Course syllabus

Hydromekanik
Hydromechanics

VVRN35, 7,5 credits, A (Second Cycle)

Valid for: 2023/24
Faculty: Faculty of Engineering, LTH
Decided by: PLED W
Date of Decision: 2023-03-27

General Information

Main field: Water Resources Engineering.
Compulsory for: MWLU1
Elective for: V4-vr, W4-vr
Language of instruction: The course will be given in English

Aim

The objective of the course is to provide a physical understanding of phenomena and concepts in advanced water flows and to introduce calculation methods to analyze a number of important hydraulic problems. The course deals mainly with free-surface flows with emphasis on open-channel hydraulics.

Learning outcomes

Knowledge and understanding
For a passing grade the student must

- Possess a solid understanding of the basic phenomena and processes that govern free-surface flows
- Be able to formulate advanced models based on the governing equations for free-surface flows and to solve the equations for commonly encountered flow situations
- Be able to analyze complex flow problems using dimensional analysis and to develop rules for experiments with scale models
- In detail understand the impact of flowing water on submerged bodies and structures

Competences and skills
For a passing grade the student must

- Be able to quantitatively analyze different situations involving free-surface flows with regard to flow conditions, water depth, water velocity, forces etc.
- Be able to formulate rules for hydraulic model experiments and to determine the main dimensionless parameters that govern a specific flow problem
- Be able to quantify the impact of flowing water on submerged bodies and structures

Judgement and approach
For a passing grade the student must

- Be able to present the basis for analyses and calculations, including simplifications and assumptions made, when formulating mathematical models
- In quantitative terms be able to communicate the results of analyses performed to a qualified group of stakeholders
- Be able to critically review studies and reports dealing with problems within advanced free-surface flows

Contents

Hydraulic models, similitude, dimensionless numbers such as the Reynolds number and the Froude number. Dimensional analysis with Buckingham's pi-theorem. Boundary layer theory. Surface drag and form drag. Open channel flow in general. The energy principle with specific energy, flow controls, critical flow, Froude number. The momentum principle with the hydraulic jump. Uniform channel flow with Manning's formula and methods of calculation. Theory and analysis of gradually varying channel flow. Water surface profiles and numerical methods for the calculation of water depths. Spatial change of flow in channels. Practical views on channel design. Discharge measurements in channels. Weirs and flumes. Flow measurements in pipelines. Rapidly varying channel flow - bridge piers, control of the hydraulic jump.

Examination details

Grading scale: TH - (U,3,4,5) - (Fail, Three, Four, Five)
Assessment: Written examination and home assignments.

The examiner, in consultation with Disability Support Services, may deviate from the regular form of examination in order to provide a permanently disabled student with a form of examination equivalent to that of a student without a disability.

Admission

Assumed prior knowledge: VVR145/VVRA05 or VVR120/VVRF10 or a corresponding course in basic hydraulics/fluid mechanics.
The number of participants is limited to: No
The course overlaps following course/s: VVR090

Reading list

- French, R.: Open Channel Hydraulics, McGraw-Hill, 1994.
- Vennard, J. & Street, R.: Elementary Fluid Mechanics, John Wiley & Sons, 6th edition, 1982 (selected parts).
- Various handouts.

Contact and other information

Course coordinator: Professor Magnus Larson, Magnus.Larson@tvrl.lth.se
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Course homepage: http://www.tvrl.lth.se/utbildning/courses/