COURSE DESCRIPTION CARD - SYLLABUS

Course name
Fluid Mechanics

Course

Field of study
Environmental Engineering Extramural First

Year/Semester
2/4

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	Laboratory classes	Other (e.g. online)
12	16	
Tutorials	Projects/seminars	

Number of credit points

3

Lecturers

Responsible for the course/lecturer:
prof. dr hab. inż. Janusz Wojtkowiak

email: janusz.wojtkowiak@put.poznan.pl

tel. (61) 6652442

Faculty of Environmental Engineering and Energy

ul. Berdychowo 4, 61-118 Poznań

Responsible for the course/lecturer:
dr inż. Ilona Rzeźnik (tutorials)

email: ilona.rzeznik@put.poznan.pl

tel. (61) 6653494

Faculty of Environmental Engineering and Energy

ul. Berdychowo 4, 61-118 Poznań

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 at a level 5/6 PRK

Physics: fundamental lows of physics, rules of mass momentum and energy conservation in classical mechanics, statics, kinematics, dynamics, and hydraulics at level 5 PRK.

Fluid mechanics at a level of 6PRK: basic properties of fluids, fluid statics, internal fluid flows, pressure losses in pipes, momentum of fluid stream.

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, calculation of hydrostatic force on plane and curved surfaces, calculations of pressure losses in pipes and ducts, calculation of force between flowing fluid and duct wall

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 student has a basic knowledge necessary for modeling the flow of water in the soil (achieved during lectures, tutorials and laboratory exercises) - [KIS_W02; KIS_W03; KIS_W04]

2. The student understands the causes of water hammer and cavitation phenomena in hydraulic systems, and knows the laws used to describe them (achieved during lectures and tutorials) - [KIS_W02; KIS_W03; KIS_W04]

3. The student knows and understands the phenomena occurring during the flow in open channels (free surface flow) and knows equations describing these phenomena (achieved during lectures, tutorials and laboratory exercises) - [KIS_W02; KIS_W03; KIS_W04]

4. The student knows and understand the laws describing liquid flows from the tanks (achieved during lectures and tutorials) - [KIS_W02; KIS_W03; KIS_W04]

Skills

1. The student can calculate: hazard of cavitation in hydraulic systems, flow rates in free surface flows, optimal shapes of channels in free surface flows, discharge time of tanks and vessels (achieved during lectures and tutorials) - [KIS_U03; KIS_U-04]

2. The student can measure: pressure of fluid (static, dynamic and total), average velocity of fluid in internal and free surface flows, pressure losses in pipes and fittings, power and efficiency of pumps, fans and blowers (achieved during laboratory exercises) - [KIS_U03; KIS_U-04]

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 exam consists of two parts. Part 1: knowledge test (4 questions to answer), Part. 2: test of skills (2 problems to solve),

Continuous assessment during lectures (rewarding activity of the students).

To pass each of the two parts of the exam (as well as to pass the tutorials) there is necessary to obtain at least 50% of the maximum points (max=20 points). The exam is passed if both part 1 and part 2 are passed. Corrected (Improved) is only this part which was failed.

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).

Laboratory exercises:

Continuous assessment in every class.

Assessment during consultation of students reports (assessing students' own work).

Written test after completing the cycle of laboratory exercises.

Programme content

Orifice flow, tank discharge. Weirs. 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 and artesian wells. Calculation of gas tank discharge and gas flow in pipes. Bernoulli equation for adiabatic gas flow.

Teaching methods

Classical lecture with elements of conversation and discussion

Laboratory exercises: teaching by experimentation

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	80	3,0
Classes requiring direct contact with the teacher	30	1,0
Student's own work (literature studies, preparation for laboratory classes, preparation for exam) [1]	50	2,0

[1] delete or add other activities as appropriate