AE2102 Quantitative Hydrogeology 7.5 credits

Quantitative Hydrogeology

This is a translation of the Swedish, legally binding, course syllabus.

If the course is discontinued, students may request to be examined during the following two academic years

Establishment

Course syllabus for AE2102 valid from Autumn 2007

Grading scale

A, B, C, D, E, FX, F

Education cycle

Second cycle

Main field of study

Built Environment

Specific prerequisites

Environmental Dynamics/Physical Processes and either Environmental Dynamics/Chemical Processes or Environmental Aquatic Chemistry.

Language of instruction

The language of instruction is specified in the course offering information in the course catalogue.

Intended learning outcomes

After fulfilment of the course the general aim is that the student should be able to

- Manage groundwater projects – including water resources problems and quality and contamination problems related to the subsurface water.

Specific aims are that the student should be able to

- Establish a conceptual hydrological and hydrogeological framework, define boundary conditions, prepare computer model settings, determine the essential parameters associated with water resources and groundwater contamination problems for a watershed,
- Carry out flow and transport modelling of subsurface water for scenario analyses, quantitative assessments and risk assessments for a given site (a landfill is used as a study case in the course), apply tools for decision aid related to water resources and water quality problems,
- Carry out risk analysis for groundwater systems,
- Plan and select methods for remediation of contaminated soil,
- Carry out and interpret field measurements (geophysics, water sampling, geohydraulics, piezometers, etc.),
- Prepare and communicate a vocational site-specific report based on groupwork for a groundwater-modelling project in an international project.

Course contents

The course lectures will include: (i) an introduction to hydrogeological units; conceptual models of groundwater recharge and flow; review of the principles of subsurface flow, theories of solute transport in porous and fractured media, confined, confined-leaky, unconfined aquifers and regional subsurface flow systems, (ii) hydrochemistry with the emphasis on mineral water equilibria in various aquifer media and aquifer types; transport processes, such as advection, diffusion, dispersion and sorption, related to substances in hydrogeological media; (iii) parameterisation by means of geostatistics and inverse modelling; accounting for the variability of hydrogeological data; variogram analysis, kriging and simulation, (iv) groundwater vulnerability and protection, and (v) soil remediation, and (vi) risk analysis.

The exercise projects will render a major course report. The exercises are directed towards problem solving, generally with computer models, and require student participation. Students are permitted to follow their own line of work within the group project, provided that it is of relevance and the course supervisors agree to it.

Course literature

The course is highly web-based. Thus, most of the lecture and exercise material will be available on the course home page. Relevant and highly recommended reference literature is presented below:

- Fetter, C.W, 2001. Applied hydrogeology. McMillan College Publishing Co (parts of the book).
- Schwartz F.W., Zhang H., 2003, Fundamentals of Groundwater, Wiley, ISBN 0-471-13785-5, 583p
- Domenico, P.A. & Schwartz, F.W, 1998. Physical and chemical hydrogeology, John Wiley & Sons, Engelewood Cliffs New Jersey, Inc. 506 pp., (parts of the book).
- Tindall, J.A., Kunkel J.R., 1999, Unsaturated Zone Hydrology for Scientists and Engineers, Prentice Hall, ISBN 0-13-660713-6, 624p.
- Anderson, M. P. & Woessner, W.W., 1992, Applied groundwater modeling - simulation of flow and advective transport, Academic Press, pp. 381 (parts of the book).
- Kehew A. E., 2001, Applied Chemical Hydrogeology, Prentice Hall, IBSN 0-13-270927-9.
- Brassington, R., 1999, Field Hydrogeology, J. Wiley & Sons, pp. 248. ISBN 0-471-97347-5.
- Field Geophysics by John Milson, Geological Society of London Handbooks, J. Wiley & Sons, ISBN 0-471-93248-5

Examination

- LAB1 - Laboratory Work, 1.5 credits, grading scale: A, B, C, D, E, FX, F
- TEN1 - Examination, 3.0 credits, grading scale: A, B, C, D, E, FX, F
- ÖVN1 - Exercises and Field Exercises, 3.0 credits, grading scale: A, B, C, D, E, FX, F

Based on recommendation from KTH's coordinator for disabilities, the examiner will decide how to adapt an examination for students with documented disability.

The examiner may apply another examination format when re-examining individual students.

Other requirements for final grade

Project (Project report and seminar with opposition, PRO1; 4,5 cr)
Computer labs (groundwater modelling and risk analysis, DL 2; 1.5 cr)
Exercises and workshops (Conceptual modelling and soil remediation, ÖVN2; 0.75 cr)
Examination (written or oral examination of theoretical aspecs of the project, TEN1; 0.75 cr)
Grading
The course grade is based on three factors: (i) structure, contents and form of the course report, (ii) an oral seminar on the course report, and (iii) an individual or group examination of theoretical issues dealt with in the course report.

Ethical approach

- All members of a group are responsible for the group's work.
- In any assessment, every student shall honestly disclose any help received and sources used.
- In an oral assessment, every student shall be able to present and answer questions about the entire assignment and solution.