



# HYDRAULIC ENGINEERING PROSPECTUS

For the Master of Science Track Hydraulic Engineering and its specialisations  
June 2017

Faculty of Civil Engineering  
and Geosciences



**colophon**

cover designed by  
Defne Osmanoglou

the picture is of the  
beach nourishment at  
Scheveningen,  
February 2015

## **preface**

The Master of Science Civil Engineering at Delft University of Technology is divided into five tracks, each of which focuses on a specific range of mutually closely related topics. One of these tracks is offered by the Department of **Hydraulic Engineering** and bears the same name. It comprises five specialisations, viz.

1. Coastal Engineering
2. Rivers, Ports and Waterways
3. Environmental Fluid Mechanics
4. Hydraulic Structures and Flood Risk

The present prospectus provides information on the way these specialisations are organised in terms of compulsory, recommended and elective courses as well as options for studying abroad, projects and master theses. It is meant primarily for students who are interested in what the MSc **Hydraulic Engineering** is about and those who want to compose and plan their own programme.

For topical information reference is made to the website of the Department (<http://www.hydraulicengineering.tudelft.nl>) and to the Organisation **Master Hydraulic Engineering** on BlackBoard. The **Guidelines MSc Thesis Project**, containing detailed information about graduation, can be found there as well. Content, learning aims and regulations regarding participation in and examination of individual courses can be found in the course browser searcher (<http://studiegids.tudelft.nl>).

This prospectus is for information. The official (and binding) regulations are published in the “implementation regulations for the Master of Science in Civil Engineering” (IR MSc CE). All these official regulation can be found at:

<http://studenten.tudelft.nl/en/students/faculty-specific/ceg/regulations-ter-rules-and-guidelines/>

Especially students who do not study nominal, but were already enrolled in previous versions of the course programmes (both for MSc and BSc) transition rules are applicable. These rules are not included in this prospectus. In those cases one should consult the official regulations.

# contents

|   |    |
|---|----|
| 1. Introduction.....  | 5  |
| 2. Programme outline.....                                   | 6  |
| 3. Specialisations.....                                     | 8  |
| 3.1. Common block Hydraulic Engineering .....               | 8  |
| 3.2. Block for the field Coastal Engineering .....          | 8  |
| 3.3. Block for the field Environmental Fluid Mechanics..... | 9  |
| 3.4. Block for the field River Engineering .....            | 9  |
| 3.5. Block for the field Ports and Waterways.....           | 9  |
| 3.6. Block for the field Dredging Engineering.....          | 9  |
| 3.7. Block for the field Hydraulic Structures .....         | 10 |
| 3.8. Block for the field and Flood Risk.....                | 10 |
| 4. Track-linked courses .....                               | 11 |
| 5. Special subjects.....                                    | 13 |
| 5.1. Internship .....                                       | 13 |
| 5.2. Multi-disciplinary project .....                       | 13 |
| 5.3. Additional thesis.....                                 | 13 |
| 5.4. Extra courses .....                                    | 14 |
| 5.5. Summary.....   | 14 |
| 6. MSc Thesis and graduation procedures .....               | 15 |
| 6.1. Introduction.....                                      | 15 |
| 6.2. Start of the project .....                             | 15 |
| 6.3. Thesis subjects.....                                   | 15 |
| 6.4. Third party involvement.....                           | 15 |
| 7. Programme extensions .....                               | 17 |
| 7.1. Visiting other universities.....                       | 17 |
| 7.2. Double degrees, double tracks and annotations .....    | 17 |
| 8. Organisation and contact information.....                | 19 |
| 9. Courses offered by Hydraulic Engineering.....            | 21 |

# 1. Introduction

The Master of Science Civil Engineering at Delft University of Technology is divided into tracks, one of which is **Hydraulic Engineering**. It comprises five specialisations, four of which are divided into fields:

| specialisation                | field   |
|-------------------------------|---|
| Hydro & Morphological Systems | Coastal Engineering (CE)<br>Environmental Fluid Mechanics (EFM)<br>River Engineering (RE) |
| Ports & Dredging              | Ports and Waterways (PW)<br>Dredging Engineering (DE)                                     |
| Structural Hydraulics         | Hydraulic Structures (HS)<br>Flood Risk (FR)  |

The educational programmes for all these specialisations and fields share a general outline (see chapter 2), but may differ with respect to compulsory courses and electives. Usually students choose a specialisation/field sometime during the first semester of the MSc programme. This choice determines their set of compulsory courses (see chapter 3).

The Department of **Hydraulic Engineering** is also one of the three partners in the European Erasmus Mundus programme Coastal and Marine Engineering and Management (CoMEM). Another partner in this collaboration is the University of Southampton and the leading partner is the Norwegian University of Technology (NTNU). CoMEM is a separate MSc programme in the sense that it doesn't reside under the MSc Civil Engineering. It offers specialisations that lead to degrees from two or three of the participating universities.

Admission to the MSc track **Hydraulic Engineering** gives automatic access to the seven regular specialisations/fields. Participation in the CoMEM programme, on the other hand, is subject to an additional application and selection procedure (see section 7.2. ).

