

Course-PM 2020

ACE085 Water systems and modelling (7.5 hp)

# Course purpose

The aim of the course is to provide students with an understanding of problem solving and modelling in the field of water systems.

# Learning objectives:

* Understand the hydraulic, hydrodynamic and pollutant transport processes in natural and constructed water systems
* Distinguish between different models, considering both simple and advanced models
* Be able to select and use an appropriate model for a given analysis to assess the quantity and quality of water, including model calibration, validation and uncertainty
* Evaluate appropriate input values for the model parameters of the models considered, and to appreciate the sensitivity of the simulation results to the selected parameter values
* Write a scientific paper
* Carry out a literature review
* Assess and give constructive feedback on other projects group's work:
  + a. Critically evaluate used methods with consideration to scientific trustworthiness
  + b. Interpret and assess the quality of the results
  + c. Evaluate whether research has been carried out in a trustworthy and defensible manner

# Contact details

Course is offered by the department of Architecture and Civil Engineering

Examiner:

* Mia Bondelind, [mia.bondelind@chalmers.se](mailto:mia.bondelind@chalmers.se), 031 – 772 21 51

Teachers:

* Oskar Modin, [oskar.modin@chalmers.se](mailto:oskar.modin@chalmers.se)
* Kathleen Murphy, [murphyk@chalmers.se](mailto:murphyk@chalmers.se)
* Maria Neth, [maria.neth@gryaab.se](mailto:maria.neth@gryaab.se)
* Ekaterina Sokolova, [ekaterina.sokolova@chalmers.se](mailto:ekaterina.sokolova@chalmers.se)

Please use email to contact the teachers.

# Course design

The course consists of several lectures and exercises, one individual assignment and one group project.

***Lectures and exercises***

Lectures and exercises cover central topics in the course. Exercises illustrate how various models can be used to model water systems. Lectures and exercises will give support to both the group work and the individual assignment. The exercises are solved in groups of two students. The exercises are graded pass or fail. Support to solve the exercise is given during the scheduled sessions.

To hand in your report. First both students join a group for each exercise. Once both students have joined the group, hand in the assignment.

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| **Exercise** |  | **Program** | **Deadline** |
| **Ex1** | Numerical modelling | Matlab |  |
|  | Report handed in. Instructions in a separate document. |  | At 18.00 11/9 |
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| **Ex2a&b** | Ex2a: MIKE model | MIKE 3 FM |  |
|  | Ex2b: MIKE model | MIKE 3 FM |  |
|  | Report handed in. Instructions in a separate document. |  | At 18.00 18/9 |
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| **Ex3** | Statistics - exploratory data analysis | Matlab |  |
|  | Report handed in. Instructions in a separate document. |  | At 18.00 25/9 |
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| **Ex4** | Wastewater process modelling | Matlab/  Excel |  |
|  | Report handed in. Instructions in a separate document. |  | At 18.00 12/10 |

***Individual assignment***

The assignment will be sent to ‘Urkund’ (Plagiarism control). The assignment is graded (Fail, 3, 4, 5). Write 2500 words (not included references) and use at least 10 different references.

Formulate a hypothesis to examine and write a reflective assignment according to the instructions below:

* Identify one problem that can be solved/addressed with digitalisation and formulate your hypothesis
* Describe briefly the background to the identified/selected problem
* Describe how digitalisation can help address/solve the selected problem
* Reflect on the advantages and limitations of the suggested approach
* Discuss the ethical issues that need to be considered

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| **Mandatory Tasks** | **Deadlines** |
| Submit draft (Send to peer review) | At 18.00, 21st of September |
| Send reviewed draft back to author | At 08.00, 23rd of September |
| Final submission of revised individual assignment for grading | At 18.00, 8th of October |

***Group project***

The group project is carried out in teacher assigned groups of 3-4 students. See separate document for further information on the group project.

You are expected to:

* Organise, plan and manage the project work load according to the tasks and the members of the group
* Collaborate professionally according to the project group's needs of structured management and task distribution

The group project will be checked for plagiarism using Urkund. The group project is graded (Fail, 3, 4, 5). The table below is designed to guide the work on the project; submissions suggested in the table are needed to facilitate effective supervision and consultations (but are not compulsory and will not be graded).

