



## COURSE DESCRIPTION CARD - SYLLABUS

Course name

Fluid mechanics [S1MiBP1>MP]

### Course

Field of study

Mechanical and Automotive Engineering

Year/Semester

2/4

Area of study (specialization)

–

Profile of study

general academic

Level of study

first-cycle

Course offered in

Polish

Form of study

full-time

Requirements

compulsory

### Number of hours

Lecture

30

Laboratory classes

15

Other (e.g. online)

0

Tutorials

15

Projects/seminars

0

### Number of credit points

5,00

### Coordinators

dr hab. inż. Jarosław Bartoszewicz prof. PP  
jaroslaw.bartoszewicz@put.poznan.pl

### Lecturers

### 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

Has knowledge in the field of mathematics, including algebra, analysis, theory of differential equations, probability, analytical geometry necessary to: describe the operation of discrete mechanical systems, understand computer graphics methods, describe the operation of electrical and mechatronic systems. Has basic knowledge of the technical mechanics of fluids, i.e. ideal liquids and gases, Newtonian and non-Newtonian viscous liquids, theory of thermal-flow machines. Has basic knowledge of technical thermodynamics, ie the theory of thermodynamic changes, heat flow, thermal machines and heating, drying and cooling devices.

### Course-related learning outcomes

Knowledge:

Can perform elementary technical calculations in the field of fluid mechanics and thermodynamics, such as heat and mass balances, pressure losses in pipelines, select parameters of blowers and fans for ventilation and transport systems, and calculate thermodynamic courses in thermal machines. Can use learned mathematical theories to create and analyze simple mathematical models of machines and their elements, and simple technical systems. Can obtain information from literature, the Internet, databases and other sources. Can integrate the obtained information, interpret and draw conclusions from it, and create and justify opinions.

#### Skills:

Is ready to fulfill social obligations and co-organize activities for the benefit of the social environment.  
Is ready to initiate actions for the public interest.  
Is willing to think and act in an entrepreneurial manner.

#### 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:

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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

Forces and stresses in fluids. Types of fluids and types of fluid structure. Description of phenomena occurring in fluids in static and dynamic issues. Criteria for solving equations used in fluid mechanics.

### Course topics

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	125	5,00
Classes requiring direct contact with the teacher	60	3,00
Student's own work (literature studies, preparation for laboratory classes/ tutorials, preparation for tests/exam, project preparation)	65	2,00