



## COURSE DESCRIPTION CARD - SYLLABUS

Course name

Fluid mechanics

### Course

Field of study

Construction and Exploitation of Means of Transport

Area of study (specialization)

Level of study

Second-cycle studies

Form of study

part-time

Year/Semester

2/4

Profile of study

general academic

Course offered in

Polish

Requirements

compulsory

### Number of hours

Lecture

18

Laboratory classes

9

Other (e.g. online)

Tutorials

9

Projects/seminars

### Number of credit points

5

### Lecturers

Responsible for the course/lecturer:

Prof. dr hab. inż. Andrzej Frąckowiak

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Responsible for the course/lecturer:

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### Prerequisites

KNOWLEDGE: Basic knowledge of mathematics, physics and mechanics.

SKILLS: in-depth understanding and interpretation of the messages communicated and effective self-education in the field related to the selected field of study.

SOCIAL COMPETENCES: has an expanded awareness of the need to expand their competences, readiness to work individually and cooperate within a team.



## Course objective

Understanding selected theoretical results in the field of fluid mechanics. Getting to know different fluid models (Newtonian and non-Newtonian) and their behavior in flow.

## Course-related learning outcomes

### Knowledge

Has basic knowledge of the technical mechanics of fluids, ie ideal liquids and gases, Newtonian and non-Newtonian viscous liquids, theory of thermal-flow machines.

### Skills

Is able to carry out elementary technical calculations in the field of fluid mechanics, such as pressure losses in pipelines.

### Social competences

He is ready to critically assess his knowledge and received content.

## Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

The knowledge acquired during the lecture is verified on the basis of a written exam carried out during the examination session. The exam consists of 6-10 questions, with different scores. Passing threshold: 50% of points. The issues for the exam, on the basis of which the questions are developed, will be sent to students by e-mail using the university's e-mail system.

The knowledge acquired during the exercises is verified by two 45-minute tests carried out during the 7th and 15th hours of the exercises. Each test consists of 3-7 tasks, with different scores. Passing threshold: 50% of points.

The skills acquired during the laboratory classes are verified on the basis of reports on the implementation of exercises and oral answers before the start of the classes.

## Programme content

Subject of fluid mechanics. Continuous medium model. Some concepts and theorems of fluid kinematics. Stream line. Current surface. Fluid element path. Acceleration of the fluid element. Substantial, convective and local derivative. Circulation. Basic fluid dynamics equations. The principle of conservation of mass. The principle of conservation of momentum and angular momentum. Forces acting on the fluid. Navier and Stokes equations. General properties of the movement of non-sticky and non-conductive fluids. Euler equation. General integrals of Euler's equation. Fluid statics. Euler's equation of equilibrium. Determination of equipotential surfaces and pressure distribution. Pressure of fluid on the walls of solids. Swimming and stability of floating bodies. The reaction of the liquid stream.

## Teaching methods

1. Lecture: multimedia presentation, illustrated with examples given on the board.
2. Exercises: performing the tasks given by the teacher.



3. Laboratory: practical exercises.

### Bibliography

#### Basic

1. M.Ciałkowski – Mechanika płynów, Wyd. Politechniki Poznańskiej, P-ń 2000.
2. M.Ciałkowski – Mechanika płynów. Zbiór Zadań z rozwiązaniami, Wyd. Politechniki Poznańskiej, P-ń 2008.
3. Z. Orzechowski, P. Wiewiórski – Ćwiczenia audytoryjne z mechaniki płynów, Wyd. Politechniki Łódzkiej, Łódź 1993
4. W.J. Prosnak –Równania klasycznej mechaniki płynów, PWN 2006

#### Additional

1. J.A. Kołodziej – Podstawy mechaniki płynów, Wyd. Politechniki Poznańskiej, P-ń 1982.
2. J. Walczak –Inżynierska mechanika płynów, Wyd. Naukowo-Techniczne, 2010

### Breakdown of average student's workload

	Hours	ECTS
Total workload	110	5,0
Classes requiring direct contact with the teacher	60	3,0
Student's own work (literature studies, preparation for laboratory classes/tutorials, preparation for tests/exam) <sup>1</sup>	50	2,0

<sup>1</sup> delete or add other activities as appropriate