MJ2635 Environmental Modelling: Introduction and Application Examples 6.0 credits

Miljömodellering: Introduktion med applikationsexempel

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

Establishment

Course syllabus for MJ2635 valid from Autumn 2009

Grading scale

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

Education cycle

Second cycle

Main field of study

Specific prerequisites

At least 150 academic credits (ECTS) in a program of engineering or natural science or the course MJ1502 or MJ1500 or equivalent.

Language of instruction

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

Intended learning outcomes

The course is intended to give introductory knowledge and an overview of methods for environmental modelling and its purposes. The course is also intended to give introductory knowledge and experience in model construction and evaluation. You will also practice your skills in communicating environmental modelling. The application examples illustrate primarily water quality issues, but also touch upon modelling of global and local element cycles and ecosystem modelling. After finishing the course, the student should be able to

- Describe the main aims and parts of water quality modelling;
- Describe the key concepts within Environmental Modelling, for example calibration, verification, validation, robustness, model error, oscillation, discretizations, and to distinguish between deterministic and stochastic models;
- Identify dominant processes and carry out sensitivity analyses;
- Mathematically formulate mass-balances for environmental modelling purposes and for simple systems solve those analytically of numerically (using EXCEL or SIMILE or similar modelling tools) for steady-state and dynamic conditions (difference equations/differential equations);
- Predict the key features of breakthrough curves for non-reactive and reactive substances and explain how these are affected by the dominant transport and chemical processes and their model parameterisation;
- On an introductory level use one or more numerical tools (for example PHREEQC, MEDUSA/HYDRA or ORWARE, SIMILE) for environmental modelling;
- Explain the key aspects of the biogeochemical cycles and be able to evaluate the cycles in terms of turn-over-times, steady-state and dynamics;
- Put up, use, and interpret a mathematical model for material cycling in ecosystems and the dynamical aspects of ecological systems, including logistic growth, carrying capacity, and oscillation;
- Understand written descriptions of environmental modelling and on a basic level evaluate these models;
- On an introductory level, communicate environmental modelling for different users, and describe the role of environmental modelling within research and development, environmental issues (including risk) and policy issues.

Course contents

- Fundamentals of environmental modelling and mathematical quantification
- Fundamental definitions and principles of model constructions
- Causality modelling
- General formulation of mass balances and their applications within environmental modelling

- Model descriptions and coupling of chemistry and transport for water quality problems
- Training in the use of numerical modelling tools
- Practice in reading environmental modelling texts and manuals and in evaluating modelling work
- Examples of modelling water quality, global and local element cycles, and ecosystem dynamics
- Project work within environmental modelling

Course literature

Will be announced on the course homepage.

Equipment

The course uses KTH's learning management system (LMS) as an important support. PC with internet and e-mail and the possibility to use Word and Excel (Microsoft version recommended) and to read pdf- files is necessary. Other software that is needed in the course will be downloadable from the internet or from the LMS.

Examination

- PRO1 - Project 1, 2.0 credits, grading scale: A, B, C, D, E, FX, F
- RED1 - Assessment 1, 0.5 credits, grading scale: A, B, C, D, E, FX, F
- UPP6 - Home Work Assignment 6, 0.5 credits, grading scale: A, B, C, D, E, FX, F
- UPP5 - Home Work Assignment 5, 0.5 credits, grading scale: A, B, C, D, E, FX, F
- UPP4 - Home Work Assignment 4, 1.0 credits, grading scale: A, B, C, D, E, FX, F
- UPP3 - Home Work Assignment 3, 0.5 credits, grading scale: A, B, C, D, E, FX, F
- UPP2 - Home Work Assignment 2, 0.5 credits, grading scale: A, B, C, D, E, FX, F
- UPP1 - Home Work Assignment 1, 0.5 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.

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

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.