Faculty of Engineering LTH

Lund has had an institute of technology for 40 years – LTH – which is now part of Lund University, constituting its Faculty of Engineering. The Faculty of Engineering LTH has more than 5,000 undergraduates studying programmes leading to various degrees.
Among the 4 ½-year engineering programmes are subjects such as engineering physics, civil engineering, chemical engineering, electrical engineering, computer science and engineering, mechanical engineering, surveying, engineering nano-science, engineering mathematics, information and communication engineering, industrial management and engineering, environmental engineering, biotechnology and risk management.
The Faculty of Engineering LTH has about 540 postgraduate students whose goal is to obtain a doctoral degree in engineering after four year's study.

International Office, Faculty of Engineering LTH

The International Office at LTH, Studiecentrum is open for students between 8.30 and 16.00. If you have any questions or problems, please feel welcome to visit. Turn to Anna Carlqvist and if you want to be sure that she is there just send an e-mail and make an appointment anna.carlqvist@kansli.lth.se

Academic Year

The academic year is divided into two terms. At LTH each term is divided into two study periods. Each study period consists of seven weeks. Usually you study at least two courses in parallel during each period.

Autumn term 2006, August 28 – January 13
Spring term 2007 (preliminary) January 15 – June 1

Christmas vacation: December 21, 2006 - - January 7, 2007
Easter vacation: April 2, 2007 - - April 9, 2007 (preliminary)

Credit System

Academic studies in Sweden are organized according to a credit system. One Swedish credit is equivalent to one week of full-time studies, and during the course of a normal academic year students should aim at obtaining 40 credits.

Degree

The international master's programmes in

- Bio- and Food Technology
- System-on-Chip
- Water Resources

will lead to the Swedish degree of "Magisterexamen" which is translated into English as "Degree of Master in...". This degree is awarded by the Faculty of Engineering LTH.

Degree projects in engineering programmes

Aim

In the project paper the student should display an ability to apply and compile knowledge and skills acquired on various central and qualified courses of the relevant educational programme. Through the project the student should demonstrate an ability to identify, analyse and solve a technical or scientific problem and evaluate the solution, and to present and document the result. The project should be an in-depth study of a topic, showing that the student can apply the methods of science and engineering.
The paper should be the result of independent work, carried out individually or in a group of two. If the paper is produced jointly there should be a clear statement of who contributed what. The paper should be written on one of the topics stated in the study programme syllabus unless the education committee permits an exception in individual cases.
A pass on the project is compulsory if a student it to obtain a degree in engineering.

Content

The work on the project includes:
• A written report in Swedish or English with a summary in English
• A separate summary which may be popular in character or take the form of a scientific article
• A presentation at a public seminar at LTH
• Acting as opponent at a seminar where another student's paper is presented
All of the above points must be approved if the project is to receive a pass grade.
The report should be available in a version for examination at least one week before the seminar. The department takes responsibility for producing the required number of copies of the report. It is desirable but not compulsory that the report should be scrutinized by another project candidate at the seminar. The same report can be scrutinized by more than one candidate. The seminar may be scheduled outside term time if the student, supervisor and examiner are in agreement.
The report is public and no part of it may be kept confidential. The examiner may not take into account any confidential information when assessing the report. The department must file the report.

Assessment and supervision

For each project topic the head of department appoints one or more teachers with research training at Lund University as examiner. This means, among other things, that the project is to be examined at Lund University even in the case of exchange students. The examiner decides the grade to be awarded to the paper. Before work on the project begins, the examiner must approve the choice of topic and appoint a supervisor to provide the candidate with continuous supervision. The aim of the supervision includes making it possible to complete the project within 20 weeks of full-time study. The student cannot expect supervision for more than 15 months. The examiner may appoint as supervisor anyone deemed suitable. The supervisor need not be a teacher at LTH. No one may act as examiner on a paper which he or she has supervised. The grades awarded are either pass or fail.

Scope

The degree project is worth 20 credits.

Eligibility and registration

Work on the project may begin when the student has at least 140 credits (30 credits for Master's

students) which may count towards the degree. Dispensation from this can only be granted by the education committee and only if there are special grounds.
To be allowed to start work on the project the student should also have acquired sufficient knowledge in the subject field of the project. It is up to the examiner to determine whether this requirement has been met before the work begins.

