GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	Fluid Mechanics and Hydraulics, PG_00060059						
Field of study	Environmental Engineering						
Date of commencement of studies	February 2024		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	1		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	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_W09	The student has knowledge of the basics of fluid mechanics, hydraulics and hydromechanics. He can use it in practice.	[SW1] Assessment of factual knowledge
K7_W01	The student has broadened and deepened knowledge in some areas of mathematics, including methods for modeling the behavior of water in natural and artificial systems	[SW1] Assessment of factual knowledge
K7_W06	The student recognizes the phenomena and laws governing the flow of liquids and gases, applies knowledge in the field of fluid mechanics and hydraulics in the design of objects and devices for environmental engineering. Applies methods of dimensioning pipelines, ventilation systems, open troughs, overflows and devices related to wastewater treatment and water filtration in the ground. He can apply his knowledge in practice	[SW1] Assessment of factual knowledge
K7_U06	The student is able to use the known mathematical methods and models - if necessary modifying them accordingly - (depending on the specialty) for the analysis and design of elements, systems and water supply systems; water flows, pollutant migration; water and wastewater treatment. He can apply his knowledge in practice	[SU2] Assessment of ability to analyse information [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

Assessment methods and criteria

Subject passing criteria	Passing threshold	Percentage of the final grade
test	60.0%	100.0%

Recommended reading

Basic literature	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.
Supplementary literature	lack
eResources addresses	Adresy na platformie eNauczanie:

Example issues/ example questions/ tasks being completed	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.
Work placement	Not applicable