



Subject card

Subject name and code	Introduction to Fluid Mechanics, PG_00071926						
Field of study	Circular economy and water management						
Date of commencement of studies	October 2026		Academic year of realisation of subject		2026/2027		
Education level	second-cycle studies		Subject group		Obligatory subject group 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		3.0		
Learning profile	general academic profile		Assessment form		exam		
Conducting unit	Department of Geotechnical and Hydraulic Engineering -> Faculty of Civil and Environmental Engineering -> Faculties of Gdańsk University of Technology						
Name and surname of lecturer (lecturers)	Subject supervisor		dr hab. inż. Tomasz Kolerski				
	Teachers		dr Natalia Lipiejko dr hab. inż. Tomasz Kolerski				
Lesson types	Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
	Number of study hours	15.0	15.0	15.0	0.0	0.0	45
	E-learning hours included: 0.0						
	eNauczanie source address: https://enauczanie.pg.edu.pl/2025/course/view.php?id=8393						
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	45		5.0		25.0	75
Subject objectives	The aim of the subject is to introduce students to the fundamental principles of fluid mechanics and their application to the analysis and design of hydraulic systems. The subject covers the behaviour of fluids at rest and in motion, including hydrostatic pressure, pipe flow, energy losses, open-channel flow, and the basic principles governing hydraulic structures and devices. The knowledge gained provides a foundation for the analysis and design of engineering systems involving fluid flow.						

Learning outcomes	Course outcome	Subject outcome	Method of verification
	[K7_U01] searches for, selects, and interprets information in a comprehensive manner in the fields of water management and the circular economy, using reliable scientific sources, standards, regulations, and technical documentation.	The student searches for, selects, and interprets information related to fluid mechanics and hydraulic engineering using reliable scientific sources, standards, regulations, and technical documentation, and applies this information to the analysis of engineering problems involving fluid flow.	[SU4] Assessment of ability to use methods and tools
	[K7_W01] identifies in a comprehensive manner the phenomena and processes related both to water management and the circular economy, including the cycles of water, energy, and materials, as well as their connections with environmental and technical systems, while indicating reliable sources of knowledge and information relevant to the analyzed issues.	The student identifies and explains fundamental phenomena and processes in fluid mechanics, including the behaviour of fluids at rest and in motion, energy transformations, and the relationships between fluid flow and hydraulic and environmental systems, using reliable sources of knowledge and information.	[SW1] Assessment of factual knowledge
	[K7_W04] analyzes complex problems related to water resources management and the implementation of circular solutions in a comprehensive manner, relying on reliable data and appropriately selected methods, and formulates logical conclusions and recommendations.	The student analyses fluid mechanics problems based on tutorial calculations and laboratory experiments, particularly those related to fluid properties, fluid statics, the Bernoulli equation, pipe flow, energy losses, Reynolds number, and open-channel flow. The student selects appropriate analytical methods, interprets measurement and calculation results, and formulates logical conclusions concerning the behaviour of hydraulic systems.	[SW1] Assessment of factual knowledge [SW3] Assessment of knowledge contained in written work and projects

Subject contents	Course content – lecture		
	Introduction to fluid mechanics: characteristics of fluids, basic properties of liquids and gases, dimensions and units, mass and weight, viscosity, and compressibility. Dimensional analysis and physical modelling: Buckingham π theorem, determination of dimensionless groups, common dimensionless numbers used in fluid mechanics, and principles of similitude.		
	Fluid statics: pressure at a point and pressure distribution in fluids, pressure measurement, hydrostatic forces on plane and curved surfaces, buoyancy, flotation, and stability.		
	Fluid dynamics: equations of fluid motion, application of Newton’s second law, the Bernoulli equation and its engineering applications, flow-rate measurement, energy grade line and hydraulic grade line. Fluid kinematics: velocity and acceleration fields.		
	Viscous flow in pipes: characteristics of internal flow, laminar and turbulent flow, fully developed flow, energy losses, and application of dimensional analysis to pipe flow.		
	Flow over immersed bodies: basic characteristics of boundary layers, drag and lift.		
	Open-channel flow: general characteristics of free-surface flow, flow energy, uniform flow, gradually and rapidly varied flow, hydraulic jump, and flow over sharp-crested and broad-crested weirs.		
	Course content – exercises		
	Tutorials focus on the practical application of fundamental relationships and calculation methods in fluid mechanics. They include problems related to fluid properties, physical dimensions and units, and the application of dimensional analysis.		
	In fluid statics, students solve problems concerning pressure distribution, pressure measurement, hydrostatic forces on plane and curved surfaces, buoyancy, flotation, and stability.		
	In fluid dynamics, calculations are performed using the Bernoulli equation, energy balance, and methods for determining flow rate. Tutorials also include the analysis of fluid velocity and acceleration fields.		
	Viscous pipe flow is analysed with respect to laminar and turbulent regimes, energy losses, and basic hydraulic relationships used in pipe-flow calculations. Problems concerning flow over immersed bodies, including drag and lift, are also considered.		
	For open-channel flow, tutorials cover flow energy, uniform flow, gradually and rapidly varied flow, hydraulic jump, and flow over sharp-crested and broad-crested weirs.		
	Course content – laboratory		
	Laboratory classes include experimental investigation of fundamental fluid mechanics phenomena and comparison of measured results with theoretical relationships.		
	The laboratory programme includes determination of fluid kinematic viscosity as a function of temperature, flow-rate measurement using a Venturi nozzle, investigation of energy losses in pipe systems, and analysis of flow resistance.		
	For free-surface flows, experiments include investigation of the hydraulic jump and flow over sharp-crested and broad-crested weirs.		
	During laboratory classes, students perform measurements, process and analyse experimental data, compare results with theoretical values, assess measurement uncertainty and discrepancies, and formulate conclusions concerning the observed hydraulic phenomena.		
	Prerequisites and co-requisites		
	Assessment methods and criteria		
Subject passing criteria		Passing threshold	Percentage of the final grade
Test (tutorials)		55.0%	30.0%
Laboratory reports		55.0%	30.0%
Exam		55.0%	40.0%

Recommended reading	Basic literature	Young, D.F., Munson, B.R., Okiishi, T.H., Huebsch, W.W., <i>A Brief Introduction to Fluid Mechanics</i> , 5th ed., John Wiley & Sons, 2010. (or later edition)
		Mays, L.W., <i>Water Resources Engineering</i> , 3rd ed., John Wiley & Sons, 2019
	Supplementary literature	
	eResources addresses	
Example issues/ example questions/ tasks being completed	<p>T: What pressure in MPa must be applied to water to reduce its volume by 3% under standard sea level atmospheric conditions?</p> <p>L: Discuss the fundamental principles of turbomachinery operation and the factors affecting its efficiency and operating conditions.</p>	
Practical activities within the subject	Not applicable	

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