Course name: ***Hydraulic Structures – design and exploitation***

ECTS	6.0
Course status	*facultative*
Course final assessment /evaluation of outcomes	*Graded credit*
Prerequisite	*basics of physics, fluid mechanics, hydrotechnical structures*

Main field of study: ***Environmental Engineering***

Educational profile	*General academic*
Code of studies and education level	*master of thesis*
Semester of studies	*winter*
Language of instruction	*English*

Course offered by:

Name of faculty offering the course	*Environmental Engineering and Land Surveying*
Name of department offering the course	*Hydraulic Engineering and Geotechnics*
Course coordinator	*Karol Plesiński, Ph.D.*

Learning outcomes:

Symbol of outcome	Description of the learning outcome	Reference to main field of study outcomes	Area symbol*
KNOWLEDGE – student knows and understands:			
HSD_K1	*the need of introduce modern structures like hydraulic structures close to nature and regarding fluvial geomorphology (oversized grain structure, cross-ribbed). To acquaint the student with the principle of work of innovative hydraulic structures, they are block ramps.*	*IS2_W12*	*T*
SKILLS – student is able to:			
HSD_S1	*calculate hydrodynamics and hydraulics parameters of these objects. Is able to design the block ramp, which will be assisted methods of computing (HEC-RAS numerical model) and calculation programs (VCMaster). In addition, it will be determined impact of the proposed structures in the bed of a mountain stream (flow regime change, changes in hydrodynamic parameters, changes in the morphology of the bed of the stream and sediment transport).*	*IS2_U06*	*T*
SOCIAL COMPETENCIES – student is ready to:			
HSD_C1	*critically assess his knowledge, continuous self-education and improve his competences*	*IS2_K01*	*T*

Teaching contents

Lectures	15 hours
Topics	*1. Hydraulic structures introduction and the classical hydraulic structures.* *2. The block ramps and other hydraulic structures close to nature.*

	3. Numerical modeling and calculation of hydraulic structures. *4. Exploitation problems of block ramps.* *5. Methods of river training close to nature.* *6. Hydraulic parameters of water flowing in river channels.* *7. Bed-load transport in river channels.*
Accomplished learning outcomes	*HSD_K1, HSD_C1*
Means of verification, rules and criteria of assessment	*Single-choice test, positive assessment should be given at least 50% of correct answers to given questions: <50% – insufficient (2.0); 50–60% – sufficient (3.0); 61–70% – satisfactory plus (3,5); 71–80% – good (4.0); 81–90% – good plus (4,5); 91–100% – very good (5.0). The share of the lecture grade in the final grade is 50%.*
Classes:	30 hours
Topics	*1. Design of block ramp.* *2. Numerical modeling of hydraulic parameters in the block ramp.* *3. Field trip – the kind of block ramp, examples from Polish Carpathians (optional).*
Accomplished learning outcomes	*HSD_S1*
Means of verification, rules and criteria of assessment	*Passing reports on exercises – a grade from exercises is an arithmetic average of formative grades. The share of the grade for the project exercises in the final grade of the subject is 50%.*

References:

Basic	1. *Plesiński K., Radecki-Pawlik A. 2017. Block Ramps: Field Example. [w:] Radecki-Pawlik A., Pagliara S., Hradecky J. (eds.). Open Channel Hydraulics, River Hydraulic Structures and Fluvial Geomorphology: For Engineers, Geomorphologists and Physical Geographers. CRC Press, Taylor & Francis Group, Boca Raton, London, New York, 82–97.* 2. *Radecki-Pawlik A., Plesiński K. 2017. Boulder ramps: selected hydraulic, environmental and designing problems. The case of Polish Carpathian streams. Wydawnictwo UR Kraków, pp. 102, monograph.* 3. *Pagliara S., Radecki-Pawlik A., Palermo M., Plesiński K. 2017. Block ramps in curved rivers: morphology analysis and prototype data supportrf design criteria for mild bed slopes. River Research and Applications, 33(3), 427–4371.*
Supplementary	1. *Radecki-Pawlik A., 2009. Bystrza jako bliskie naturze rozwiązania utrzymania koryt rzek i potoków górskich. Nauka Przyr. Technol. 3, 3.* 2. *Bartnik W., Książek L., Michalik A., Radecki-Pawlik A., Strużyński A. Modeling of fluvial processes along a reach of the Skawa River using CCHE2D model. Zeszyty Naukowe Akademii Rolniczej we Wrocławiu, seria Konferencje, XXXVII, 481, 155–165.* 3. *Książek L., Radecki-Pawlik A. 2008. Modeling of hydrodynamics conditions within the outlet of a sand-gravel Upland River – The Raba River, Polish Carpathians. Proc. Int. Conf. on Fluvial Hydraulics, River Flow 2008, 2.* 4. *Bartnik W., Banasik K., Książek L., Radecki-Pawlik A., Strużyński A. 2005. Forecasting of fluvial processes on the Skawa River within back-water reach of the Świnna Poręba Water Reservoir. Publs. Inst. Geophys. Pol. Acad. Sc., E-5 (387), 57–85.*

Structure of learning outcomes

Area of academic study: R – Agricultural, forestry and veterinary sciences	0.0	ECTS **
Area of academic study: T – technical sciences	6.0	ECTS**

Structure of student activity

Contact hours	57	hrs.	2.3	ECTS**
Including: lectures	15	hrs.		
classes and seminars	30	hrs.		
consultations	10	hrs.		
participation in research	0	hrs.		
obligatory traineeships	0	hrs.		
participation in examination	2	hrs.		
e-learning	0	hrs.	0.0	ECTS**
student own work	93	hrs.	3.7	ECTS**

*Areas of academic study in the fields of: A – the arts; H – humanities; M – medical, sport and health sciences; N – natural sciences; P – biological sciences; R – agricultural, forestry and veterinary sciences; S – social studies; T – engineering and technology

** stated with an accuracy to 0.1 ECTS, where 1 ECTS = 25–30 hours of classes