COURSE DESCRIPTION CARD - SYLLABUS

Course name

Fluid Mechanics

Course

Field of study

Sustainable Building Engineering

Year/Semester

2/4

Area of study (specialization)

Profile of study

general academic

Level of study

First-cycle studies

Course offered in

English

Form of study

full-time

Requirements

compulsory

Number of hours

Lecture

15

Laboratory classes

Other (e.g. online)

Tutorials

15

Projects/seminars

Number of credit points

2

Lecturers

Responsible for the course/lecturer:

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Responsible for the course/lecturer:

Prerequisites

Mathematics: algebra - functions, equations and inequalities, plane and space geometry, trigonometry, analytic geometry, equations and systems of equations, elements of differential and integral calculus of functions of one variable at a level 5/6 KRK. Physics: fundamental lows of physics, rules of mass momentum and energy conservation in classical mechanics, statics, kinematics, dynamics, and hydraulics at level 5 KRK

Course objective

Purchase by the students basic knowledge and skills in fluid mechanics necessary to solve common tasks of fluid flows occurring in civil engineering and built environment.

Course-related learning outcomes

Knowledge

1. The students knows physical quantities characterizing fluids, understands their physical meaning and knows their units

2. The student has knowledge of hydrostatic force on plane and curved surfaces

3. Student knows and understands equations describing force and torque by the flow on the walls

4. The student has an elementary knowledge of the laws governing the operation of turbomachinery

5. The student has ordered knowledge of the phenomena responsible for the loss of pressure in the pipes and fittings and knows the equations used to describe them

6. The student has a basic knowledge necessary for modeling the flow of water in the soil

7. The student knows and understands the phenomena occurring during the flow in open channels

Skills

1. The student can apply and convert units of physical quantities used in fluid mechanics

2. The students can calculate: hydrostatic forces on plane and curved surfaces of the tanks, the forces of dynamic interactions between flowing fluid and pipe walls and immersed bodies, the power and efficiency of turbomachines

3. The student can calculate: pressure losses in straight pipes and fittings, the pressure differences that cause a chimney effect and natural ventilation

4. The student can calculate flow rates in free surface flows, optimal shapes of channels in free surface flows

Social competences

1. The student understands the need for teamwork in solving theoretical and practical problems

2. The student sees the need for systematic increasing his skills and competences

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

Lectures:

Final written knowledge test consisting of 4 questions. Test duration: 45 minutes. Term of the test: last lecture during the semester. Continuous assessment during lectures (rewarding activity of the students).

Tutorials

One written tests during the semester - at the end of the semester. Continuous assessment of the students (rewarding students activity).

To pass the tests there is necessary to obtain at least 50% of the maximum points (max=20 points).

Grading system:

0-9 points = 2,0 (failed); 10-12 points = 3,0 (sufficient); 13-14 points = 3,5 (sufficient plus); 15-16 points = 4,0 (good); 17-18 points = 4,5 (good plus); 19-20 points = 5,0 (very good).

Programme content

Lectures

Classification of fluids. Newtonian and non-newtonian fluids. Shear stress in the fluid, the perfect fluid and viscous fluid. Basic physical properties of fluids. The basic equation of fluid statics. The hydrostatic pressure. Absolute pressure, gauge pressure and vacuum. Archimedes low. Hydrostatic force on plane and curved surfaces. The equation of continuity. Local velocity and average velocity of the fluid. The velocity distribution. Friction pressure losses. Laminar and turbulent flows. Critical Reynolds number. Bernoulli equation for inviscit and viscous fluids. Friction factor. Darcy-Weisbach formula. Hagen and Blasius formulas. Roughness of the pipe, Moody chart. Colebroock-White, Walden and Haaland formulas. Minor pressure loss. Calculation of pressure losses in complex hydraulic systems. Momentum of the fluid. Force and torque by the flow on the walls. Open channel flows. Chezy formula. Manning roughness coefficient. Subcritical and supercritical free surface flows. Froude number. Optimal shape of open channel cross-section. Measurements of liquid flow in open channels. Underground water motion. Water inflow to traditional well.

Tutorials

Hydrostatic manometers. Hydrostatic force on plane and curved surfaces. Momentum of fluid. Pressure losses in pipes. Efficiency of traditional well. Flow rate in open chanels. Optimal cross section of open chanel.

Teaching methods

Classical lecture with elements of conversation

Tutorials: solving problems method

Bibliography

Basic

1. White F.M., Fluid Mechanics. McGrawHill Book Company. 5th Int. Ed. Boston 2003.

2. Munson B.R., Young D.F., Okiishi T.H., Fundamentals of Fluid Mechanics (4rd. Ed.). John Wiley and Sons Inc., New York 2002.

3. Bloomer J.J., Practical Fluid Mechanics for Engineering Applications. Marcel Dekker, Inc, New York, Basel 2000.

Additional

1. Mitosek M., Mechanika płynów w inżynierii i ochronie środowiska. WNT, W-wa 2014.

2. Orzechowski Z., Prywer J., Zarzycki R., Mechanika płynów w inżynierii i ochronie środowiska, WNT, W-wa 2009.

3. Jeżowiecka-Kabsch, Szewczyk H., Mechanika płynów, Politechnika Wrocławska, Wrocław 2001.

Breakdown of average student's workload

	Hours	ECTS
Total workload	55	2,0
Classes requiring direct contact with the teacher	30	1,0
Student's own work (literature studies, preparation for tutorials, preparation for tests) [1]	25	1,0

[1] delete or add other activities as appropriate