## 2. Programme outline

The general outline of the programmes of all five specialisations contains four main constituents, reading:

| constituent  | EC | total EC  |
|--|----|-----------|
| an ethics course   |    | 4         |
| track-linked courses<br>(72 EC for the fields HS and FR) |    | 56 (72)   |
| special subjects:  |    |           |
| either: extra courses                                    | 20 |           |
| or: two choices out of:                                  |    |           |
| internship (CIE4040-09)                                  | 10 |           |
| multi-disciplinary project (CIE4061-09)                  | 10 |           |
| additional thesis (CIE5050-09)                           | 10 |           |
| extra courses  | 10 |           |
|  |    | 20        |
| MSc thesis (CIE5060-09)                                  |    | 40        |
| total<br>(136 EC for the fields HS and FR)               |    | 120 (136) |

A course on ethics is compulsory for all MSc students Civil Engineering. Two courses are offered:

- Climate change: science and ethics (CIE4510)
- Philosophy, technology assessment and ethics for civil engineers (WM0312CIE)

and one of these needs to be chosen.

Track-linked courses are all courses that are offered within the track **Hydraulic Engineering**, either compulsory or as an elective. Regarding the compulsory courses, distinction is made between a common block (compulsory for all specialisations) and specialisation or field-dependent blocks of compulsory courses. For each specialisation it holds that any track-linked course that is not a compulsory one may serve as an elective. Schemes of compulsory courses per specialisation and electives are given in chapters **Error! Reference source not found.** and 4.

It is possible to replace individual track-linked courses by ones offered at another university, either domestic or foreign. In the case of a compulsory course, evidence must be provided beforehand that the replacement is sufficiently comparable in terms of content and study load. Track-linked electives, on the other hand, can be replaced by courses on subjects fitting the chosen specialisation or are closely related to it. They do not necessarily be look-alikes of track-linked electives, but they must be at least at MSc level (or comparable). It is important to note that in both cases, inclusion of non-track linked courses in one's programme requires, in advance, positive advice from the curriculum co-ordinator and formal permission from the Board of Examiners (also see section 7.1. ).

Besides courses and an MSc thesis, the programme includes a choice of two out of four options (special subjects): an internship, a multidisciplinary project, an additional thesis and extra courses (together worth at least 10EC). Apart from the extra courses, these options are project-based and commonly cover one period (two to three months). The multi-disciplinary project inherently involves teamwork with representatives from various disciplines. The focus, however, is commonly on some hydraulic engineering challenge. An additional thesis can be carried out by one or two students. It may be related to one's MSc thesis, but that is not necessarily the case. In any case the

additional thesis has to be assessed completely individually from the main thesis. An internship is always strictly individual.

As a rule, internships, multi-disciplinary projects and additional theses involve at least 8 weeks of full time work and are worth exactly 10 EC's, even if after completion more time appears to have been spent on carrying them out. Furthermore, the four options are mutually exclusive, meaning that it is not possible, for example, to combine half an internship with 5 EC's worth of extra courses into a single option. Further information on the four options can be found in chapter 5.

Note that for students starting their MSc in 2017 it is no longer allowed to select both the Internship and the Multi-disciplinary project.

Instead of selecting one of these two options, it is also possible to select a set of 20 EC of extra courses. However, this is not the most recommended option.

The MSc thesis is the final piece of the programme. Although not actually formalised, the start of the project is preceded by a period of orientation on potential subjects, making contact with a graduation professor and supervisor as well as getting acquainted with the way things work in this type of project. Although the general outline is fixed, subtle differences may (will) occur depending on the scope and boundary conditions of individual projects. Effectively, each MSc project is a unique one, especially regarding its content. Some information on choosing a subject and initiating the project can be found in chapter 6. Formal procedures and everything else one might want to know about graduation is presented in detail in the [Guidelines MSc Thesis Project](#) (available on BlackBoard, [Organisation Master Hydraulic Engineering](#)).

### 3. Specialisations

The compulsory programme for each specialisation consists of two blocks of courses, a common block for all specialisations and a block of field-specific courses. The common block consists of four courses adding up to 24 EC. Together with the specialisation and field specific blocks as well as electives, the total load of courses amounts to 56 EC (not counting the ethics course; see chapter 2).

In addition to the presented programme students must meet the following requirements:

- Students with a relevant foreign Bachelor of Science degree who opt for the field Hydraulic Structures of the specialisation Hydraulic Structures and Flood Risk, will, if required by intake, do Dynamics and Introduction to Continuum Mechanics (CIE4145-09) as a compulsory elective subject.
- Students who have not done Open Channel Flow (CT3310-09 or CTB3350) in the BSc will have to do CIE3310-09 as a compulsory elective subject.
- Students who have not done Hydraulic Structures 1 (CT3330 or CTB3355) in the BSc will have to do CIE3330 as a compulsory elective subject.

The three blocks of compulsory courses for the various specialisations and fields are specified in the tables below.

#### 3.1. Common block Hydraulic Engineering

| code    | subject  | EC's |
|---------|--|------|
| CIE4130 | Probabilistic Design and Risk Management           | 4    |
| CIE4305 | Coastal Dynamics 1                                 | 6    |
| CIE4310 | Introduction to Bed, Bank and Shoreline Protection | 4    |
| CIE4325 | Ocean Waves  | 6    |
| CIE4345 | River Engineering                                  | 4    |
|         |  | 24   |

This common block applies to all specialisations in the track **Hydraulic Engineering**. The five courses in this block are mentioned also in subsequent tables with compulsory courses for the various specialisations (sections 3.2. - **Error! Reference source not found.**). They are printed grey.