Examination

There is always one week of examinations at the end of each study period prior to the start of the next study period. It is not unusual for a course to run over two study periods and be followed by an examination at the end of the course. Written examinations at the end of a course are the most common form of evaluation, however, written reports, which may be presented orally to the lecturer or to a group, are also a common means of evaluating the performance of students.
There are always three periods of re-examination every year: in August, just prior to the start of the new academic year, in the beginning of January and just after the Easter holidays.

Grades

The grades usually awarded at the Faculty of Engineering LTH are:

5 - Excellent
4 - Very good
3 – Pass

Some of the courses are graded simply as Pass or Fail. NB! The only grade available for a Master's thesis is a Pass.
There will be no ranking of the students enrolled in the master's programmes.

Individual written exams

The length of the exam can vary from 1 to 6 hours. Normally the students should register in advance in order to participate in the exam.
The student should bring the following to an exam: Valid ID, the original “Letter of Acceptance” and permissible accessories such as pencil, ruler and eraser.
During the written exam, invigilators will answer any general questions and ensure a controlled environment. The responsible lecturer is normally available during parts of the exam to answer more specified questions. Students may bring drinks or snacks to the exam. The student should enquire as to which accessories are allowed during the exams. It is forbidden to bring accessories such as, notes, books, calculators, mobile phones, tape recorders etc., unless approved by the responsible lecturer. It is considered cheating if forbidden accessories are used or found during the exam. Communication between examining students is also considered cheating. Also note, that cheating is not socially accepted among students! Any incidence occurred where cheating is suspected will be reported to the Board of Discipline and may lead to that the student will be expelled, if he is found guilty.

Graduation Day

Graduation will be celebrated once a year by a ceremony in the University building in December.

Student Counselling

Are you having trouble concentrating on your studies, perhaps because of personal problems? Are you going through difficulties as a result of studying abroad or because of a culture change? Are you in a crisis situation and need to talk to someone or get help?

At LTH we have student counsellors who are trained social workers and are there to help you. Please be assured that all your dealings with these counsellors are strictly confidential. You can call or e-mail to make an appointment at:
046-222 71 91, LTH, E-building, Ulla.Bergman@kansli.lth.se

Students´ Health Care

Studenthälsan/student health care centre provides care and counselling for all students at Lund University/LTH. They can help you with physical, personal or social problems, which may hamper your capacity to succeed with your studies. You may consult a general practitioner or psychiatrist, a social worker, psychologist or nurse. The centre can also provide support groups and the possibility to discuss focus issues like alcohol, eating disorders, stress reactions and examination anxiety.

Visiting address: Gerdagatan 7a, Lund
Postal address: Box 117, 221 00 Lund
Phone: 046-222 4377 (reception 222 0000)
Fax: 046-222 4386
E-mail: studhals@stu.lu.se

Time booking: Mon-Thurs 9-00 - 12-00, 13.00 – 15.00, Fri 9.00 – 12.00, 13.00 – 14.00

Timetables

The schedule generator is only available in Swedish. Here is a short instruction how to generate your timetable:

1) Go to the schedule generator Http://klth4d.kansli.lth.se/start.html, and choose the appropriate study period.
2) Enter the course code in the form field and click “Sök” (Search)
3) The search has one result. Mark the box and click “Lägg till” (Add).
4) If you have successfully added a course, you will see a list of the courses that you have chosen. You can use the form field to add more courses
5) When your list is complete, click “Generera schema” (Generate schedule)

This may seem rather complicated, but you’ll soon get the hang of it, so don’t give up.

STUDY PLAN

WATER RESOURCES

Master's Programme in Water Resources

1 Aim and purpose

1.1

The programme comprises 60 credit points/90 ECTS credit points, corresponding to 1,5 years of full-time studies and leads to a Magister degree (translated as Master) in Water Resources.

1.2 General content of the programme

General objective for all Master's Programmes are that they should give the students abilities to seek and evaluate knowledge within their chosen field.

1.3 Special objective of master's education in Water Resources

A special objective for the Master's Programme in Water Resources is to give the student a solid science and technology knowledge base relevant for analysis and development of human activities in the Water Sector.

