



LUNDS UNIVERSITET
Lunds Tekniska Högskola

Course syllabus

Vattenrörledningssystem - design, analys och förvaltning

Pipe System Engineering and Hydraulics

VVRN25, 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.

Elective for: MWLU2, V5-vr, W5-vr

Language of instruction: The course will be given in English

Aim

The course is given for students at the International Masters programme Water Resources (WaterLU), and for students following the 5 year programmes in Civil Engineering and Environmental Engineering and specialising in Water Resources Engineering. The objective is to prepare students for work with pipe systems in a wide context, e.g. feasibility studies, design, maintenance etc. The main focus of the course is on providing students with an in-depth theoretical understanding of hydraulics of pipe flow and pipe systems. The course is mainly concerned with analysis, design, planning and management of pipelines and pipe systems for water and drainage/sewage, while also treating pipe systems for district heating and district cooling.

Learning outcomes

Knowledge and understanding

For a passing grade the student must

- Show a deep understanding of which issues related to pipe systems that have to be treated; from planning and design to construction and management including maintenance and renewal.
- Show a deep understanding of fundamental physical phenomena and concepts relevant for pipe hydraulics.

- Be able to describe and analyse in-depth equations and mathematical models pertaining to pipe flow and pipe systems.
- Show deep understanding of how to apply equations and methods for solving complex practical engineering problems related to pipe systems.
- Have a fundamental understanding for the relationship between a pipe system and the quality of delivered water at the tap.
- Have an understanding of the main components of a management system for pipe systems.

Competences and skills

For a passing grade the student must

- Be able to apply advanced methods for quantifying flows in complex pipe systems.
- Be able to make computations for various types of non-steady flows, including water hammer and surface waves.
- Be able to apply, at a professional level, theoretical knowledge in design of pipe systems.
- Be able to plan the management of a pipe system and make good estimates of the need for renewal.
- Be able to present project results in an engineering report in English.
- Be able to communicate with a broad group of stakeholders the results from engineering analyses.

Judgement and approach

For a passing grade the student must

- Show a deep understanding for how pipe system design and management must be carried out with due consideration for sustainability, climate change and other societal interests.
- Be able to critically analyze proposals and reports concerning pipe flow and pipe systems.
- Show a deep understanding of the importance of presenting clearly the uncertainty in results and limitations of methods and models in connection with results based on hydraulic computations.

Contents

- Pipe systems put in a context (historical development, various types of engineering tasks).
- Fundamental equations and flow analysis based on finite control volumes.
- Turbulence theory and infinitesimal flow analysis, Navier-Stokes equations.
- Pipe systems (complex systems with pressurized and gravitational flow).
- Computer models for analysis and design of pipe systems.
- Hydraulic structures (weirs, gates, orifices, reservoirs, storages).
- Pumps and valves (analysis and design of pump systems, pump types, valve types).
- Non-steady flow (water hammer, surface waves).
- Water quality aspects (vulnerable points, methods for mitigating potential problems).
- Practical aspects of pipe system design, CAD, GIS.
- Measurement techniques, on-line monitoring, control systems, risk management.
- Management, maintenance and renewal of pipe systems.

Examination details

Grading scale: TH - (U,3,4,5) - (Fail, Three, Four, Five)

Assessment: The course examination is based on an extensive project assignment and a written exam. Marking of the project assignment is based on both the content and the style of the report, as well as an oral presentation. The course grade is based on a weighted average of the marks acquired at the exam and from the project assignment.

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

Admission requirements:

- VVR120/VVRF10 or Water VVR145/VVRA05 or other course in hydraulics

The number of participants is limited to: No

Reading list

Contact and other information

Course coordinator: Magnus Larson, magnus.larson@tvrl.lth.se

Course coordinator: Johanna Sörensen, johanna.sorensen@tvrl.lth.se

Course homepage: <http://www.tvrl.lth.se/utbildning/courses/>