#### 3.2. Block for the field Coastal Engineering

| code    | subject  | EC's  |
|---------|--|-------|
| CIE4130 | Probabilistic Design and Risk Management           | 4     |
| CIE4305 | Coastal Dynamics 1                                 | 6     |
| CIE4310 | Introduction to Bed, Bank and Shoreline Protection | 4     |
| CIE4325 | Ocean Waves  | 6     |
| CIE4345 | River Engineering                                  | 4     |
| CIE4309 | Coastal Dynamics 2                                 | 5     |
| CIE4330 | Ports and Waterways 1                              | 4     |
| CIE4340 | Computational Modelling of Flow and Transport      | 4     |
| CIE5308 | Breakwaters and Closure Dams                       | 4     |
|         |  | 17+24 |



### 3.3. Block for the field Environmental Fluid Mechanics

| code    | subject  | EC's  |
|---------|--|-------|
| CIE4130 | Probabilistic Design and Risk Management           | 4     |
| CIE4305 | Coastal Dynamics 1                                 | 6     |
| CIE4310 | Introduction to Bed, Bank and Shoreline Protection | 4     |
| CIE4325 | Ocean Waves  | 6     |
| CIE4345 | River Engineering                                  | 4     |
| CIE4340 | Computational Modelling of Flow and Transport      | 4     |
| CIE5302 | Stratified Flows                                   | 3     |
| CIE5312 | Turbulence in Hydraulics                           | 3     |
| CIE5315 | Computational Hydraulics                           | 3     |
| CIE5317 | Physical Oceanography                              | 3     |
|         |  | 16+24 |

### 3.4. Block for the field River Engineering

| code    | subject  | EC's  |
|---------|--|-------|
| CIE4130 | Probabilistic Design and Risk Management           | 4     |
| CIE4305 | Coastal Dynamics 1                                 | 6     |
| CIE4310 | Introduction to Bed, Bank and Shoreline Protection | 4     |
| CIE4325 | Ocean Waves  | 6     |
| CIE4345 | River Engineering                                  | 4     |
| CIE4330 | Ports and Waterways 1                              | 4     |
| CIE4340 | Computational Modelling of Flow and Transport      | 4     |
| CIE5300 | Dredging Technology                                | 4     |
| CIE5311 | River Dynamics                                     | 4     |
| CIE5315 | Computational Hydraulics                           | 3     |
|         |  | 16+24 |

### 3.5. Block for the field Ports and Waterways

| code    | subject  | EC's  |
|---------|--|-------|
| CIE4130 | Probabilistic Design and Risk Management           | 4     |
| CIE4305 | Coastal Dynamics 1                                 | 6     |
| CIE4310 | Introduction to Bed, Bank and Shoreline Protection | 4     |
| CIE4325 | Ocean Waves  | 6     |
| CIE4345 | River Engineering                                  | 4     |
| CIE4330 | Ports and Waterways 1                              | 4     |
| CIE4340 | Computational Modelling of Flow and Transport      | 4     |
| CIE5300 | Dredging Technology                                | 4     |
| CIE5311 | River Dynamics                                     | 4     |
| CIE5306 | Ports and Waterways 2                              | 4     |
|         |  | 16+24 |

### 3.6. Block for the field Dredging Engineering

| code    | subject  | EC's |
|---------|--|------|
| CIE4130 | Probabilistic Design and Risk Management           | 4    |
| CIE4305 | Coastal Dynamics 1                                 | 6    |
| CIE4310 | Introduction to Bed, Bank and Shoreline Protection | 4    |
| CIE4325 | Ocean Waves  | 6    |
| CIE4345 | River Engineering                                  | 4    |

|         |   |              |
|---------|---|--------------|
| CIE4330 | Ports and Waterways 1                         | 4            |
| CIE4340 | Computational Modelling of Flow and Transport | 4            |
| CIE5300 | Dredging Technology                           | 4            |
| CIE5311 | River Dynamics                                | 4            |
| OE44040 | Dredging Processes I                          | 4            |
|         |   | <b>16+24</b> |

### 3.7. Block for the field Hydraulic Structures

| code                    | subject   | EC's         |
|-------------------------|---|--------------|
| CIE4130                 | Probabilistic Design and Risk Management                | 4            |
| CIE4305                 | Coastal Dynamics 1                                      | 6            |
| CIE4310                 | Introduction to Bed, Bank and Shoreline Protection      | 4            |
| CIE4325                 | Ocean Waves   | 6            |
| CIE4345                 | River Engineering                                       | 4            |
| CIE4170                 | Construction Technology of Civil Engineering Structures | 4            |
| CIE5313                 | Hydraulic Structures 2                                  | 3            |
| CIE3109-09 <sup>1</sup> | Structural Mechanics 4                                  | 4            |
| CIE3150 <sup>2</sup>    | Concrete Structures 2                                   | 4            |
| CIE4140                 | Structural Dynamics                                     | 4            |
| CIE4160                 | Prestressed Concrete                                    | 4            |
|                         |   | <b>23+24</b> |

### 3.8. Block for the field and Flood Risk

| code                 | subject   | EC's         |
|----------------------|---|--------------|
| CIE4130              | Probabilistic Design and Risk Management                | 4            |
| CIE4305              | Coastal Dynamics 1                                      | 6            |
| CIE4310              | Introduction to Bed, Bank and Shoreline Protection      | 4            |
| CIE4325              | Ocean Waves   | 6            |
| CIE4345              | River Engineering                                       | 4            |
| CIE4170              | Construction Technology of Civil Engineering Structures | 4            |
| CIE5313              | Hydraulic Structures 2                                  | 3            |
| CIE3325 <sup>3</sup> | Mechanics and Transport by Flow in Porous Media         | 4            |
| CIE4367              | Embankments and Geo-synthetics                          | 3            |
| CIE5310              | Probabilistic Design in Hydraulic Engineering           | 3            |
| CIE5314              | Flood Defences  | 3            |
|                      |   | <b>20+24</b> |

Depending on the courses completed in previous education, foreign students choosing the field Hydraulic Structures can be compelled to include the course 'Dynamics and Introduction to Continuum Mechanics' (CIE4145-09, 4EC) in their MSc programme. Apart from that, this course is strongly recommended for Dutch students with a BSc in Civil Engineering from the University of Twente.

