GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	Fluid Mechanics, PG_00056193		
Field of study	Transport and Logistics		
Date of commencement of studies	October 2021	Academic year of realisation of subject	2022/2023
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	Full-time studies	Mode of delivery	at the university
Year of study	2	Language of instruction	Polish
Semester of study	3	ECTS credits	3.0
Learning profile	general academic profile	Assessment form	assessment
Conducting unit	Institute of Ocean Engineering and Ship Technology -> Faculty of Mechanical Engineering and Ship Technology		
Name and surname of lecturer (lecturers)	Subject supervisor	dr inż. Michał Krężelewski	
	Teachers	mgr inż. Olga Kazimierska dr inż. Michał Krężelewski	

Lesson types and methods of instruction

Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
Number of study hours	20.0	10.0	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	5.0	40.0	75

Subject objectives

Fmiliarize students with the basic concepts and laws of fluid mechanics, such as:- density, viscosity, compressibility, surface tension,- Static equilibrium equations of fluid, hydrostatic pressure, fluid forces on straight surfaces, etc.- Continuity equation,- The principle of momentum conservation,- Calculation of hydrodynamic forces,- The principle of conservation of energy for non-viscous fluid, incompressible flow (Bernoulli eq.)- Basic issues of viscous liquid flow, determination of losses in the flow.- The concept of the stress tensor in a real (viscous) fluid.

Learning outcomes

Course outcome	Subject outcome	Method of verification
[K6_U02] can work individually and in a team, communicate through various techniques in professional environment and also record, analyse, and present the results of work, can estimate the time needed to complete a given task	The student is able to solve simple tasks in the field of fluid mechanics (fluid statics, 1D flows of perfect and real liquid). He can estimate the time and resources to solve the task.	[SU1] Assessment of task fulfilment
[K6_W02] has a basic knowledge in physics, including technical mechanics, fluid mechanics, solid-state physics, optics and acoustics necessary to understand basic physical phenomena occurring in transport	Student formulates basic flow problems and solves them based on the laws and methods of fluid mechanics. Applies the laws and methods of fluid mechanics in design and for the purpose of understanding physical phenomena occurring in ocean engineering.	[SW3] Assessment of knowledge contained in written work and projects

Subject contents	Scope of the course: The main properties of fluids:- The density, viscosity, compressibility, surface tension, Basic concepts:- Particle fluid- The pressure, shear stress,- Pascal's law. Fluid statics:- The hydrostatic equilibrium equations of fluid- The hydrostatic pressure formula,- Pressure force to the flat surface- - The concept of the center of pressure force,- - Calculation of the moment of pressure force.- - Buoyancy, center of buoyancy.- Stability of floating bodies (ships)- - Metacentric radius,- - Metacentric height,- - Equilibrium conditions. The main issues of fluid kinematics:- A description of the motion of fluids:- - Eulerian method,- - Lagrangian method- Determination of position, velocity and acceleration of the fluid,- The concept of the path of the fluid particles (pathline), streamline, streamsurface, streamtube The principle of conservation of mass (continuity equation):- The concept of the mass flow rate the volumetric flow rate,- The concept of control surface, control volume- Calculation of the flow velocity at varying cross channel The principle of conservation of energy for perfect fluid, incompressible flow (Bernoulli's equation):- Solving one-dimensional flow problems in channels: determination of the flow rate and pressure. The principle of conservation of momentum,- The concept of a volume of liquid,- Guiding principles of conservation of momentum in the form of integral,- Calculation of hydrodynamic forces, The concept of the stress tensor in a real(viscous) fluid. Basic issues of the real fluid flow, determination of loss in the flow:- Generalized Bernoulli equation,- Determining the amount of local loss and linear :- - Types of flow of real fluids:- - - Laminar flow- - - Transitional flow,- - - Turbulent flow
Prerequisites and co-requisites	Knowledge of the basic concepts of physics / mechanics:- Force (force vector)- Torque,- The arm of force,- What is the pressure (?)- Momentum, potential energy, kinetic energy,- Knowledge of units related to above concepts, Knowledge of the basic concepts of calculus / calculus- Definite integral,- Derivative of the function,- Basic ability to apply integrals in problems of physics- Ordinary differential equations with separated variables- The surface integral, volume integral Knowledge of algebra:- The transformation of algebraic expressions,- The ability to "take before the parenthesis" (!!!)Algebra of vectors:- The scalar product,- Vector product,- Vector component,- The projection of the vector on the direction of the specified unit vector Knowledge of trigonometric functions- Sine, cosine, tangent, cotangent Basic knowledge of stereometry (3D geometry)- Eg .: calculating the volume of a cylinder, cuboid, and the like.- Eg .: calculating the area of the cylinder Knowledge of floating point notation, eg .: * 10 ^ 6- Ability to use scientific calculator.

Assessment methods and criteria

Subject passing criteria	Passing threshold	Percentage of the final grade
Exercises – Colloquium	50.0%	60.0%
Lecture - Colloquium	50.0%	40.0%

Recommended reading

Basic literature

Teoria (wykład):

[1] R. Puzyrewski, J. Sawicki: Podstawy mechaniki płynów i hydrauliki.Wydawnictwo Naukowe PWN, Warszawa 2000

[2] R. Gryboś: Podstawy mechaniki płynów. Wydawnictwo NaukowePWN, Warszawa 1998

Zadania (ćwiczenia):

[3] R. Gryboś: Zbiór zadań z technicznej mechaniki płynów.Wydawnictwo Naukowe PWN, Warszawa 2002

[4] E.S. Burka: Mechanika Płynów w Przykładach. WydawnictwoNaukowe PWN, Warszawa 1994

Supplementary literature

[5] Bar-Meir, Genick, Basics of Fluid Mechanics, Last modified: Version0.3.4.0 March17, 2013, www.potto.org/downloads.php

[6] Yunus A. Çengel, John M. Cimbala: Fluid Mechanics. Fundamentalsand Applications. McGraw Hill Higher Education, Boston, 2006

[7] W.J. Prosnak: Mechanika Płynów (Tom I). Państwowe Wydawnictwo Naukowe, Warszawa 1970.

[8] J. Bukowski: Mechanika Płynów. Państwowe Wydawnictwo Naukowe, Warszawa 1959.

	eResources addresses	Adresy na platformie eNauczanie:
Example issues/ example questions/ tasks being completed		
Work placement	Not applicable	