2 The main content and arrangement of the programme

The programme consists of compulsory courses (37,5 ECTS credit points), optional courses (22,5 ECTS credit points) and a degree project (30 ECTS credit points).

3 Special prior knowledge required for admission

General: B.Sc or B.Eng. in Civil Engineering, Environmental Engineering, Environmental Science or equivalent with at least 3 years of studies at University level. Proven proficiency in the English language is also required: TOEFL at level 550 (213 for computer based TOEFL) or more, IELTS 6.0 or Cambridge Certificate of Proficiency.
Special requirements: University courses in Mathematics (calculus), Hydraulics/Fluid Mechanics and Geology or equivalent. For the optional course in Limnology an elementary course in Ecology is required.

4 Grading

Grades are awarded for whole courses and tests as stated in the respective syllabus. Whole courses are graded as fail, pass (3), credit (4), and distinction (5). Grades for tests are either fail or pass. The syllabus may, however, contain instructions that a particular whole course shall be graded as either fail or pass. For degree projects the grade is failed or passed. In addition, the syllabus may contain rules about different grade scales for the constituent tests. Courses and tests which a student has failed are not included in the course certificate or degree certificate. Note that, in the grade system used at LTH, grades are absolute and directly linked to the target knowledge and not based on ranking of the students.

5 Degree certificate and qualification

When the requirements for the degree are satisfied, students receive a degree certificate as Master in Water Resources. The certificate is accompanied by a Diploma Supplement in English, describing the content and scope of the education. This is intended to facilitate the acknowledgment of university qualifications throughout Europe and in other parts of the world.

6 Examination requirements

6.1 Required courses

The programme is divided into courses. Section 8 shows which courses must (compulsory courses) or may (optional courses) be part of the qualification if a student is to be considered to have followed and passed the programme. All the courses listed in section 8 are given in English. To obtain a degree, students, besides the basic eligibility stated in section 3, must have passed compulsory and optional courses and completed a degree project, all to a total value of at least 60 credit points/90 ECTS credit points. At least 45 credit points, including the degree project, must be obtained at LTH. Students who wish to include a course which is not listed in section 8 below must apply to the Education Committee for permission to do so. Courses from other faculties at Lund University may be included after application to the Education Committee; further information is available from the study counsellor. A course from outside the programme will only be included in the degree if it is relevant for a Master's in Water Resources.

7 Special regulations

7.1 Pre registration

Pre registration is compulsory for all courses.

7.2 Prerequisites

For some courses prerequisites are given and must normally be adhered to.

7.3 Course Outlines

All necessary information, general as well as practical, regarding the course is given in course outlines, which should be distributed electronically to the students at least two weeks in advance of the first class.

7.4 Laboratory exercises and field trips

All laboratory exercises and field trips in the programme are compulsory unless otherwise stated in the course description.

7.3 Course evaluations

All courses in the programme will be evaluated.

8 List of courses

8.1 Compulsory courses, year 1

Code	Course	Credits	Study period
VVR140	Rural Waters	5	1 Autumn
VVA030	Urban Waters	10	1 – 2 Autumn
VTG070	Groundwater and Environment	10	2 Autumn – 1 Spring

8.2 Optional courses, year 1

Code	Course	Credits	Study period
VVR090	Hydromechanics	5	1 Spring
VVR170	River Restoration	5	1 – 2 Spring
VVR???	Environmental Hydraulics	5	1 - 2 Spring
VVR041	Coastal Engineering	5	2 Spring
VVR130	International Water Issues	5	2 Spring
TEK035	Limnology	10	2 Spring

8.3 Specializations

By choosing optional courses, corresponding to 15 credit points/22,5 ECTS credit points the students follow an individual specialization within the field of Water Resources or Ecology.

COURSES

WATER RESOURCES

LIMNOLOGY BIO621

Credit Points: 10 **Grading:** UV. **Prerequisites:** Elementary course in Ecology.