<sup>1</sup> Not if Structural Mechanics 4 (CT3109-09) has been completed in the BSc

<sup>2</sup> Not if Concrete Structures 2 (CT3150) has been completed in the BSc

<sup>3</sup> Not if Mechanics and Transport by Flow in Porous Media (CTB3390) has been completed in the BSc

## 4. Track-linked courses

All courses that are linked to the track **Hydraulic Engineering**, either as an elective or as a compulsory one, are listed in the following tables. For each course the number of EC's is mentioned, the educational period in which they are scheduled (column 'Q') and the specialisations and fields for which they are compulsory (grey box) or recommended (R). Every course that is compulsory for one specialisation or field, may serve as an elective for another. Depending on ones previous education it may happen that some courses cannot be included in the MSc programme, for instance when a course has been taken already as an elective in the BSc. Such exceptions are mentioned as footnotes to the tables. Other courses than the ones listed in the tables may be acknowledged as an elective only after consultation with and explicit approval of the graduation professor. In the case of non-DUT courses, also approval of the curriculum coordinator and the Board of Examiners is required.

| Code                    | Title   | EC | Q   | Specialisation / field |    |    |    |     |    |    |       |   |
|-------------------------|---|----|-----|------------------------|----|----|----|-----|----|----|-------|---|
|                         |   |    |     | CE                     | RE | PW | DE | EFM | HS | FR | HEWRM |   |
| CIE4030                 | Methodology for Scientific Research                     | 3  | 4   |                        |    |    |    |     |    |    |       |   |
| CIE4115 <sup>4</sup>    | Steel Structures 2                                      | 4  | 1   |                        |    |    |    |     |    |    |       |   |
| CIE4140                 | Structural Dynamics                                     | 4  | 3   |                        |    |    |    |     |    |    | R     |   |
| CIE4145-09 <sup>5</sup> | Dynamics and Introduction to Continuum Mechanics        | 4  | 1   |                        |    |    |    |     |    |    |       |   |
| CIE4160                 | Prestressed Concrete                                    | 4  | 4   |                        |    |    |    |     |    |    | R     |   |
| CIE4170                 | Construction Technology of Civil Engineering Structures | 4  | 2   |                        |    |    |    |     |    |    |       |   |
| CIE4180                 | Plates and Slabs  | 4  | 2   |                        |    |    |    |     |    |    |       |   |
| CIE4190 <sup>6</sup>    | Analysis of Slender Structures                          | 4  | 1   |                        |    |    |    |     |    |    |       |   |
| CIE4301                 | Building with Nature in Hydraulic Engineering           | 5  | 4   | R                      | R  |    | R  | R   |    |    |       | R |
| CIE4305                 | Coastal Dynamics 1                                      | 6  | 3   |                        |    |    |    |     |    |    |       |   |
| CIE4308                 | Sediment Dynamics                                       | 3  | 4   | R                      | R  |    | R  | R   |    |    |       |   |
| CIE4309                 | Coastal Dynamics 2                                      | 5  | 4   |                        | R  | R  | R  | R   |    |    | R     | R |
| CIE4310                 | Introduction to Bed, Bank and Shoreline Protection      | 4  | 2   |                        |    |    |    |     |    |    |       |   |
| CIE4325                 | Ocean Waves   | 6  | 1   |                        |    |    |    |     |    |    |       |   |
| CIE4330                 | Ports and Waterways 1                                   | 4  | 1,2 |                        |    |    |    |     |    |    | R     |   |
| CIE4340                 | Computational Modelling of Flow and Transport           | 4  | 1,2 |                        |    |    |    |     |    |    | R     |   |
| CIE4345 <sup>7</sup>    | River Engineering                                       | 4  | 1   |                        |    |    |    |     |    |    |       |   |
| CIE4361                 | Behaviour of Soils and Rocks                            | 6  | 2   |                        |    |    |    |     |    | R  | R     |   |
| CIE4362                 | Soil-Structure Interaction                              | 3  | 4   |                        |    |    |    |     |    | R  | R     |   |
| CIE4363                 | Deep Excavations  | 4  | 1   |                        |    |    |    |     |    | R  | R     |   |
| CIE4365-13              | Coupled Processes in Subsurface                         | 6  | 4   |                        |    |    |    |     |    |    |       |   |
| CIE4366                 | Numerical Modelling in Geo-Engineering                  | 6  | 3   |                        |    |    |    |     |    |    |       |   |
| CIE4367                 | Embankments and Geo-synthetics                          | 3  | 4   | R                      |    |    |    |     |    | R  |       |   |
| CIE4390                 | Geo Risk Management                                     | 3  | 2   |                        |    |    |    |     |    |    |       |   |

continued on next page

<sup>4</sup> Not if Steel Structures 2 (CT3121) has been completed in the BSc

<sup>5</sup> For foreign students only

<sup>6</sup> Not if Analysis of Slender Structures (CT3110) has been completed in the BSc

