MODULE SPECIFICATION

Module code	
Module title in Polish	**Hydraulika 2**
Module title in English	**Hydraulics 2**
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 3**
Semester in the academic year in which the module is taught	**Winter 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	**15**		**15**	**15**	

C. LEARNING OUTCOMES AND ASSESSMENT METHODS

Module aims	The aim of the module is to acquaint students with theoretical fundamentals of solving issues occurring in designing the underground water supplies, open stable and unstable channels, channel armouring, the clear span of bridges and passages, dimensioning other engineering objects, calculating the parameters of the selected hydraulic phenomena in devices and hydraulic and sanitary objects. Another aim includes familiarising students with the fundamentals of hydraulic model phenomena and hydraulic devices.

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 hydraulic calculation of underground water supplies.	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 motion of liquid in, water and sanitary open stable and unstable channels.	l	IŚ_W12	T1A_W03 T1A_W04 T1A_W07
W_03	A student knows basic laws and phenomena describing rapidly-varied motion of liquid in a closed system.	l	IŚ_W12	T1A_W03 T1A_W04 T1A_W07
W_04	A student knows basic laws facilitating conducting hydraulic model tests of phenomena or hydraulic devices.	l	IŚ_W12	T1A_W03 T1A_W04 T1A_W07
U_01	A student can correctly select dependencies facilitating making hydraulic calculations of passages, overfalls, and bores; a student can also determine the system of water table above and below the object.	l/lab/p	IŚ_U01 IŚ_U02 IŚ_U22	T1A_U01 T1A_U05 T1A_U07 T1A_U08 T1A_U09 T1A_U15
U_02	A student can determine mean flow velocity in an open channel.	lab	IŚ_U01 IŚ_U02 IŚ_U03 IŚ_U22	T1A_U01 T1A_U02 T1A_U05 T1A_U07 T1A_U08 T1A_U09 T1A_U15
U_03	A student can make basic hydraulic calculations for water flow in soli as well as in sanitary installations.	p	IŚ_U01 IŚ_U02 IŚ_U03 IŚ_U22	T1A_U01 T1A_U02 T1A_U05 T1A_U07 T1A_U08 T1A_U09 T1A_U15
U_04	A student can determine the values of forces operating on surfaces submerged below water table.	p	IŚ_U01 IŚ_U02 IŚ_U03 IŚ_U05 IŚ_U22	T1A_U01 T1A_U02 T1A_U03 T1A_U04 T1A_U05 T1A_U07 T1A_U08 T1A_U09 T1A_U15
U_05	A student can determine the coefficient of porosity of an open channel.	lab	IŚ_U01 IŚ_U02 IŚ_U03 IŚ_U22	T1A_U01 T1A_U02 T1A_U05 T1A_U07 T1A_U08 T1A_U09 T1A_U15
U_06	A student can apply OHS regulations during the conducted	lab	IŚ_U26	T1A_U11

	experiments.			
K_01	A student can work on the assigned task responsibly.	lab/p	IŚ_K01	T1A_K03
K_02	A student can interpret the results of his/her works in a substantive manner.	lab/p	IŚ K02	T1A_K02 T1A_K05
K_03	A student is aware of raising his/her professional and personal competences.	l/p	IŚ K03	T1A_K01 T1A_K02 T1A_K04

Module content:

1. Topics to be covered in the lectures

No.	Topics	Module outcome code
1	The hydraulics of underground waters. Calculating the range of depression, the coefficient of filtration with the method of initial pumping. Well efficiency. Inflow to a channel.	W_01 K_03
2	The characteristics of a stream and the classification of water motion in open channels. Calculating uniform and non-uniform motion.	W_02 K_03
3	The equation of the water table system in the channel.	W_02 K_03
4	Permissible velocities, stable and unstable channels. Dimensioning the section of the channel. Selecting channel reinforcements.	W_02 K_03
5	Calculating clear spans of bridges and passages. Calculating and dimensioning points of convergence.	W_02 U_01 K_03
6	Hydraulic surge and its parameters.	W_02 K_03
7	Hydraulic thrust.	W_03 K_03
8	The fundamentals of the affinity theory and modelling hydraulic phenomena.	W_04 K_03

2. Topics to be covered in the laboratories

No.	Topics	Module outcome code
1-2	Familiarising students with the OHS regulations binding in the Hydraulic Laboratory. Determining mean flow velocity in the channel on the basis of the following: the measurements of water table system as well as with Chézy, Manning, Colebrook-White, Bazin formulas.	U_02 U_06 K_01 K_02
3-4	Measuring flow volume in open channels with a hydrometric mill. Determining mean velocity values in a vertical with two methods: tachoids and theorems.	U_02 U_06 K_01 K_02
5	Determining the length of backwater area during backwater in an open channel.	U_01 U_06 K_01 K_02
6	Determining the coefficient of triangular and rectangular overfall overflows with sharp edge.	U_01 U_06 K_01 K_02
7	Determining the coefficient of overflows concerning a large non-submerged bore.	U_01 U_06 K_01 K_02
8	Determining the coefficient of channel porosity on the basis of measuring flow intensity and the system of water table in an open channel.	U_05 U_06 K_01 K_02

3. Topics to be covered in the project

No.	Topics	Module outcome code

1-2	Introductory class. Familiarising students with the principles binding during the classes. Discussing the essence of the classes and presenting all subjects of projects. Determining thrust on a curved wall with the graphical and analytical method. Determining the point of resultant thrust apposition vector and calculating its value.	U_04 K_01 K_02 K_03
3-4	Calculating linear and local losses for the pipeline systems. Graphical presentation of the course of energy lines as well as the piezometric pressure line. The Venturi effect. Calculating water flow intensity in the tube.	U_03 K_01 K_02
5	Calculating overfall overflows. Calculating upper elevation of the water table above the edge with the assigned geometrical parameters.	U_01 K_01 K_02
6	Liquid motion in channels and open channels. Selecting the most favourable, in hydraulic terms, shape of an open channel.	U_01 K_01 K_02
7-8	Calculating well overflows as well as the range of interaction of a depression critical flow.	U_03 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
W_04	A test
U_01	A test, a report and a project
U_02	A report
U_03	A project
U_04	A project
U_05	A report
U_06	Correct completion of laboratory class assignment
K_01	A report and a project
K_02	A report and a project
K_03	A test and a project

D. STUDENT LEARNING ACTIVITIES

ECTS summary		
	Type of learning activity	**Study time/ credits**
1	Contact hours: participation in lectures	**15**
2	Contact hours: participation in classes	**-**
3	Contact hours: participation in laboratories	**15**
4	Contact hours: attendance at office hours (2-3 appointments per semester)	**1**
5	Contact hours: participation in project-based classes	**15**
6	Contact hours: meetings with a project module leader	**4**
7	Contact hours: attendance at an examination	**-**

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	**2**
12	Private study hours: preparation for classes	**-**
13	Private study hours: preparation for tests	**-**
14	Private study hours: preparation for laboratories	**2**
15	Private study hours: writing reports	**7**
16	Private study hours: preparation for a final test in laboratories	**2**
17	Private study hours: preparation of a project/a design specification	**10**
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*	**40**
25	**Number of ECTS credits for practice-based hours** *(1 ECTS credit =25-30 hours of study time)*	**1.6**

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 Intrudaction. 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	