Aim:

provide teaching in the basic features of structure and function of inland waters

offer practical training in limnological laboratory and field methods

highlight the effect of man on inland water ecosystems

provide information about conservation and restoration measures for lakes and watercourses

provide training in limnological synthesis

provide a basis for further studies and professional roles within the limnological area

Description

During the first half of the course current theories and models concerned with the physical properties of water, cycling of nutrients and other ions, and the relations within and between organism populations as well as between organisms and the abiotic environment are presented. Emphasis is placed on the understanding of recent discoveries about the function of aquatic ecosystems. Effects of man on lake ecosystems is discussed with special reference to eutrophication and acidification. Different types of lakes and rivers are studied on field trips, and the connection between lake type and the different physical and chemical parameters of water as well as organism populations are highlighted. Material is collected for the analysis of phyto- and zooplankton, bacteria, benthic invertebrates, fish, macrophytes and the chemistry of water and sediment.

GROUNDWATER AND ENVIRONMENT VTG070

Credit Points: 10. **Grading:** TH. **Lecturer:** Universitetslektor Gerhard Barmen och universitetsadjunkt Conny Svensson, Engineering Geology. **Prerequisites:** Geology corresponding to 5 ECTS, VTG011 or VTG060 and also hydrology/hydraulics corresponding to 10 ECTS or VVR150 **Examination:** Written examination 5 hours. Two compulsory supervised projects. Written report and oral presentation at a seminar. **Notes:** If less than 15 participants the course can be cancelled.

Aim

Knowledge

- The student shall obtain basic knowledge about hydrogeology in order to be able to handle water supply, waste management and other civil and environmental engineering tasks,
- The student shall obtain a thorough understanding of groundwater and soil water occurrence, flow, origin and also chemical and physical properties. The student shall also obtain thorough understanding of how handling and management of waste and remnants can cause soil and groundwater contamination, in particular by leaching of contaminants.

Skills

- The student shall obtain practice in carrying out calculations and technical investigations dealing with hydrogeology, groundwater hydraulics, well construction, contaminant transport and groundwater protection,
- The student shall obtain experience from the use of simulation software regarding groundwater flow, hydro geochemical processes and contaminant transport,

- The student shall become skilled in presenting hydro geologically related commissions by written reports and to some extent by oral presentations,

Attitude

- The student shall fully realize the need of knowledge of geology, hydrology and hydraulics as well as hydro geochemistry when treating complex hydro geological problems,
- The student shall realize the importance of cooperation between experts and specialists with different skills when carrying out projects concerning groundwater and groundwater contamination,

The student shall adopt a critically reviewing relationship to results from different kinds of computer based simulation tools.

Description

Hydrogeology: groundwater occurrence and behaviour in various kinds of aquifers. Soil water and soil water movement. Fluctuations in groundwater level on various time-scales and in various formations. Temperature and age of groundwater. Groundwater quality: water analyses, chemical composition, equilibrium, chemical processes and pollution. Drilling and well technology. Hydraulic properties of aquifers and wells. Groundwater withdrawal and test pumpings. Analysis of data by graphical methods. Hydraulic boundaries. Projects: two compulsory projects in which students use their theoretical and practical knowledge to solve a complex groundwater-engineering problem emphasizing risk of contamination. Projects are tackled in small groups with a supervisor. The results are presented in written form and in a seminar. The environmental part of the course includes general descriptions of handling of waste and remnants in the society as well as characterization of waste. Contaminated soil and waste deposits and also other sources of pollutants are treated. Treatment and cleaning-up of contaminated soils. Leaching of contaminants are emphasized as well as simulation of chemical reactions and contaminant transport by the computer code PHREEQC.

Literature

Fetter, C W: Applied Hydrogeology Fourth edition. Prentice Hall 2001
Svensson, C: Groundwater chemistry. Teknisk geologi, LTH 2004.
Exercises. Additional books and off-prints for the environmental part.

URBAN WATERS VVA030

Credit Points: 10. **Grading:** TH. **Lecturer:** Associate professor Karin Jönsson, Water and Environmental Engineering. **Prerequisites:** VVR015 or VVR120 or corresponding knowledge. **Recommended prerequisites:** VVB100 Infrastructure Systems - Urban Water
Examination: Written examination. Written and oral presentation. Laboratory lessons. Computer exercises. Presence at seminars. **Comments:** A minimum of 15 participants is a requirement for the accomplishment of the course. Re-examination can be either oral or written examination. The course is a prerequisite for VVR130 International water issues.
Web page: www.vateknik.lth.se.

