MODULE SPECIFICATION

Module code	
Module title in Polish	**Mechanika płynów**
Module title in English	**Fluid Mechanics**
Module running from the academic year	**2017/2018**

A. MODULE IN THE CONTEXT OF THE PROGRAMME OF STUDY

Field of study	**Environmental Engineering**
Level of qualification	**First cycle** (first cycle, second cycle)
Programme type	**Academic** (academic/practical)
Mode of study	**Full-time** (full-time/part-time)
Specialism	
Organisational unit responsible for module delivery	**The Department of Geotechnical, Geomatics and Waste Management**
Module co-ordinator	**Bartosz Szeląg, PhD, Eng.**
Approved by:	**Maria Żygadło, Professor, PhD hab., Eng.**

B. MODULE OVERVIEW

Module type	**Core module** (core/programme-specific/elective HES*)
Module status	**Compulsory module** (compulsory/optional)
Language of module delivery	**Polish/English**
Semester in the programme of study in which the module is taught	**Semester 2**
Semester in the academic year in which the module is taught	**Summer semester** (winter semester/summer semester)
Pre-requisites	**None** (module code/module title, where appropriate)
Examination required	**No** (Yes/No)
ECTS credits	**3**

* elective HES – elective modules in the Humanities and Economic and Social Sciences

Mode of instruction	lectures	classes	laboratories	project	others
Total hours per semester	**30**		**15**		

C. LEARNING OUTCOMES AND ASSESSMENT METHODS

Module aims	The aim of the module is to familiarize students with basic knowledge concerning fluid mechanics (as regards engineering applications). Another aim includes learning and understanding basic notions, phenomena, and laws governing the flow of fluids.

Module outcome code	Module learning outcomes	Mode of instruction *(l/c/lab/p/ others)*	Corresponding programme outcome code	Corresponding discipline-specific outcome code
W_01	A student has general knowledge as regards fluid mechanics in terms of assessing fluid properties.	l	IŚ_W01 IŚ_W12	T1A_W01 T1A_W02 T1A_W03 T1A_W04 T1A_W07
W_02	A student knows basic laws and phenomena describing the behaviour of a fluid in static equilibrium conditions.	l	IŚ_W01 IŚ_W12	T1A_W01 T1A_W02 T1A_W03 T1A_W04 T1A_W07
W_03	A student knows basic phenomena and law governing the flow of fluids in pressure and gravity installations.	l	IŚ_W01 IŚ_W12	T1A_W01 T1A_W02 T1A_W03 T1A_W04 T1A_W07
U_01	A student can describe basic parameters of fluid in motion.	l	IŚ_U01 IŚ_U02 IŚ_U11 IŚ_U22	T1A_U01 T1A_U02 T1A_U05 T1A_U07 T1A_U08 T1A_U09 T1A_U15
U_02	A student can (with the use of appropriate methods) determine the coefficient of linear resistance and channel coarseness; a student can also experimentally determine their values.	l/l	IŚ_U01 IŚ_U03 IŚ_U11 IŚ_U22	T1A_U02 T1A_U07 T1A_U08 T1A_U09 T1A_U15
U_03	A student is able to determine the coefficient of local resistance; a student can also experimentally determine its value.	l/l	IŚ_U01 IŚ_U03 IŚ_U11 IŚ_U22	T1A_U02 T1A_U07 T1A_U08 T1A_U09 T1A_U15
U_04	A student can prepare the characteristics of a fluid flow machine.	l	IŚ_U01 IŚ_U02 IŚ_U11 IŚ_U22	T1A_U01 T1A_U02 T1A_U05 T1A_U07 T1A_U08 T1A_U09 T1A_U15
U_05	A student can determine the points of work as regards the flow system.	l	IŚ_U01 IŚ_U02 IŚ_U11 IŚ_U22	T1A_U01 T1A_U02 T1A_U05 T1A_U07

				T1A_U08 T1A_U09 T1A_U15
U_06	A student is able to prepare the characteristics of a straight-line piece of cord armed in a bolt and other flow elements.	I	IŚ_U01 IŚ_U03 IŚ_U11 IŚ_U22	T1A_U02 T1A_U07 T1A_U08 T1A_U09 T1A_U15
U_07	A student acts according to the OHS principles which are binding in the laboratory.	I	IŚ_U26	T1A_U11
K_01	A student can work in a responsible manner on a given assignment.	I	IŚ_K01 IŚ_K05	T1A_K03 T1A_K04
K_02	A student can formulate conclusions in a substantive manner.	I	IŚ_K07	T1A_K07
K_03	A student is aware of raising his/her professional and personal competences.	I/I	IŚ_K03	T1A_K01 T1A_K02

Module content:

