GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	Fluid Mechanics and Hydraulics, PG_00038243						
Field of study	Environmental Engineering						
Date of commencement of studies	October 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	1		ECTS credits		5.0		
Learning profile	general academic profile		Assessment form		exam		
Conducting unit	Department of Hydraulic Engineering -> 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	15.0	0.0	0.0	75
	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	75		5.0	45.0		125
Subject objectives	Acquainting with the basic laws of mechanics related to fluid movement. Basic concepts and terminology, main laws leading to general equations of fluid movement and to turbulent motion equations. Presentation of many practical aspects from the use of fluid mechanics and CFD in practice. Hydraulic issues are discussed as practical issues - basic hydrostatic relations, Bernoulli equation, uniform motion in open channels, slow and fast-changing motion and filtration. Solutions for practical tasks that take into account different aspects of flows						

Learning outcomes	Course outcome	Subject outcome	Method of verification
	[K7_W06] has deepened, structured and theoretical knowledge related to hydraulics used in the construction, operation, operation of networks and plumbing, sewage, heating, ventilation or water treatment plants and wastewater treatment facilities	Student recognizes phenomena and laws governing the flow of liquids and gases, applies knowledge of fluid mechanics and hydraulics in the design of facilities and devices serving environmental engineering. He applies methods of dimensioning of pipelines, ventilation systems, open channels, transfers and devices related to wastewater treatment and groundwater filtration.He can use knowledge in practice	[SW1] Assessment of factual knowledge
	[K7_U06] can use the known mathematical methods and models, if needed, to modify them, for: analysis and design of water systems and their components or water flows, migration of pollutants or water and wastewater treatment and sewage sludge handling	Student is able to use the known methods and mathematical models - if necessary, modifying them - (depending on the specialty) to analyze and design elements, systems and water supply systems; water flows, migration of pollutants; water and wastewater treatmen. He can use knowledge in practice	[SU2] Assessment of ability to analyse information [SU4] Assessment of ability to use methods and tools
	[K7_W01] has broadened and deepened knowledge of selected mathematics sections, including statistics components and optimization methods, and mathematical and numerical methods necessary for: 1) modeling and analysis of water supply systems and their physical phenomena; 2) description and analysis of flood protection systems; 3) functional analysis, optimization and reliability of sanitary engineering systems; 4) description of phenomena related to the flow of water in the environment, in pipes and open channels, filtration, migration of pollutants	Student has broadened and deep knowledge in some areas of mathematics, including methods for modeling water behavior in natural and artificial systems	[SW1] Assessment of factual knowledge
	[K7_W09] has deepened, ordered, theoretically developed knowledge related to: hydrology, drainage, water management, flood protection or resource and water intake or water and sewage management	Student has knowledge of the basics of fluid mechanics, hydraulics and hydromechanics. He can use it in practice.	[SW1] Assessment of factual knowledge
	[K7_U09] can choose tools (analytical or numerical) to solve engineering problems	Student is able to use the methods and mathematical models learned - if necessary modifying them - (depending on the specialty) to solve engineering problems in the field of water flows. He can use the presented models in practice.	[SU4] Assessment of ability to use methods and tools

Subject contents	Basic definitions. Physical properties of liquids. Forces acting on fluids. Hydrostatics - basic equations. Pressure on a flat and curved wall. Buoyancy. Archimedes' law. Balance of submerged bodies. The balance of floating bodies. Hydrodynamics. Hydrodynamic quantities. Continuity equation for the liquid stream. Bernoulli equation. Basic laws of hydrodynamics. Equation of mass behavior, preservation of the amount of motion, Bernoulli's equation for the real liquid stream. Hydrodynamic reaction and hydrodynamic pressure. Real liquid flow. Reynolds experience. Resistance of motion in monolithic laminar traffic. Speed distribution in laminar motion. Speed distribution in turbulent traffic. Liquid flow in pipes under pressure. Practical calculation of pipelines. Losses on length and local losses. Examples of determining local losses. Liquid flow in open channels. Uniform motion. Solving flow problems in open channels. Hydraulically the most advantageous shape of the trough. Natural and composite beds. Critical movement. Non-uniform motion fixed in open channels. Slow-changing traffic. The curve of accumulation and depression. High-speed movement. Hydraulic jump. Liquid flow through openings, overflows and culverts. Fixed outflow. Transfers and passes. Unsteady flow. Outflow of water from the tank. Hydraulic hit. Ground water movement. Properties of the ground, Darcy's law. Slow-changing flow, assumptions of Dupuit. Axia-symmetrical inflow to the well. Inlet to the artesian well. Wells team. Inlet to the ditch and drain. Discussion of practical aspects in relation to the presented equations, mathematical models and solutions.
Prerequisites and co-requisites	Knowledge in the subject of mathematics and physics

<table>
<tr><td>Assessment methods and criteria</td><td colspan="2"><table><tr><th>Subject passing criteria</th><th>Passing threshold</th><th>Percentage of the final grade</th></tr><tr><td>test</td><td>60.0%</td><td>100.0%</td></tr></table></td></tr>
<tr><td rowspan="3">Recommended reading</td><td>Basic literature</td><td>1. Massey B.; Ward-Smith J.: Mechanics of Fluids (1st-8th ed.), Taylor & Francis,

2. White F. M.: Fluid Mechanics (1st-4th ed.), McGraw-Hill,

3. Chadwick A., Morfett C.: Hydraulics in Civil and Environmental Engineering (1st-4th ed.), E & Fn Spon,

4. Chow V. T.: Open Channel Hydraulics, McGraw-Hill Book Company.</td></tr>
<tr><td>Supplementary literature</td><td>lack</td></tr>
<tr><td>eResources addresses</td><td>Adresy na platformie eNauczanie:</td></tr>
<tr><td>Example issues/ example questions/ tasks being completed</td><td colspan="2">What are the properties of liquids

Formula called Newton's hypothesis

Formula of mass conservation law for steady compressible fluid motion

Formula of the Navier-Stokes equation for an incompressible and inviscid fluid

Define a streamline.

Describe aspects of the practical use of fluid mechanics and CFD.</td></tr>
<tr><td>Work placement</td><td colspan="2">Not applicable</td></tr>
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