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| **Suggested tasks to complete before the consultation** | **Submit before the consultation** | **Consultation** |
| Formulate aim of the project, create a conceptual model, identify the required data, list the scenarios to be simulated | Word file with aim, conceptual model, list of data, list of scenarios  Before 14th of September at 18.00 | 15th of September at 10.00 |
| Write Introduction in your paper  Set-up the model, simulate first scenarios | Zipped folder containing your MIKE 3 FM model: specification file, all input files (bathymetry and forcings), ECO Lab template, results folder (if not too large, otherwise exclude the results) Before 21st of September at 18.00 | 22nd of September at 10.00 |
| Write Methods in your paper  Improve the model, simulate scenarios | Word file with Methods section of your paper, updated model according to instructions above  Before 28th of September at 18.00 | 29th of September at 10.00 |
| Write Results and Discussion in your paper  Analyse results | Word file with figures and tables presenting the results of your project (i.e. Results section of your paper)  Before 5th of September at 18.00 | 6th of October at 10.00 |
| Complete your paper with Conclusions and Abstract  Prepare an outline of your presentation | Submit what you need help with  Before 12th of October at 18.00 | 13th of October at 10.00 |

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| **Mandatory Tasks** | **Deadlines** |
| Submit paper (Send paper to reviewers) | At 18.00, 13th of October |
| Send reviewed paper back to authors | At 18.00, 16th of October |
| Presentation of results | At 10 – 12, 20th of October |
| Hand in final paper | At 18.00, 23rd of October |

***Computer Software***

We will use Matlab, Excel and MIKE 3 FM in the course.

# Course literature

The course literature consists of documents and scientific articles. It can be found on Canvas.

# Examination

Written individual assignment (graded). Computer exercises (Pass/Fail). Project work is reported in a written scientific paper (graded). Perform a clear oral presentation of the project result that is well-suited to its intended audience. Assess and give constructive feedback to other project group's work and scientific paper.

# Course schedule

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| **W1** | **Time** |  |  | **Teacher** |
| 1/9 | 8-10 | Le | Introduction and start of group work | MB/ES |
| 1/9 | 10-12 | Le | Transport in fluids, partial differential equations and numerical solutions | MB |
| 2/9 | 8-10 | Le | Transport in fluids, partial differential equations and numerical solutions | MB |
| 4/9 | 8-12 | Ex1 | Numerical modelling | MB |
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| **W2** |  |  |  |  |
| 8/9 | 8-10 | Le | Hydrodynamic modelling | ES |
|  | 10-12 | Ex2a | Hydrodynamic modelling, MIKE | ES |
| 9/9 | 8-10 | Le | Academic writing, research ethics and group work | MB |
| 11/9 | 8-10 | Le | Water quality modelling | ES |
|  | 10-12 | Ex2b | Water quality modelling, MIKE | ES |
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| **W3** |  |  |  |  |
| 15/9 | 8-10 | Le | Statistics - exploratory data analysis | KM |
| 15/9 | 10-12 | GW | GW consultation help with MIKE-modelling | ES/MB |
| 16/9 | 8-10 | Le | Statistics - exploratory data analysis | KM |
| 18/9 | 8-12 | Ex4 | Statistics - exploratory data analysis | KM |
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| **W4** |  |  |  |  |
| 22/9 | 8-10 | Le | Giving feedback and reviewing a paper | MB |
| 22/9 | 10-12 | GW | GW consultation help with MIKE-modelling | ES |
| 23/9 | 8-10 | Le | Discussion on individual assignment | MB |
| *25/9* | *8-12* | *Le* | *External lecturer* | *-* |
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| **W5** |  |  |  |  |
| 29/9 | 8-10 | Le | Wastewater process modelling | MN |
| 29/9 | 10-12 | GW | GW consultation help with MIKE-modelling | ES |
| 30/9 | 8-10 | Ex3 | Wastewater process modelling | MN |
| 2/10 | 8-10 | Ex3 | Wastewater process modelling | MN |
| 2/10 | 10-12 | Le | Bioinformatics for water engineers | OM |
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| **W6** |  |  |  |  |
| *6/10* | *8-10* | *Le* | *External lecturer* | *-* |
| 6/10 | 10-12 | GW | GW consultation help with MIKE-modelling | ES |
| *7/10* | *8-10* | *Le* | *External lecturer* | *-* |
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| **W7** |  |  |  |  |
| 13/10 | 8-10 | Le | *External lecturer* | *-* |
|  | 10-12 | GW | GW consultation, final questions, help with MIKE-modelling | ES |
| 14/10 | 8-10 | Le | *External lecturer* | *-* |
| 16/10 | 8-12 | Le | *External lecturer* | *-* |
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| **W8** |  |  |  |  |
| 20/10 | 10-12 | Le | Presentations – mandatory attendance! | MB/ES |