Course name: Numerical Modeling of Fluvial Processes

ECTS	6.0
Course status	*facultative*
Course final assessment /evaluation of outcomes	*exam / test*
Prerequisite	*basics of: open channel hydraulics, river morphology*

Main field of study: ***Engineering and Water Management***

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	*Environment Engineering and Land Surveying*
Name of department offering the course	*Hydraulic Engineering and Geotechnics*
Course coordinator	*Leszek Książek Ph.D., Andrzej Strużyński 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:			
NMF_K1	*the principles of operation of 1- and 2-dimensional numerical models. Has theoretical foundations in the construction of numerical models. Knows the rules of collecting data for a numerical model. Is familiar with the possibilities and limitations of numerical models.*	*IGW2_W01*	*T*
SKILLS – student is able to:			
NMF_S1	*model fluvial processes along a river reach within the influence of the back-water caused by a water reservoir as well as changes of river bed after flood events. The study are carried out using a set of the field measurements as well as computer simulations with one and two dimension depth-averaged model. Involving numerical modelling to computation allows increase the efficiency of work.*	*IGW2_U06*	*T*
SOCIAL COMPETENCIES – student is ready to:			
NMF_C1	*critically assess his knowledge, continuous self-education and improve his competences*	*IGW2_K01*	*T*

Teaching contents

Lectures:	15 hours
Topics	1. Introduction; 1D, 2D and 3D models; applications, limitations of use, data verification. 2. Governing equations and numerical methods; models structure. 3. Data collecting, numerical model of terrain, boundary conditions. 4. Simulations. Presentation and visualization of results. Interpretations of results, errors correction.

Accomplished learning outcomes	*NMF_K; NMF_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. *1–8. Program HEC-RAS – 1D model of water flow and sediment transport on a sector of the river.* 2. *8–20. CCHE2D model – modelling of fluvial processes on a mountain river: numerical model of terrain, mesh generator, boundary conditions, running a simulations, vizualization of results.*

Accomplished learning outcomes	*NMF_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. *Khan A.A. 2003. CCHE2D-GUI – Graphical User Interface for the CCHE2D Model.* 2. *Zhang Y., Jia Y. 2002. CCHE2D Mesh Generator.* 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, Vol. 2, 1399–1406.* 4. *Strużyński A., Wyrębek M. 2008. Evaluation of the Nida River main current below the perpendicular flood channel outlet. Hydraulic Methods for Catastrophes: Floods, Droughts, Environmental Disasters, IG PAS, Hydrology, E-10 (406), 175–185.*
Supplementary	1. *Tena A., Książek L., Vericat D., Batalla R. J. 2013. Assessing the geomorphic effects of a flushing flow in a large regulated river. River Res. Applic., 29, 7, 876–890, doi: 10.1002/rra.2572.* 2. *Mrokowska M. M., Rowiński P. M., Książek L., Strużyński A., Wyrębek M., Radecki-Pawlik A. 2016. Flume experiments on gravel bed load transport in unsteady flow – preliminary results. GeoPlanet: Earth and Planetary Science, 221–233, doi:10.1007/978-3-319-27750-9_18.*

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