources addresses</td><td></td></tr>
</table></td></tr>
<tr><td>Example issues/ example questions/ tasks being completed</td><td>List exact methods for solving systems of linear equations.

Describe Newton's method for solving a single nonlinear equation and systems of nonlinear equations.

Describe the Runge-Kutta method

Discuss the basics of the finite difference method

Describe the finite-difference solution of the transport equation with an implicit scheme

Describe the preparation of input data for the HEC-RAS program</td></tr>
<tr><td>Practical activites within the subject</td><td>Not applicable</td></tr>
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