<sup>7</sup> Not if River Engineering (CT3340 or CIE4345MI) has been completed in the BSc

| Code                 | Title  | EC | Q   | Specialisation / field |    |    |    |     |    |    |       |   |
|----------------------|--|----|-----|------------------------|----|----|----|-----|----|----|-------|---|
|                      |  |    |     | CE                     | RE | PW | DE | EFM | HS | FR | HEWRM |   |
| CIE4400              | Environmental Modelling                                | 4  | 4   |                        | R  |    |    |     |    |    |       |   |
| CIE4410              | Water Systems, People and Society                      | 4  | 3   |                        |    |    |    |     |    |    |       | R |
| CIE4420 <sup>8</sup> | Principles of Geohydrology                             | 4  | 3   |                        |    |    |    |     |    |    |       |   |
| CIE4431              | Hydrologic Models                                      | 4  | 3   |                        | R  |    |    |     |    |    |       |   |
| CIE4440              | Hydrological Measurements                              | 4  | 1   |                        |    |    |    |     |    |    |       |   |
| CIE4450              | Integrated Water Management                            | 4  | 1   |                        |    |    |    |     |    |    |       |   |
| CIE4460              | Polders and Flood Control                              | 4  | 4   |                        |    |    |    |     |    |    | R     |   |
| CIE4480              | Integrated Systems Design                              | 4  | 4   |                        |    |    |    |     |    |    |       |   |
| CIE4491              | Urban Drainage and Water Management                    | 4  | 1   |                        |    |    |    |     |    |    |       |   |
| CIE4495-13           | Fundamentals of Water Treatment                        | 4  | 1   |                        |    |    |    |     |    |    |       |   |
| CIE4760              | Infrastructure Projects: Assessment and Planning       | 6  | 2   |                        |    | R  |    |     |    |    |       |   |
| CIE4780              | Trending Topics in Geo-Engineering                     | 4  | 3   |                        |    |    |    |     |    |    |       |   |
| CIE5300              | Dredging Technology                                    | 4  | 1   | R                      |    |    |    | R   |    |    |       | R |
| CIE5302              | Stratified Flows                                       | 3  | 4   |                        |    |    | R  |     |    |    |       |   |
| CIE5304              | Waterpower Engineering                                 | 3  | 4   |                        |    |    |    |     |    |    |       |   |
| CIE5305              | Bored and Immersed Tunnels                             | 4  | 1   |                        |    |    |    |     |    |    |       |   |
| CIE5306              | Ports and Waterways 2                                  | 4  | 4   |                        |    |    |    |     |    |    |       |   |
| CIE5308              | Breakwaters and Closure Dams                           | 4  | 3   |                        | R  | R  | R  | R   |    |    |       | R |
| CIE5310              | Probabilistic Design in Hydraulic Engineering          | 3  | 4   |                        |    |    |    | R   |    |    |       |   |
| CIE5311              | River Dynamics   | 4  | 2   | R                      |    |    |    | R   |    |    | R     |   |
| CIE5312              | Turbulence in Hydraulics                               | 3  | 3   |                        | R  |    | R  |     |    |    |       |   |
| CIE5313              | Hydraulic Structures 2                                 | 3  | 4   |                        |    |    |    |     |    |    |       |   |
| CIE5314              | Flood Defences   | 3  | 4   |                        | R  |    |    |     | R  |    |       |   |
| CIE5315              | Computational Hydraulics                               | 3  | 4   | R                      |    |    |    |     |    |    |       |   |
| CIE5317              | Physical Oceanography                                  | 3  | 1   | R                      | R  | R  |    |     |    |    |       |   |
| CIE5318              | Fieldwork Hydraulic Engineering                        | 4  | 1   | R                      |    |    |    |     |    |    |       |   |
| CIE5320              | Site Characterisation, Testing and Physical Model      | 6  | 1   |                        |    |    |    |     |    |    |       |   |
| CIE5340              | Soil Dynamics  | 3  | 4   |                        |    |    |    |     |    |    |       |   |
| CIE5401              | GIS and Remote sensing                                 | 3  | 3   |                        |    |    |    |     |    |    |       |   |
| CIE5421              | Water and Health                                       | 4  | 3   |                        |    |    |    |     |    |    |       |   |
| CIE5440              | Groundwater modelling                                  | 2  | 4   |                        |    |    |    |     |    |    |       |   |
| CIE5450              | Hydrology of Catchments, Rivers and Deltas             | 4  | 2   |                        | R  |    |    |     |    |    |       | R |
| CIE5471              | Hydrological and Ecological Fieldwork in River Systems | 4  | 4   |                        |    |    |    |     |    |    |       |   |
| CIE5490              | Operational Water Management                           | 4  | 2   |                        |    |    |    |     |    |    |       |   |
| CIE5500              | Water Law and Organisation                             | 4  | 2   |                        |    |    |    |     |    |    |       |   |
| CIE5510              | Urban Water Management                                 | 4  | 3,4 |                        |    |    |    |     |    |    |       | R |
| CIE5541              | Urban Drainage Monitoring and Modelling                | 3  | 4   |                        |    |    |    |     |    |    |       |   |
| CIE5560              | Engineering and Development                            | 4  | 2   |                        |    |    |    |     |    |    |       |   |
| CIE5580              | Ecology and Morphology in Catchments                   | 5  | 2   |                        | R  |    |    | R   |    |    |       | R |
| CIE5741              | Trenchless Technologies                                | 4  | 2   |                        |    |    |    |     |    |    |       |   |
| CIE5981              | Forms of Collaboration in Civil Engineering            | 4  | 1   |                        |    |    |    |     |    |    |       |   |
| AES1630              | Engineering Geology                                    | 4  | 1   |                        |    |    |    |     |    |    |       |   |
| CME2300              | Financial Engineering                                  | 4  | 1   |                        |    |    |    |     |    |    |       |   |
| OE44030              | Offshore Geotechnical Engineering                      | 3  | 3   |                        |    |    |    |     |    |    |       |   |
| OE44035              | Dredging Pumps and Slurry Transport                    | 4  | 3   |                        |    |    | R  |     |    |    |       |   |
| OE44040              | Dredging Processes I                                   | 4  | 2   |                        |    |    |    |     |    |    |       |   |
| OE44055              | Load Identification and Monitoring of Structures       | 4  | 4   |                        |    |    |    |     |    |    |       |   |
| OE44115              | Arctic Engineering                                     | 4  | 4   |                        |    |    |    |     |    |    |       |   |

