GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	Fliud Mechanics, PG_00060465		
Field of study	Mechanical and Naval 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	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 Głuch	
	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_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	[SU5] Assessment of ability to present the results of task [SU3] Assessment of ability to use knowledge gained from the subject
[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	[SW3] Assessment of knowledge contained in written work and projects [SW1] Assessment of factual knowledge
[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

<table>
<tr><td>Subject contents</td><td>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.

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.</td></tr>
<tr><td>Prerequisites and co-requisites</td><td>Knowledge of differential and integral calculus, differential equations and the basics of vector calculus. Knowledge of the basics of classical solid mechanics</td></tr>
<tr><td>Assessment methods and criteria</td><td><table>
<tr><th>Subject passing criteria</th><th>Passing threshold</th><th>Percentage of the final grade</th></tr>
<tr><td>Written exam</td><td>50.0%</td><td>100.0%</td></tr>
</table></td></tr>
<tr><td>Recommended reading</td><td><table>
<tr><td>Basic literature</td><td>Tesch K.: Mechanika płynów, Wyd. Politechniki Gdańskiej, Gdańsk 2008</td></tr>
<tr><td>Supplementary literature</td><td>Puzyrewski R., Sawicki J.: Podstawy mechaniki płynów i hydrauliki, PWN Warszawa 1998</td></tr>
<tr><td>eResources addresses</td><td>Adresy na platformie eNauczanie:</td></tr>
</table></td></tr>
<tr><td>Example issues/ example questions/ tasks being completed</td><td>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 virtuity 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.</td></tr>
<tr><td>Work placement</td><td>Not applicable</td></tr>
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