GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	Modeling Methodologies for the Environment, PG_00060001		
Field of study	Environmental Engineering		
Date of commencement of studies	February 2023	Academic year of realisation of subject	2023/2024
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	dr hab. inż. Piotr Zima prof. dr hab. inż. Jacek Mąkinia	

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_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
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_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_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_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

Subject contents

LectureControl 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).TutorialsAnalytical solutions of advection-diffusion equations for various boundary conditions - excercises in Excel. Group project on modeling of wastewater flow through the bioreactor - ASM 2d model

Prerequisites and co-requisites

Knowledge of basic numerical methods

Assessment methods and criteria

Subject passing criteria	Passing threshold	Percentage of the final grade
exercises to be carried out at home	50.0%	20.0%
final test (60 min)	50.0%	80.0%

Recommended reading

Basic literature

Chapra, S. (1997). *Surface Water Quality Modeling*, McGraw Hill or (Waveland Press, 2008).

	Supplementary literature	Thomann R.V. and Mueller J.A. (1987). *Principles of Surface Water Quality Modeling and Control*. Harper & Row Publ. Sawicki J.M., *Migracja zanieczyszczeń*, Wyd. PG, Gdańsk 2003. Adamski W., *Modelowanie systemów oczyszczania wód*, PWN, Warszawa 2002.
	eResources addresses	Adresy na platformie eNauczanie:
Example issues/ example questions/ tasks being completed	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	