COURSE DESCRIPTION CARD - SYLLABUS

Course name

Fluid Mechanics

Course

Field of study

Environmental Engineering Extramural First

Year/Semester

2/3

Area of study (specialization)

Profile of study

general academic

Level of study

First-cycle studies

Course offered in

polish

Form of study

part-time

Requirements

compulsory

Number of hours

Lecture

14

Laboratory classes

Other (e.g. online)

Tutorials

12

Projects/seminars

Number of credit points

3

Lecturers

Responsible for the course/lecturer:

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Responsible for the course/lecturer:

dr inż. Ilona Rzeźnik (tutorials)

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Prerequisites

1.Knowledge: Mathematics: algebra - functions, equations and inequalities, plane and space geometry, trigonometry, analytic geometry, basic probability theory, equations and systems of equations, elements of differential and integral calculus of functions of one variable

Physics: fundamental lows of physics, rules of mass momentum and energy conservation in classical mechanics, statics, kinematics, dynamics, and hydraulics

2.Skills :

Solving algebraic equations and systems of algebraic equations, formulating physical problems in the language of mathematics, solving simple differential equations, the use of integral calculus to calculate the geometrical quantities (eg, surface areas) and physical quantities (eg, average values of velocity, momentum of inertia), solving typical problems in classical mechanics - statics, kinematics, dynamics and hydraulics.

3.Social competencies

Awareness of the need to constantly update and supplement knowledge and skills

Course objective

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

Course-related learning outcomes

Knowledge

1. The students knows physical quantities characterizing fluids, understands their physical meaning and knows their units (achieved during lectures and tutorials) - [KIS_W02; KIS_W03; KIS_W04]

2. The student has knowledge of hydrostatic force on plane and curved surfaces (achieved during lectures and tutorials) - [KIS_W02; KIS_W03; KIS_W04]

3. Student knows and understands equations describing force and torque by the flow on the walls (achieved during lectures and tutorials) - [KIS_W02; KIS_W03; KIS_W04]

4. The student has an elementary knowledge of the laws governing the operation of turbomachinery (pumps, funs, blowers and compressors) (achieved during lectures and tutorials) - [KIS_W02; KIS_W03; KIS_W04]

5. The student has basiced knowledge of the phenomena responsible for the loss of pressure in the pipes and fittings and knows the equations used to describe them (achieved during lectures and tutorials) - [KIS_W02; KIS_W03; KIS_W04]

Skills

1. The student can apply and convert units of physical quantities used in fluid mechanics (achieved during lectures and tutorials) - [KIS_U03;KIS_U04]

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 (achieved during lectures and tutorials) - [KIS_U03;KIS_U04]

3. The student can calculate: pressure losses in straight pipes and fittings, the pressure differences that cause a chimney effect and natural ventilation, the pressure increase and velocity of pressure wave in water hammer phenomenon (achieved during lectures and tutorials) - [KIS_U03;KIS_U04]

Social competences

1. The student understands the need for teamwork in solving theoretical and practical problems (achieved during lectures and tutorials) - [KIS_K02]

2. The student is aware of the need to repeat the measuring actions and to evaluate the uncertainty of measurement and calculation results (achieved during lectures and tutorials) - [KIS_K02]

3. The student sees the need for systematic increasing his skills and competences (achieved during lectures and tutorials) - [KIS_K02]

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

Lectures:

Final written test at the end of the semester (45 min., 4 questions). List of questions is published at the beginning of the semester.

Continuous assessment during lectures (rewarding activity of the students.

To pass the final test as well as to pass the tutorials 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)

Tutorials:

Short written final test at the end of the semester (60 min., 2 problems to solve).

Continuous assessment of the students (rewarding students activity).

Course description

Programme content

Classification of fluids. Newtonian and non-newtonian fluids. Shear stress in the fluid, the perfect fluid and viscous fluid. Basic physical properties of fluids. Effect of temperature and pressure on parameters of fluids. The basic equation of fluid statics. The hydrostatic pressure. Absolute pressure, over-and underpressure. Archimedes low. The pressure distribution in the Earth atmosphere. The surface tension. 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. Water hammer phenomenon. Orifice flow, tank discharge. Weirs.

Teaching methods

Classical lecture with elements of conversation

Tutorials: solving problems method

Bibliography

Basic

1. Mitosek M., Mechanika płynów w inżynierii i ochronie środowiska. Warszawa, PWN 2001

2. Orzechowski Z., Prywer J., Zarzycki R., Mechanika płynów w inżynierii środowiska. Wyd. 2 zmienione. Warszawa, WNT 2001

3. Jeżowiecka-Kabsch K., Szewczyk H., Mechanika płynów. Oficyna Wydawnicza Politechniki Wrocławskiej, Wrocław 2001

4. Mitosek M., Matlak M., Kodura A., Zbiór zadań z hydrauliki dla inżynierii i ochrony środowiska. Oficyna wydawnicza Politechniki Warszawskiej, Warszawa 2004

5. Orzechowski Z., Prywer J., Zarzycki R., Zadania z mechanika płynów w inżynierii środowiska. Warszawa, WNT 2001

Additional

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

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

Breakdown of average student's workload

	Hours	ECTS
Total workload	75	3,0
Classes requiring direct contact with the teacher	26	1,0
Student's own work (literature studies, preparation for classes, preparation for tests, project preparation) [1]	49	2,0

[1] delete or add other activities as appropriate