GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	Fluid Mechanics and Hydraulics I, PG_00059019		
Field of study	Environmental Engineering		
Date of commencement of studies	October 2024	Academic year of realisation of subject	2025/2026
Education level	first-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	Part-time studies	Mode of delivery	at the university
Year of study	2	Language of instruction	Polish
Semester of study	3	ECTS credits	4.0
Learning profile	general academic profile	Assessment form	exam
Conducting unit	Faculty of Civil and Environmental Engineering -> Wydziały Politechniki Gdańskiej		
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	0.0	0.0	0.0	0.0	30

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	30	0.0	70.0	100

Subject objectives: Acquiring knowledge of the basic problems of hydrostatics, flow in pips and open channel flow.

Learning outcomes

Course outcome	Subject outcome	Method of verification
[K6_U02] can work individually and in a team; knows how to estimate the time needed to complete the task ordered; is able to develop and implement a work schedule that ensures deadlines	The student performs the group tasks in the assumed period	[SU3] Assessment of ability to use knowledge gained from the subject
[K6_W14] knows and understands the methods of measuring basic quantities characteristic for fluid mechanics and hydraulics, hydrology; knows the calculation methods and IT tools necessary to analyze the results of laboratory and field work	The student knows and understands methods of measuring basic quantities characteristic of fluid mechanics and hydraulics	[SW1] Assessment of factual knowledge
[K6_W05] knows the theoretical basis of hydromechanics and its practical models, necessary to solve technical problems in the field of environmental engineering (sanitary engineering, water melioration, water management and flood protection, pollution spread)	The students solve and analyze the problems of hydrostatics and hydrodynamics. The students calculate the basic hydraulic parameters and learns design methodology for: pipes, open channels and weirs. The students solve the problems for filtration in porous medium.	[SW1] Assessment of factual knowledge
[K6_K01] can think and act in a creative and enterprising way; can set priorities for the implementation of an individual or group task; understands the need for continuous training and professional responsibility for their activities and team	The student performs the group tasks in the assumed period. The student analyzes the information and makes decisions related to the selected engineering problems.	[SK2] Assessment of progress of work

Subject contents	Basic definitions. Physical properties of fluids. Forces acting in fluids. Hydrostatics basic equations. Pressure on a flat and curved wall. Buoyancy. Archimedes' law. Equilibrium of immersed bodies. Balance of floating bodies. Hydrodynamics. Hydrodynamic quantities. Continuity equation for a liquid stream. Bernoulli's equation. Basic laws of hydrodynamics. Equation of conservation of mass, conservation of quantity of motion, Bernoulli's equation for a real fluid stream. Hydrodynamic reaction and hydrodynamic pressure. Real fluid flow. Reynolds experience. Resistance to motion in uniform laminar motion. Velocity distribution in laminar motion. Velocity distribution in turbulent motion. Liquid flow in lines under pressure. Practical pipeline calculations. Length and local losses. Examples of determining local losses. Liquid flow in open troughs. Uniform movement. Solving flow problems in open channels. Hydraulically the most advantageous shape of the trough. Natural and complex channels. Critical movement. Uneven movement established in open channels. Slow-changing motion. Curve of accumulation and depression. Quick-change movement. Hydraulic jump. Liquid flow through holes, overflows and culverts. Steady flow. Overflows and culverts. Unsteady flow. Water flow from the tank. Water hammer. Groundwater movement. Properties of land, Darcy's law. Slowly changing flow, Dupuit's assumptions. Axisymmetric inflow to the well. Inflow to an artesian well. Well complex. Inflow to the ditch.
Prerequisites and co-requisites	Acquiring knowledge of the basic problems of hydrostatics, flow in pips and open channel flow.

Assessment methods and criteria

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

Recommended reading

Basic literature	Jaworska B., Szuster A., Utrysko B.: *Hydraulika i hydrologia*, Oficyna Wydawnicza Politechniki Warszawskiej, Warszawa 2008. Kubrak E., Kubrak J.: *Hydraulika techniczna. Przykłady obliczeń*, SGGW, Warszawa 2004; Mitosek M., Matlak M., Kodura A.: *Zbiór zadań z hydrauliki dla inżynierii i ochrony środowiska*, Oficyna Wydawnicza Politechniki Warszawskiej, Warszawa 2008. Sawicki M.J.: *Mechanika Przepływów,* Wydawnictwo PG, Gdańsk 2009.
Supplementary literature	Czetwertyński E., Utrysko B.: *Hydraulika i hydromechanika*, PWN, Warszawa 1968; Gryboś P.: *Podstawy mechaniki płynów*, PWN, Warszawa 1989; Puzyrewski R., Sawicki J.: *Podstawy mechaniki płynów i hydrauliki*, PWN, Warszawa 1999;
eResources addresses	

Example issues/ example questions/ tasks being completed	1). What is the property of fluids manifested in the formation of resistance during the flow of liquids in open pipes and under pressure?2). Discuss the problems that the designer may encounter when designing sewage and water pipes.3) Make a design calculation of the wall of the tank filled with water.4). Discuss the problem of hydrostatic pressure and hydrodynamic pressure.5). Using the Bernoulli equation for a real liquid as a tool for designing open and pressurized pipes.6). Under what flow conditions (turbulent or laminar) we perform design calculations.7) Colebrook-White formula - nomogram or equation?8) How to design the channel shape which is hydraulically most favorable?9) how to counteract the unfavorable phenomena occurring during rushing flows in the channels.10) Overflow and orifice as a measuring device.12) How to properly design the excavation drainage?
Work placement	Not applicable

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