



Environmental Hydraulics  
Umwelthydraulik

Mode of Examination	Art/SWH	Language	CP	Semester
K	2V / 2Ü	E	6	WS

**Learning Objectives**

This module introduces the general principles needed to describe and model surface and subsurface flows. Elementary theories such as the conservation of mass, energy and flux as well as quantities to describe flow properties are described. The module also gives an insight into the concepts of physical and numerical modeling. Furthermore, knowledge about hydraulic structures and their main purposes are presented. Upon successful completion of this module the students are able

- to understand the physical processes and phenomena that are relevant for surface and subsurface flow;
- to remember the fundamental principles for modeling flow processes and implementing them for practical problems;
- to apply simple hydro-numerical solution schemes.

**Contents**

1. Groundwater Hydraulics:
  - Continuum description of porous media
  - Darcy's law
  - Continuum equation for ground water
  - Application for different types of aquifers
  - Well hydraulics
  - Regional ground water flow
  - Numerical schemes for groundwater flow
2. River Hydraulics:
  - Kinematics and kinetics of flow (balance equations)
  - Laminar and turbulent flow
  - Flow models, similarity theory, physical modeling
  - Potential theory
  - Stationary, steady state open channel flow
  - Normal discharge, supercritical and subcritical flow
  - St. Venant equations, iterative solutions for the water table
  - Fundamentals of hydronumerical simulations (floods)

<b>Workload</b>	180 h (60 h in-class teaching and 120 h self-study incl. course achievements and examination performances)
<b>Recommended Prior Knowledge</b>	-
<b>Literature</b>	Baer, J., 1979: Hydraulics of Groundwater. McGraw-Hill, New York. Freeze, R.A. and Cherry, J.A., 1979: Groundwater. Prentice-Hall Inc. Englewood Cliffs. Kinzelbach, W. 1986: Groundwater Modeling, Elsevier. Lamb, H., 1993: Hydrodynamics. Cambridge Mathematical Library, Cambridge University Press. Chadwick, A., 2004: Hydraulics in Civil and Environmental Engineering. Taylor & Francis
<b>Media</b>	Blackboard, Beamer, StudIP
<b>Particularities</b>	none



<b>Organizer</b>	Thomas Graf	
<b>Lecturer</b>	Schlurmann, Torsten; Visscher, Jan	
<b>Supervisor</b>	Visscher, Jan	
<b>Examiner</b>	Schlurmann, Torsten	
<b>Institute</b>	Institute of Fluid Mechanics and Environmental Physics in Civil Engineering, <a href="http://www.hydromech.uni-hannover.de/">http://www.hydromech.uni-hannover.de/</a> Faculty of Civil Engineering and Geodetic Science	
<b>Programme Specific Information</b>	<b>P (mandatory) / W (elective) depending on Major</b>	
	<b>Major A: Water Resources Management</b>	<b>Major B: Sanitary Engineering</b>
	P	P