GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	NUMERICAL MODELING OF HYDROSYSTEMS, PG_00060008		
Field of study	Environmental Engineering		
Date of commencement of studies	October 2023	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	2	Language of instruction	English
Semester of study	3	ECTS credits	4.0
Learning profile	general academic profile	Assessment form	assessment
Conducting unit	Department of Geotechnical and Hydraulic Engineering -> Faculty of Civil and Environmental Engineering		
Name and surname of lecturer (lecturers)	Subject supervisor	dr hab. inż. Michał Szydłowski	
	Teachers	dr hab. inż. Michał Szydłowski prof. dr hab. inż. Adam Szymkiewicz	

Lesson types and methods of instruction

Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
Number of study hours	30.0	15.0	15.0	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	38.0	103

Subject objectives

The course provides students with knowledge on development and application of numerical models for water flow problems.

Learning outcomes

Course outcome	Subject outcome	Method of verification
K7_W01	The student has knowledge of the advantages and limitations of selected mathematical models of water flow. The student knows the mathematical description of the phenomena of migration of pollutants in groundwater and has basic knowledge of numerical methods used to solve transport equations.	[SW1] Assessment of factual knowledge
K7_U06	The student is able to select appropriate numerical tools for modeling the flow and transport of pollutants in aquatic systems and analyze the results. The student is able to simulate the transport of conservative pollutants in an aquifer for simple initial boundary conditions,	[SU4] Assessment of ability to use methods and tools
K7_W09	The student has knowledge of flow stream interactions between different water systems such as surface water and groundwater.	[SW1] Assessment of factual knowledge
K7_W06	The student has knowledge of the basic principles of describing the movement of fluids in hydro-systems.	[SW1] Assessment of factual knowledge

<table>
<tr><td>Subject contents</td><td>Lecture: Role of computer tools in water resources management; mathematical models of flow and contaminant transport in hydrosystems, development of numerical model: preprocessing, simulation and postprocessing; verification, validation and calibration of the model, sensitivity analysis; numerical solution of partial differential equations: spatial discretization methods (finite difference, finite element, finite volume), time discretization methods (explicit and implicit schemes), solution of systems of linear and nonlinear algebraic equations; stability and accuracy of numerical methods, boundary conditions; solution strategies for coupled problems.

Tutorials/ Laboratory: Application examples: formulation of the problem, preparing input data, problem solution using freely available numerical codes, visualization of the results.</td></tr>
<tr><td>Prerequisites and co-requisites</td><td>no requirements</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>Presentation of completed modeling exercises</td><td>50.0%</td><td>100.0%</td></tr>
</table></td></tr>
<tr><td>Recommended reading</td><td><table>
<tr><td>Basic literature</td><td>Szymkiewicz R., Numerical modeling in open channel hydraulics.

Rushton K.R., Groundwater hydrology: conceptual and computational models.

Wang H., Anderson M.P., Introduction to groundwater modeling: finite difference and finite element methods.</td></tr>
<tr><td>Supplementary literature</td><td>MODFLOW software documentation http://water.usgs.gov/nrp/gwsoftware/modflow2005/modflow2005.html

HEC-RAS River Analysis System, Hydraulic Reference Manual, US Army Corps of Engineers, Davis 1997.

MT3DMS software documentation: https://hydro.geo.ua.edu/mt3d/mt3dmanual.pdf</td></tr>
<tr><td>eResources addresses</td><td>Adresy na platformie eNauczanie:</td></tr>
</table></td></tr>
<tr><td>Example issues/ example questions/ tasks being completed</td><td>Modeling of water flow in open channels.

Modeling of ground water flow.</td></tr>
<tr><td>Work placement</td><td>Not applicable</td></tr>
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