<sup>8</sup> Not combined with Mechanics and Transport by Flow in Porous Media (CIE3325)

## 5. Special subjects

The special subjects in the MSc programme **Hydraulic Engineering** are

- internship (CIE4040-09),
- multi-disciplinary project (CIE4061-09),
- additional thesis (CIE5050-09),
- extra courses (with a total of either 10 or 20 EC).

One should select a combination totalling 20 EC. The combination internship + multi-disciplinary project is for students starting in 2017 with the MSc no longer an allowed combination. An internship is not recommended for students with a HBO Civil Engineering degree, as this has been part of their previous education.

### 5.1. Internship

Information about the Internship (CIE4040-09, 10 EC) can be found in the Civil Engineering Internship Manual, obtainable from the Internship Office (room. 2.73). The Internship Office will also do its utmost to provide you with all the support you need to find an appropriate type of internship. Additional information can be found on Blackboard (Organisation **Master Hydraulic Engineering**).

It is important to note that it is the student's own responsibility to find a supervisor, commonly a member of the scientific staff of the department. The best way to arrange this is to contact ir. W.F. Molenaar (r. 3.75, e-mail: w.f.molenaar@tudelft.nl), responsible for the coordination of internships within the track **Hydraulic Engineering**.

### 5.2. Multi-disciplinary project

The Multidisciplinary Project (CIE4061-09, 10 EC) is carried out by a team of 4 to 6 students. A few available projects can be found on Blackboard (Organisation **Master Hydraulic Engineering**), but suggestions for alternatives are welcome. Although many students prefer projects that take place abroad, both domestic and foreign projects are possible. To ensure a proper start of the project, students should consult the department's coordinator ir. H.J. Verhagen (r. 3.88, e-mail: h.j.verhagen@tudelft.nl) from the moment they start looking around for a possible project. Realise that the preparation time for a foreign project is quite long. Many students like to do a project in Q1, this implies that one has to start first preparations in January of the preceding academic year.

### 5.3. Additional thesis

The Additional MSc Thesis (CIE5050-09, 10 EC) is carried out individually or by a group of 2 students, either at DUT or elsewhere. Although the Additional MSc Thesis may or may not have a relation with the MSc Thesis, it is a separate project and it is assessed individually. Suggestions for topics may be presented by students, companies, department staff et cetera. The final assignment of the Additional MSc Thesis, however, is defined always by appointed staff members.

## 5.4. Extra courses

The option Extra Courses, worth at least 10 EC of 20 EC, may include any track-linked course (see chapter 4) as well as any course from the MSc programme Civil Engineering. MSc courses from other faculties and even from other universities can be selected too (also see section 7.1. ). However, restrictions may apply to courses on non-technical topics. Language courses, for instance, may not be included. Check with the curriculum coordinator whether restrictions apply to a specific course you consider.

## 5.5. Summary

In summary the following credits are necessary for the various fields:

| Field                         | Ethics course | Common courses | Field specific | Track linked electives | Free electives | Thesis work |
|-------------------------------|---------------|----------------|----------------|------------------------|----------------|-------------|
| Coastal Engineering           | 4             | 24             | 17             | 15                     | 20             | 40          |
| Environmental Fluid Mechanics | 4             | 24             | 16             | 16                     | 20             | 40          |
| River Engineering             | 4             | 24             | 16             | 16                     | 20             | 40          |
| Ports and Waterways           | 4             | 24             | 16             | 16                     | 20             | 40          |
| Dredging Engineering          | 4             | 24             | 16             | 19                     | 20             | 40          |
| Hydraulic Structures          | 4             | 24             | 23             | 9                      | 20             | 40          |
| Flood Risk                    | 4             | 24             | 20             | 12                     | 20             | 40          |

## 6. MSc Thesis and graduation procedures

### 6.1. Introduction

An important part of the MSc programme is the MSc Thesis Project (CIE5060-09, 40 EC). Detailed information about the MSc Thesis Project and the graduation procedures can be found in the ‘Guidelines MSc Thesis Project Hydraulic Engineering’, which can be found on Blackboard (Organisation [Master Hydraulic Engineering](#)). All formalities, procedural aspects, project outline, supervision and assessment et cetera are explained in detail in these Guidelines. It is strongly recommended that master students get acquainted with these guidelines already in an early stage of their programme. For convenience, a few frequently inquired aspects of graduation are mentioned briefly hereafter.