Aim

The student will within the limits of this course obtain a survey of water transport and handling in urban areas. The student will also learn how to dimension and plan operation of establishments for drinking-water supply, wastewater treatment and storm-water handling in urban areas.

Knowledge goals

Through the course:

- the student will obtain basic knowledge about the elements of the urban water system and the relations between the elements.
- the student will obtain basic knowledge about quantity and quality aspects of storm water, drinking water and municipal and industrial wastewaters.
- the student will obtain basic knowledge about processes and methods for handling and treatment of storm water, drinking water and municipal and industrial wastewaters.
- the student will obtain basic knowledge about fundamental microbiological facts and chemical reactions making up the foundation for processes in the urban water system.
- the student will obtain an overview of small-scale systems for storm-water and wastewater handling in industrialized and developing countries.
- the student will obtain an overview of methods and applications for re-use of storm water and wastewater.

Proficiency goals

Through the course:

- the student will obtain training in evaluation of different process alternatives from a dimensional and operational point of view.
- the student will obtain training in identifying important dimensioning factors in basic data.
- the student will obtain training in evaluating operational data in relation to the methods that have generated the data.
- the student will obtain training in compilation of reliable parameters for dimensioning.
- the student will obtain training in how to bring about knowledge and how to give causes for and present chosen process alternatives.
- the student will obtain training in using computer simulations when evaluating operation and dimensioning of wastewater treatment plants. The student might also get training in using computer simulations of storm-water transport.

Attitude goals

Through the course:

- the student will obtain an understanding of the relation between water quality and the choice of water treatment method.
- the student will obtain an understanding of how the elements of the urban water system are related to each other and how they interact.
- the student will obtain an understanding of what effect a variation in the parameters of the urban water system has on the operation and dimensioning of the components of the system.
- the student will obtain a critical attitude to different technical solutions in the urban water system.

Process goals

The supervisors (teachers/researchers and assistants) shall assist the students´capability to independently collect relevant knowledge. The supervisors shall support the students´ learning activities and their development of the capability of critical thinking and independent assessments and reflections. The students´capability to control their own learning will be trained. The students´ability to actively take part in group discussions and to co-ordinate different interests in a constructive way is trained by working in groups. The students´competence of identifying and solving problems is strengthened by project works. The students get training in oral and written presentation in English.

Description

The first part of the course contains to a comparatively large extent tutor-aided lectures and exercises. Some of the lectures/exercises are adjusted to the different previous knowledge of the students and hence they take part in smaller groups. In parallel, the course is started with a minor project carried out in small groups. Written and oral reports of the projects are presented at a seminar after a few weeks. All students will have at least one oral presentation during the course.

The second part of the course begins with computer exercises offering the students the possibility to test the knowledge gained during the first part of the course. Commercial computer models are used within the course. Lectures and exercises are arranged in parallel to the computer exercises. Written and oral reports of the computer exercises are presented at a seminar. The computer exercise ends with a lecture on how to apply computer modelling to urban water systems. By means of study visits and laboratory lessons possibilities of practical implementation of gained theoretical knowledge from lectures and exercises is offered to the students. The course ends with a written examination.

The course includes essential aspects on the whole urban water system. The course deals with the following areas of knowledge:

- Survey of water resources, water consumption and water quality
- Treatment processes for potable water.
- Storage and distribution of potable water.
- Urban hydrology.
- Storm-water handling and treatment.
- Computer models on storm-water.
- Centralized and decentralized wastewater systems.
- Characterisation of municipal and industrial waste waster systems.
- Physical, chemical and biological treatment processes.
- Computer models on activated-sludge processes.
- Sludge treatment.
- Re-use of wastewater and storm-water.

Literature

Compendium.

COASTAL HYDRAULICS VVR040

Credit Points: 5. **Grading:** TH. **Lecturer:** Hans Hanson, Water Resources Engineering.
Prerequisites: VVR120 Fluid Mechanics or VVR150 Water and Environment.
Examination: To qualify for a final grade, students must have submitted the compulsory exercises. The final grade equals the grade obtained in the examination. **Web page:** aqua.tvrl.lth.se/course/Undergraduate.html.

