



Subject card

Subject name and code	Modeling Methodologies for the Environment, PG_00060001						
Field of study	Environmental Engineering						
Date of commencement of studies	February 2024		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	1		Language of instruction		English		
Semester of study	2		ECTS credits		5.0		
Learning profile	general academic profile		Assessment form		exam		
Conducting unit	Faculty of Civil and Environmental Engineering						
Name and surname of lecturer (lecturers)	Subject supervisor		dr hab. inż. Piotr Zima				
	Teachers						
Lesson types and methods of instruction	Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
	Number of study hours	30.0	30.0	0.0	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	Understanding the processes that affect the migration and transformation of pollutants in the environment (with particular emphasis on surface waters). Classes relate to the basics and principles of building water quality models and are used to show how these models can be used to solve problems in environmental engineering.						

Learning outcomes	Course outcome	Subject outcome	Method of verification
	K7_W01	The student is able to apply basic knowledge of statistics, optimization and numerical methods necessary to describe, analyze or model phenomena related to the migration of pollutants in water.	[SW1] Assessment of factual knowledge
	K7_W04	The student has broadened and deepened knowledge in the field of automation, including solving complex engineering tasks modeling, optimization and process control.	[SW1] Assessment of factual knowledge
	K7_W06	The student knows and understands methods for modeling the transport and transformation of pollutants characteristic of water supply and sewage networks, as well as the optimization and reliability of wastewater treatment systems.	[SW1] Assessment of factual knowledge
	K7_U06	The student is able to develop a functional method to describe the processes of pollutant migration and their removal in problems related to water and sewage treatment and sewage sludge processing.	[SU4] Assessment of ability to use methods and tools
	K7_U11	The student is able to formulate and solve design or research tasks in environmental modeling, modeling the behavior of water in natural and artificial systems, migration of pollutants and description of self-purification processes. Knows the impact of these processes on economic conditions.	[SU2] Assessment of ability to analyse information
Subject contents	<p>Lecture Control volumes and mass balances. Systems with full and incomplete mixing. Advection/dispersion transport. Kinematic mixing. Chemical equilibrium and mass behavior. Chemical kinetics and partitioning. Gas exchange at the air-water interface. Sedimentation. Biodegradation and kinetics of microbial growth. Preservation of dissolved oxygen. Eutrophication and heat budget. Migration of pollutants in rivers, lakes and estuaries. Water quality models (WASP, QUAL2K, Aquatox, EPD-RIV1, IWA RWQM No. 1). Tutorials Analytical solutions of advection-diffusion equations for various boundary conditions - exercises in Excel. Group project on modeling of wastewater flow through the bioreactor - ASM 2d model</p>		
Prerequisites and co-requisites	Knowledge of basic numerical methods		
Assessment methods and criteria	Subject passing criteria	Passing threshold	Percentage of the final grade
	final test (60 min)	50.0%	80.0%
	exercises to be carried out at home	50.0%	20.0%
Recommended reading	Basic literature	Chapra, S. (1997). <i>Surface Water Quality Modeling</i> , McGraw Hill or (Waveland Press, 2008).	

	Supplementary literature	<p>Thomann R.V. and Mueller J.A. (1987). <i>Principles of Surface Water Quality Modeling and Control</i>. Harper & Row Publ.</p> <p>Sawicki J.M., <i>Migracja zanieczyszczeń</i>, Wyd. PG, Gdańsk 2003.</p> <p>Adamski W., <i>Modelowanie systemów oczyszczania wód</i>, PWN, Warszawa 2002.</p>
	eResources addresses	Adresy na platformie eNauczenie:
Example issues/ example questions/ tasks being completed	<ol style="list-style-type: none"> 1. Advantages and disadvantages of computer simulation 2. Model describing the growth of microorganisms and consumption of substrate 3. Equations describing the sedimentation process 4. Streeter-Phelps equation 5. A model describing the eutrophication process in the aquatic environment 	
Work placement	Not applicable	