STUDY MODULE DESCRIPTION FORM

Name of the module/subject **Fluid Mechanics**		Code **1010134231010100197**
Field of study **Environmental Engineering Extramural First-**	Profile of study (general academic, practical) **(brak)**	Year /Semester **2 / 3**
Elective path/specialty **-**	Subject offered in: **Polish**	Course (compulsory, elective) **obligatory**
Cycle of study: **First-cycle studies**	Form of study (full-time,part-time) **part-time**	
No. of hours Lecture: **14** Classes: **12** Laboratory: **-** Project/seminars: **-**		No. of credits **4**
Status of the course in the study program (Basic, major, other) **(brak)**	(university-wide, from another field) **(brak)**	
Education areas and fields of science and art		ECTS distribution (number and %)

Responsible for subject / lecturer:

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Responsible for subject / lecturer:

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Prerequisites in terms of knowledge, skills and social competencies:

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 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
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

Assumptions and objectives of the course:

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.

Study outcomes and reference to the educational results for a field of study

Knowledge:

1. The student has a basic knowledge necessary for modeling the flow of water in the soil - [K_W03, K_W07]
2. The student understands the causes of water hammer and cavitation phenomena in hydraulic systems, and knows the laws used to describe them - [K_W03, K_W07]
3. The student knows and understands the phenomena occurring during the flow in open channels (free surface flow) and knows equations describing these phenomena - [K_W03, K_W07]
4. The student knows and understand the laws describing liquid flows from the tanks - [K_W03, K_W04]

Skills:

1. The student can calculate: danger 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 - [K_U01, K_U013,]
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 - [K_U01, K_U08, K_U09]

Social competencies:

1. The student understands the need for teamwork in solving theoretical and practical problems - [K_K03, K_K04]
2. The student is aware of the need to repeat the measuring actions and to evaluate the uncertainty of measurement and calculation results - [K_K05]
3. The student sees the need for systematic increasing his skills and competences - [K_K01]

Assessment methods of study outcomes

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).

Tutorials

?Two short written tests during the semester and one written final test

?Continuous assessment of the students (rewarding students activity).

Laboratory exercises:

?Assessment of individual prepared reports and their oral presentation

?Continuous assessment of the students during laboratory exercises.

Course description

Momentum of the fluid. Force and torque by the flow on the walls. Water hammer phenomenon. 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.

Basic bibliography:

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

6. Bogusławski L. (Red.), Ćwiczenia laboratoryjne z mechaniki płynów. Wydawnictwo Politechniki Poznańskiej, Poznań 1999

7. Niełacny M., Ćwiczenia laboratoryjne z mechaniki płynów. Wydawnictwo Politechniki Poznańskiej, Poznań 1996

Additional bibliography:

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

Result of average student's workload

Activity	Time (working hours)
1. Participation in lectures	14
2. Participation in tutorials	12
3. Participation in laboratory exercises	0
4. Preparation for the laboratory exercises	0
5. Preparing (at home) reports of the laboratory exercises	0
6. Participation in consultations related to the lectures, tutorials and laboratory exercises	0
7. Preparation for the final test of tutorials	0
8. Preparation for the exam and the present at the exam	0

Student's workload

Source of workload	hours	ECTS
Total workload	36	4
Contact hours	26	0
Practical activities	12	0