Aim

The course provides knowledge in the areas of Coastal Hydraulics, Coastal Sediment Transport, and Coastal Management. Coastal Hydraulics focuses on wind-generated waves and the forces such waves create in the coastal area. Coastal Sediment Transport discusses transport processes under waves and currents. Coastal Management includes engineering methods for protection against coastal erosion as well as strategies for planning and management of coastal areas in a broader societal context. The main objectives of the course are to provide basic knowledge about

the governing physical processes as well as to communicate coastal problems and solutions as an integrated part of society.

Description

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Literature

US Army Corps of Engineers: Shore Protection Manual. Hanson, H.: Coastal Engineering Issues in Coastal Zone Management, Hanson, H.: Sediment Transport and Coastal Protection. Hanson, H.: Sample problems in coastal engineering.

HYDROMECHANICS VVR090

Credit Points: 5. **Grading:** TH. **Lecturer:** Lennart Jönsson, Water Resources Engineering. **Prerequisites:** VVR150 or VVR120 or a corresponding course in basic hydraulics/fluid mechanics. **Examination:** Written examination, assignments and a laboratory exercise. **Web page:** aqua.tvrl.lth.se/course/Undergraduate.html.

Aim

This course is a continuation and enhancement of the hydraulics part of the basic course in Water Resources Engineering. The aim is to convey a physical understanding of technically important hydraulic phenomena as well as to describe computational methods. Significant emphasis is placed on free surface flow - mainly concerning channel flow. Some other areas - such as boundary layer theory, similitude and dimensional analysis, drag, flow measurement methods - are also treated.

Description

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.

Literature

French, R.: Open Channel Hydraulics, McGraw-Hill, 1994
Vennard, J. & Street, R.: Elementary Fluid Mechanics, John Wiley & Sons, 6th edition, 1982 (three chapters)
Hand-outs

INTERNATIONAL WATER ISSUES VVR130

Credit Points: 5. **Grading:** TH. **Lecturer:** Associate Professor Linus Zhang, Water Resources Engineering. **Prerequisites:** VVR111 Hydrology and Aquatic Ecology and VVR120 Fluid Mechanics or equivalent. **Examination:** Written examine plus one project. **Web page:** http://aqua.tvrl.lth.se/course/VVR130/VVR130.htm **Comments:** The course will be based to a large extent on recent or ongoing international research projects at the department. Also one or more projects from departments of Water and Wastewater Engineering, Technical Geology and Limnology.

Aim

The aim of the course is to prepare the students for international water related jobs (mainly in the developing countries).

After completing the course the student is expected to

- have good knowledge about the main international water issues,

- have a good understanding of the importance of non-technical aspects of water issues,

- know the special problems of the developing countries and their most common problems related to water and the environment.

Description

International water issues: Floods, droughts, drinking water, sanitation, pollution, water resources planning. These issues will be studied with an emphasis on technical aspects and natural sciences, but also taking other aspects into account.

Non-technical aspects: International organisations, water related international aid, politics and administration related to water.

Project work/Case-studies relating to ongoing international research projects.

Literature

Principles of Water Resources: History, Development Management and Policy. By Cech, Thomas V.
Wiley, UK, 2002 (ISBN 0471438618). First or Second Edition.
Some complementary material.

RURAL WATERS VVR140

Credit Points: 5. **Grading:** TH. **Lecturer:** Rolf Larsson, Water Resources Engineering. **Recommended prerequisites:** Hydrology and Hydraulics as VVR150(alt. VVR015) or VVR111+VVR120 or corresponding.Mathematical Statistics **Examination:** Written examination, compulsory assignments. **Web page:** aqua.tvrl.lth.se/course/vvr140/vvr140.html.

Aim

The main objectives are that the students should reach an advanced understanding of the hydrological processes and that the students should acquire an ability to compute precipitation generated flows in rivers. The students should learn to use mathematical models as tools for river runoff computations and for design of hydraulic works and structures.