### 6.2. Start of the project

According to the Implementation Regulations of the MSc programme Civil Engineering, a student can start the MSc Thesis Project only after having completed courses and special subjects of the MSc programme worth at least 65 EC’s. Only if the student meets this requirement the student will get permission from the Central Student Administration to commence the MSc Thesis Project. To this end the form ‘Application Start MSc Thesis Project (CIE-1)’ needs to be completed and submitted (see the Guidelines MSc Thesis Project). Generally it is wise, however, to start the MSc Thesis Project later, preferably when the special subjects have been completed and (nearly) all courses.

### 6.3. Thesis subjects

Available MSc Thesis Projects can be found on Blackboard (Organisation [Master Hydraulic Engineering](#)) and on the notice boards of the Department [Hydraulic Engineering](#). It is advisable to ascertain what an MSc Thesis Project entails by attending MSc presentations and by reading recent MSc Theses (see the repository of the library of DUT). In addition, during meetings of the [Master Community Hydraulic Engineering](#), organised by the [Waterbouwdispuut](#) (the student association of Hydraulic Engineering; [www.waterbouwdispuut.nl](http://www.waterbouwdispuut.nl)), students can share their experiences.

### 6.4. Third party involvement

Sometimes a subject for an MSc Thesis suggested by a company or institution is offered with the possibility to carry out the project at that company or institution. This is open only to selected students and therefore it requires *a priori* permission from the chairman of the MSc Thesis Assessment Committee. Whether or not permission is granted depends on the student’s performance as appears from a complete and recent list of marks (Osiris output). The student submits this list to the graduation coordinator who, in turn, will issue an advice to the chairman.

Note that also subjects suggested by a company or institution always require approval from the chairman of the MSc Thesis Assessment Committee. When such a subject is announced via

Blackboard or the official notice boards of the Department, you may assume that this approval is granted. However, when the subject is suggested to you directly by the company, it is good to verify if the subject will be acceptable from an academic point of view. Therefore discuss the subject in advance with the foreseen chairman of the Committee or daily supervisor at TU Delft.

Realise that subjects including permanent confidentiality are usually not acceptable (see also the paragraph on confidential subjects on Blackboard (Organisation [Master Hydraulic Engineering](#))).



## 7. Programme extensions

### 7.1. Visiting other universities

Every student has the possibility to attend courses at another Dutch university, in principle without extra costs. For example, the University of Utrecht offers courses related to the physics of coastal and river systems, and Wageningen University offers courses related to international land and water management, environmental sciences, and climate studies. However, depending on the subject some courses qualify only as Extra Courses (as a part of the concerned special subject; see section 5.4. ).

Another, more adventurous option, is to visit a foreign university. It broadens your perspective and may add to achieving specific learning aims. On the other hand, it nearly always delays your MSc study. For this reason, students who consider spending some period abroad are advised to draw up, in advance, a time schedule for their entire MSc to reveal the attended pro's and con's and discuss them with the curriculum coordinator. Points of particular interest are that the level of education at foreign universities may deviate from that in Delft and that the content of courses may be focused (implicitly) on local circumstances (natural conditions, regulations and legislation). For further information one is referred to the website of DUT ([www.tudelft.nl](http://www.tudelft.nl), Student Portal, Studying Abroad) and to the guide "Study Abroad", issued by the student association of the faculty of Civil Engineering, 'Praktische Studie'.

Last but not least, students are referred to the double or triple degree programme CoMEM (see [www.comem.tudelft.nl](http://www.comem.tudelft.nl) and [www.ntnu.edu/studies/mscomen](http://www.ntnu.edu/studies/mscomen)). CoMEM stands for Coastal and Marine Engineering and Management. It is an Erasmus Mundus programme with NTNU (Trondheim) in Norway and the University of Southampton in the UK and leads to two or three MSc diplomas. Students interested in this programme should apply in the third year of their BSc programme, already during fall (look at the afore mentioned websites for the deadlines). To be admitted, candidates should have at least good grades for their BSc modules (a cumulative grade point average of at least 7.5) and should complete their BSc programme without serious delays.

### 7.2. Double degrees, double tracks and annotations

To some extent it is possible to combine two full MSc programmes into one so-named Double Degree Programme, leading to two diplomas. Such programmes are tailor-made. They comprise courses and projects up to at least 180 EC's. In a similar fashion it is possible to combine two tracks within the same MSc. This latter option leads to a single diploma mentioning both tracks.

The 180 credits has to be composed in the following way:

- 4 credits on a ethics course
- 56 credits from the compulsory and track-linked courses of track/programme 1
- 60 credits from the compulsory and track-linked courses of track/programme 2
- 20 credits from the free electives (including Project, Internship, Additional thesis or extra elective courses
- 40 credits for a this on a subject covering both tracks/programmes

Contact the curriculum coordinator for further information.

Annotations are meant to broaden the scope of your MSc programme by incorporation aspects of a subject connected to, and of added value for your specialisation. We mention two options.