1. Topics to be covered in the lectures

No.	Topics	Module outcome code
1	Introduction. The division and essence of fluid mechanics, basic definitions. A fluid as a continuous medium. Real and ideal fluids. Basic units of the SI system. The definitions of a solid body, fluid and gas (and the differences among them).	W_01 K_03
2	Physical properties of fluids. Research methods concerning fluid mechanics. The application of fluid mechanics. Basic models of fluids (Newtonian and non-Newtonian).	W_01 K_03
3	Fluid statistics (basic notions). Pressure as a scalar value. Pressure units. The types of pressure. The distribution of pressure and temperature in the atmosphere of the Earth. The devices for pressure measurement.	W_02 K_03
4	Forces operating in fluids. Basic laws of hydrostatics (Pascal's and Euler's laws). Fluid equilibrium in connected vessels.	W_02 K_03
5	Fluid pressure on flat surfaces. Fluid pressure on flat surfaces. Calculating pressure, the centre of pressure, anchor point of a pressure resultant. Fluid pressure on a container bottom (Stevin's paradox).	W_02 K_03
6	The equilibrium of floating bodies: the Archimedes' laws, the stability of floating bodies, and metacentric height.	W_02 K_03
7	Fluid kinematics (selected issues). Basic notions and definitions concerning fluid motion.	W_03 U_01 K_03
8	Analytical methods of examining fluid motion (Lagrange and Euler's methods). The elements of fluid motion. Potential motion and examination methods. Angular motion.	W_03 K_03
9	Fluid dynamics. The fundamentals of the dynamics concerning ideal fluids. An ideal fluid and a real fluid. Motion types: a steady/non-steady motion; uniform and non-uniform motion.	W_03 U_01 K_03
10	Basic laws and equations of hydrodynamics. The equation of motion continuity. Bernoulli's equation for an ideal fluid.	W_03 K_03
11	Bernoulli's equation for a real fluid. Ancona's diagram.	W_03 U_02 K_03
12	Laminar, transient, and turbulent flow. Reynold's number. Boundary layer. Velocity profiles. The instruments for measuring the flow intensity as well as the methods of determining cord porosity.	W_03 U_02 K_03
13	Hydraulic states induced by friction. Hydraulic losses induced by local resistance. The	W_03

	methods of experimental determining energy losses.	U_02 U_03 K_03
14	The problem of gas dynamics. The equation of energy balance. Thermodynamics properties of gases.	W_03 K_03
15	Isothermal and non-isothermal flow. Bernoulli's equation for gases. The flow of gases through holes and nozzles.	W_03 K_03

2. Topics to be covered in the laboratories

No.	Topics	Module outcome code
1	Familiarising students with the OHS regulations in the Hydraulic Laboratory.	U_07
2	Determining the coefficient of linear losses.	U_02 K_01 K_02
3	Determining the coefficient of local losses.	U_03 K_01 K_02
4	Determining the characteristics of pipeline characteristics.	U_06 K_01 K_02
5	Determining the characteristics of a flow machine.	U_04 K_01 K_02
6	Measuring the point of work as regards a flow system.	U_05 K_01 K_02
7-8	Determining a pressure line in a pipeline installation.	U_02 U_03 U_04 U_05 U_06 K_01 K_02

Assessment methods

Module outcome code	Assessment methods *(Method of assessment; for module skills − reference to specific project, laboratory and similar tasks)*
W_01	A test
W_02	A test
W_03	A test
U_01	A test
U_02	A report and a test
U_03	A report and a test
U_04	A report and a test

U_05	A report and a test
U_06	A report and a test
K_01	A report and a test
K_02	A report and a test
K_02	A test

D. STUDENT LEARNING ACTIVITIES

ECTS summary		
	Type of learning activity	**Study time/ credits**
1	Contact hours: Participation in lectures	**30**
2	Contact hours: Participation in classes	**-**
3	Contact hours: Participation in laboratories	**15**
4	Contact hours: Participation in tutorials (2-3 times per semester)	**3**
5	Contact hours: Participation in project classes	**-**
6	Contact hours: Project tutorials	**-**
7	Contact hours: Participation in an examination	**2**
8		
9	**Number of contact hours**	**50** *(total)*
10	**Number of ECTS credits for contact hours** *(1 ECTS credit =25-30 hours of study time)*	**2.0**
11	Private study hours: background reading for lectures	**5**
12	Private study hours: preparation for classes	**-**
13	Private study hours: preparation for tests	**-**
14	Private study hours: preparation for laboratories	**7**
15	Private study hours: writing reports	**8**
16	Private study hours: preparation for a final test in laboratories	**3**
18	Private study hours: preparation for an examination	**2**
19		
20	**Number of private study hours**	**25** *(total)*
21	**Number of ECTS credits for private study hours** *(1 ECTS credit =25-30 hours of study time)*	**1.0**
22	**Total study time**	**75**
23	**Total ECTS credits for the module** *(1 ECTS credit =25-30 hours of study time)*	**3.0**
24	**Number of practice-based hours** *Total practice-based hours*	**33**
25	**Number of ECTS credits for practice-based hours** *(1 ECTS credit =25-30 hours of study time)*	**1.32**

E. READING LIST

References	1. Knight DW., MC Gahey C., Lamb R., Samuels PG., 2010. Practical Channel Hydraulics. Taylor & Francis Group, London, UK. 2. Novak P., Guinot V., Jeffrey A., Reeve DE., 2010. Hydraulic Modelling – an Introduction.

	Taylor & Francis Group, New York, USA. 3. Daugherty RL., Franzini JB., Finnemore EJ., 1985. Fluid Mechanics with Engineering Applications. Mc-Graw-Hill, Inc. 4. Vischer DL., Hager WH., 1998. Dam Hydraulics. Wiley, England.
Module website	