



Subject card

Subject name and code	Fluid Mechanics, PG_00060465						
Field of study	Mechanical and Naval Engineering						
Date of commencement of studies	October 2023	Academic year of realisation of subject			2024/2025		
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 no comments		
Semester of study	4	ECTS credits			5.0		
Learning profile	general academic profile	Assessment form			exam		
Conducting unit	Institute of Energy -> Faculty of Mechanical Engineering and Ship Technology						
Name and surname of lecturer (lecturers)	Subject supervisor		dr hab. inż. Jerzy Gluch				
	Teachers						
Lesson types and methods of instruction	Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
	Number of study hours	18.0	9.0	9.0	0.0	0.0	36
	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	36		8.0		81.0	125
Subject objectives	The aim of the course is to provide the student with theoretical and practical knowledge of fluid mechanics, allowing to solve engineering computational problems related to fluid mechanics						
Learning outcomes	Course outcome		Subject outcome		Method of verification		
	[K6_W09] possesses knowledge within the range of thermodynamics and fluid mechanics, construction and operation of heat generating devices, process equipment, including renewable energy sources, cooling and air conditioning		The student is able to use mathematical and physical models to analyze processes and phenomena occurring in mechanical devices in the field of thermal energetics, thermodynamics, cooling, freezing and fluid mechanics		[SW1] Assessment of factual knowledge		
	[K6_W02] possesses an organized knowledge on physics, including classic mechanics, electricity and magnetism, shows knowledge of the elements of thermodynamics		The student is able to analyze phenomena in the field of physics including classical mechanics, electricity and magnetism, thermodynamics		[SW1] Assessment of factual knowledge [SW3] Assessment of knowledge contained in written work and projects		
	[K6_U06] is able to use mathematical and physical models for analysing the processes and phenomena occurring in mechanical devices within the range of material strength, thermodynamics and fluid mechanics		The student is able to use mathematical and physical models to analyze processes and phenomena occurring in mechanical devices in the field of material strength, thermodynamics and fluid mechanics		[SU3] Assessment of ability to use knowledge gained from the subject [SU5] Assessment of ability to present the results of task		

Subject contents	<p>LECTURE Introduction and basic definitions. Properties of fluids. Fluid models. Fluid equilibrium state. Determination of hydrostatic thrust. Archimedes' Law. Ways to describe the motion of a fluid. The general movement of the fluid. Deformation of the fluid element. Spinning motion of the fluid. Principles of conservation of mass, momentum, and energy. Entropy balance. Navier-Stokes equation. Bernoulli's equation.</p> <p>EXERCISE AND LABORATORY Flow kinematics. Laminar and turbulent flows in a pipe - averaging of flow parameters. Practical application of Bernoulli's equation. Determination of forces acting on the walls of canals and surfaces of flowing bodies. Solving simplified forms of the Navier-Stokes equation.</p>		
Prerequisites and co-requisites	<p>Knowledge of differential and integral calculus, differential equations and the basics of vector calculus. Knowledge of the basics of classical solid mechanics</p>		
Assessment methods and criteria	Subject passing criteria	Passing threshold	Percentage of the final grade
	Written exam	50.0%	100.0%
Recommended reading	Basic literature	<p>Tesch K.: Mechanika płynów, Wyd. Politechniki Gdańskiej, Gdańsk 2008</p>	
	Supplementary literature	<p>Puzyrewski R., Sawicki J.: Podstawy mechaniki płynów i hydrauliki, PWN Warszawa 1998</p>	
	eResources addresses	Adresy na platformie eNauczanie:	
Example issues/ example questions/ tasks being completed	<ol style="list-style-type: none"> 1. Provide a definition of current lines and surfaces and vortex lines and surfaces. What differential equation is used to describe current lines and vortex lines? 2. What velocities are the velocities of any point in a fluid element? Provide a pattern with a drawing and explain the meaning of the individual symbols and their physical interpretation. 3. Give (formula and figure) and explain the content of Helmholtz's first virial theorem. 4. Give the differential form of the equation of conservation of mass. What do the different symbols mean? How can this equation be simplified in the stationary, incompressible, and potential cases? 5. Give the differential form of the equation for conservation of momentum. What do the different symbols mean? What is the physical interpretation of the whole equation and the individual terms? 6. Give Newton's hypothesis for a compressible fluid. What do the different symbols mean? Why is it introduced? 7. Give the forms of the Navier-Stokes equation depending on the density and viscosity coefficient. 8. State and explain Pascal's law. 9. State and explain Archimedes' law. 		
Work placement	Not applicable		