Description

Run-off modelling in rural areas. Hands-on exercises using computer models. Associated topics; rain characteristics, snow melt, melt water movement, water movement in the unsaturated zone, surface run-off, linear reservoir theory, conceptual modelling. Thermo- and hydrodynamics of lakes. Assignments include an essay, rainfall-runoff modelling and lake routing.

Literature

Ward & Robinson: Principles of Hydrology, McGrawHill.

RIVER RESTORATION VVR170

Credit Points: 5. **Grading**: TH. **Lecturer:** Dr Rolf Larsson, Rolf.Larsson@tvrl.lth.se, Water Resources Engineering. **Recommended prerequisites:** Hydrology and Hydraulics as VVR150 or VVR111 and VVV120. Also VVR 090. **Examination:** Written exam, mandatory assignments and excursions. **Comments:** http://aqua.tvrl.lth.se/course/TNV080/TNV080.html **Notes:** The course is delivered in cooperation with the Limnology Department. Class scheduled for evenings. A minimum of 15 participants is a requirement for the accomplishment of the course.

Aim

After completing the course each student should:

- have enough knowledge of the physical/biological processes involved in river related problems to be able to communicate with other specialists;
- have a clear overall picture of river restoration/management approaches;
- have good knowledge concerning key rules and regulations related to river management (focused on Sweden);
- know where to find relevant information concerning river restoration/management;
- have good knowledge of existing problems and management methods in Europe

Description

Review of basic concepts in hydrology, hydraulics, sediment transport and lotic ecology. Introduction to river management / restoration goals and approaches. Overview of recent advances in river restoration methodology and techniques. Overview of key legal and administrative aspects of river restoration in Europe (EU), with focus on Sweden. Overview of experiences from around the world.

Literature

1. Madsen B.L., 1995. Danish Watercourses — Ten years with the new watercourse act (collected examples of maintenance and restoration). Danish Environmental Protection Agency, Ministry of Environment and Energy, Denmark. Available for free at (link also found on course web site): http://www.mst.dk/udgiv/Publications/1995/87-7810-344-4/pdf/87-7810-344-4.PDF
2. Lecture notes. Distributed as handouts during lectures and/or published on www (aqua.tvrl.lth.se/course/TNV080/TNV080.html).

ENVIRONMENTAL HYDRAULICS VVR???

Credit Points: 5 **Grading:** TH **Lecturer:** Professor Magnus Larsson, Magnus.Larsson@tvrl.lth.se **Prerequisites:** VVR150, VVR120 or a corresponding course in basic hydraulics/fluid mechanics. **Examination:** Written examination and home assignments

Aim

Since the beginning of time human activities have been located close to surface waters such as river, lakes, and coastal areas. In connection with such activities, questions have arisen concerning the effects of water flow on the activities as well as the impact of the activities on the natural environment. Originally the former questions were of greatest concern, but during the latest decades the most important issues have encompassed the environmental impact. The objective of the present course is to provide a fundamental understanding of the phenomena and processes that govern the water flow in the environment with the special purpose of providing the students with knowledge to analyze the conditions for and consequences of human activities. Activities refer primarily to discharge of pollutants to different water bodies, but the interaction between structures and water flow is also discussed. A brief overview of basic sediment transport is also included.

Description

An overview of water flow in the environment – phenomena and processes related to such flow. Transport processes and spreading of pollutant. Balance equations for water and pollutants in surface water systems with instantaneous mixing. Piston flow and nominal retention time. Basic mechanisms for mixing such as diffusion (laminar and turbulent), dispersion, and advection. The general transport (advection-diffusion) equation – formulation and special cases. Mixing in rivers, lakes, and coastal areas. Jets and plumes (shear flows). Near- and far field mixing. Diffusers and other technical solutions for pollution discharge. Field measurement techniques. Case studies concerning pollution discharge and environmental impact. Density-driven flows including stratification and horizontal spreading of pollutants. Temperature and oxygen conditions in natural waters together with governing equations. Interaction between structures and water flow. Basic sediment transport and boundary layer theory. Bed load and suspended load. Some commonly used sediment transport formulas.

Literature

Jönsson, L. 2004. ”Receiving water hydraulics,” Department of Water Resources Engineering, Lund, Sweden.
Parts of Fischer et al. 1979. ”Mixing in inland and coastal waters,” Academic Press, New York, NY.