FLUIDS MECHANICS

Course Code/Course ID : **01LBUD_pNadGenQPIC6**

Type of course: compulsory

Teaching language: English

Director of studies: dr hab.inż. Zygmunt Lipnicki, prof. UZ

Name of lecturer: IEE teachers

Form of instruction	Number of teaching hours per semester	Number of teaching hours per week	Semester	Form of receiving a credit for a course	Points ECTS
Full-time studies					7
Lecture	30	2		Exam	
Laboratory	30	2		Grade with notes	
Project	15	1		Grade with notes	

THE AIM OF THE LECTURE

The aim of the course is to learn the basic knowledge of fluid mechanics and understanding of the fundamental concepts, phenomena and laws governing the flow of fluids and the acquisition of the ability to apply this knowledge in theory and practice.

ENTRY REQUIREMENTS

Formal: credit mathematics course I and II, mechanics and strength of materials.

Informal: no requirements.

SCOPE OF COURSE TOPICS

The program of lectures: Basic concepts and principles of fluid mechanics. Fluids and their properties. Fluid kinematics - the basic concepts. Basic equation of fluid dynamics: principle of mass conservation, momentum and moment of momentum conservation. Tensor of the deformation velocity. Stress tensor for the newtonian fluid. Navier-Stokes equation. Fluid statics: equilibrium equations, the distribution of pressure and temperature in the atmosphere, the static pressure of the fluid restricting surfaces, swimming bodies. Fluid reaction on the walls of solid. Model of an ideal fluid and viscous Newtonian. The equations of ideal fluid motion. Bernoulli's equation for a perfect fluid. Applications of the Bernoulli equation. The flow of liquid through the holes and snap. Some solutions Navier-Stokes. The similarity of flow phenomena. Laminar and turbulent flows. Boundary layer. Fluid flow in pipelines under pressure and open channels. Fluid dynamic feedback. Elements of compressible flow dynamics. The flow of gas through nozzles and orifices. Filtration. The movement of groundwater. Flow of water into the filter wells and channels. Selected aspects of compressible flow and incompressible fluids. Laboratory program: Instruments for measuring the hydraulic. Measurements of pressure and fluid viscosity. Fluid flow in hydraulic systems. Velocity of fluid in the pipe cross-section. Loss of flow in the pipeline (in length and local). Measurements of parameters of hydraulic equipment: pumps and fans. Auditorium exercise program: Static equilibrium equations of fluid. Pressure on flat and curved surfaces. Solving some of the Navier-Stokes equations. The use of the Bernoulli equation for ideal and viscous flows.

Program of projects: Design calculations of devices using: equations of static statics of fluids, pressures on flat and curved surfaces, some Navier-Stokes equations and Bernoulli equations for ideal and viscous flows.

TEACHING METHODS

Giving methods: lecture information - problem.
Searching methods: practical design method and laboratory method.

LEARNING OUTCOMES

Symbol	Learning outcomes after completion of the course. Student:	The reference to the effects of education in the field of technical sciences
Knowledge		
K_W02	The student has a basic knowledge in the field of fluid mechanics, knows the basic concepts of goals and tasks of fluid mechanics.	T1A_W01
K_W05	The student has general knowledge about basic equations of equilibrium, pressure and temperature distributions, knows the laws of conservation of mass, momentum and energy; can determine the velocity profiles of the flowing fluid in pipes under pressure and open channels.	T1A_W03
K_W12	The student knows the basic methods, techniques, tools and materials used to solve simple engineering tasks in the field of fluid mechanics.	T1A_W07
Skills		
K_U05	The student is able to plan and carry out experiments on the measurement of pressure, speed, fluid viscosity. He can interpret the obtained results and draw conclusions. Can use analytical, simulation and experimental methods to formulate and solve engineering tasks.	T1A_U05
K_U09	The student has the ability to self-study and obtain information from literature, databases and other properly selected sources; can integrate the obtained information, make their interpretation and critical evaluation, as well as draw conclusions and formulate and fully justify opinions.	T1A_U08
Social competence		
K_K04	The student is able to interact and work in a group, assuming different roles in both performing the experiment and developing results.	T1A_K03
K_K05	The student is able to properly determine the priorities for the implementation of specific tasks and is aware of the importance of non-technical aspects and effects of engineering fluid mechanics and the associated responsibility for decisions.	T1A_K04

ASSESSMENT CRITERIA

The basis for passing the laboratory classes is: attendance at all classes, preparation for each class, laboratory tests, preparation of reports from the conducted tests and positive completion of the classes by the teacher, as well as - positive evaluation of the final final colloquium.
The basis for passing the project classes is the attendance at all classes, systematic preparation for each class and preparation, and then - submission on time and passing the project.
Examination: the condition to take the exam is to obtain a positive grade from the laboratory exercises - the exam is in writing (2 problem questions, 2 accounting tasks).
Grading scale: 0 ÷ 50% - insufficient, 51 ÷ 60% - satisfactory, 61 ÷ 70% - satisfactory plus, 71 ÷ 80% - good, 81 ÷ 90% - good plus, 91 ÷ 100% - very good. The basis for determining the cumulative rating is the weighted average obtained by adding: 0.7 lecture scores, 0.3 grades from laboratory exercises. The weighted average is rounded to two decimal places. The total rating is based on the weighted average according to the rule: below 3.24 - sufficient, from 3.25 to 3.74 - satisfactory plus, from 3.75 to 4.24 - good, from 4.25 to 4.74 - a good plus, from 4.75 - very good.

SELF STUDENT'S WORK

Independent student work (set up to: classes, exams, reading literature, dissertations, projects, presentations, reports, speeches): 100 h;

Contact hours (classes, tutorials, exams, etc.): 75 h.

RECOMMENDED READING

1. Y. Nakayama R.F. Boucher, Introduction to fluid mechanics, Butterworth-Heinemann 2000
2. M. Schobeiri, Applied Fluid Mechanics for Engineers, McGraw-Hill Education, 2014
3. K. Stewartson, The theory of laminar boundary Layers in compressible fluids, Oxford University Press, 1964
4. D. F. Young , B. R. Munson , T. H. Okiishi , W. W. Huebsch, Introduction To Fluid Mechanics, 2011

OPTIONAL READING

1. K.L. Kumar, Engineering fluids mechanics. S Chand, 2009