- Design Management (IDM) annotation, intended for those students who want to combine specific technical knowledge with management skills. This is valuable especially for students aiming at a career in a multidisciplinary environment. For further information, reference is made to [www.idm.citg.tudelft.nl](http://www.idm.citg.tudelft.nl).
- Hydro-Geotechnics annotation. Especially in Deltaic environments the influence of the two subjects together is of extreme importance and this annotation provides students the ability to be qualified between the two subject areas.

Annotations are set-up in such a way that the track-linked and/or elective courses are filled-in in such a way that they cover the area of the annotation and still do not exceed the 120 EC of the MSc programme. Most of the compulsory courses for the annotation are part of the track-linked electives (see chapter 4).

For the annotation in Hydro-Geotechnics it means in nearly all cases that students following the Hydraulic Engineering track have to include in their track-link electives the following courses:

- CIE4361 6 EC Behaviour of soil and Rocks
- CIE4365 5 EC Modelling coupled processes for engineering applications
- CIE5320 6 EC Site characterisation, testing and physical modelling
- CIE4420 4 EC Principles of Geohydrology

and any other course from track-linked electives list from chapter 4 with a total of 4 EC. And then there is still 10 EC left for a Multidisciplinary project, an Internship, an Additional Thesis or 10EC free electives.

## 8. Organisation and contact information

The Department of **Hydraulic Engineering** is organised in agreement with the structure of the educational programme. In fact, both are pragmatic projections of modern insights into the groupiness of scientific topics.

The Department of **Hydraulic Engineering** comprises four sections, being

1. Coastal Engineering
2. Rivers, Ports and Waterways
3. Environmental Fluid Mechanics
4. Hydraulic Structures and Flood Risk

Sections are organisation-wise sub-divided into groups corresponding to fields in the educational programme. The only exception is the field Dredging Engineering, residing under Rivers, Ports and Waterways. The reason for this is that Dredging Engineering is offered in co-operation with the Faculty of Mechanical, Maritime and Materials Engineering (3mE).

Table 1 (next page) contains contact information for all specialisations and fields in the educational programme of the track **Hydraulic Engineering**. If you want to get in touch with a representative of a certain field and the table refers to two staff members, start with the second one.

Further contacts within the Department are

| contact   | e-mail                    | phone          | office |
|---|---------------------------|----------------|--------|
| Curriculum co-ordinator (programme set-up, choosing courses et cetera)        |                           |                |        |
| ir. H.J. Verhagen   | masterHE-CEG@tudelft.nl   | +31 15 2785067 | 3.88   |
| Graduation co-ordinator (procedural aspects of the MSc thesis and graduation) |                           |                |        |
| ir. M.A. Burgmeijer   | m.a.burgmeijer@tudelft.nl | +31 15 2789446 | 3.74   |
| Multi-disciplinary project  |                           |                |        |
| ir. H.J. Verhagen   | h.j.verhagen@tudelft.nl   | +31 15 2785067 | 3.88   |
| Internship  |                           |                |        |
| ir. W.F. Molenaar   | w.f.molenaar@tudelft.nl   | +31 15 2789447 | 3.75   |

Table 1: contact information

| specialisation and field                   | contact  | e-mail   | phone                            | office               |
|--|--|--|----------------------------------|----------------------|
| <b>Coastal Engineering</b>                 |  |  |                                  |                      |
| Coastal Morphology                         | prof.dr.ir. S.G.J. Aarnikhof<br>ir. J. Bosboom     | S.G.J.Aarnikhof@tudelft.nl<br>J.Bosboom@tudelft.nl   | +31 15 2785487<br>+31 15 2784606 | 3.69<br>3.66         |
| Coastal Structures                         | prof.dr.ir. S.G.J. Aarnikhof<br>dr.ir. B., Hofland | S.G.J.Aarnikhof@tudelft.nl<br>B.Hofland@tudelft.nl   | +31 15 2785487<br>+31 15 2785067 | 3.69<br>3.88         |
| Lagoons and Estuaries                      | prof.dr.ir. Z.B. Wang                              | Z.B.Wang@tudelft.nl                                  | +31 15 2785075                   | 3.79                 |
| <b>Rivers, Ports and Waterways</b>         |  |  |                                  |                      |
| River Engineering                          | prof.dr.ir. W.S.J. Ujttewaal<br>dr.ir. A. Blom     | W.S.J.Ujttewaal@tudelft.nl<br>Astrid.Blom@tudelft.nl | +31 15 2781371<br>+31 15 2785064 | S3.0.060<br>S3.0.100 |
| Ports and Waterways                        | prof.ir. T. Vellinga<br>ir. H. Verheij             | T.Vellinga@tudelft.nl<br>H.J.Verheij@tudelft.nl      | +31 15 2784285<br>+31 15 2784740 | 3.77<br>3.84         |
| Dredging Engineering                       | prof.dr.ir. C. van Rhee                            | C.vanRhee@tudelft.nl                                 | +31 15 2783973                   | (3mE)                |
| <b>Environmental Fluid Mechanics</b>       |  |  |                                  |                      |
| Free surface waves                         | prof.dr.ir. A. Reniers                             | A.J.H.M.Reniers@tudelft.nl                           | +31 15 2781371                   | 2.93                 |
| Experimental Hydraulics                    | prof.dr.ir. W.S.J. Ujttewaal                       | W.S.J.Ujttewaal@tudelft.nl                           | +31 15 2781371                   | S3.0.060             |
| Physical Oceanography                      | prof.dr. J.D. Pietrzak                             | J.D.Pietrzak@tudelft.nl                              | +31 15 2789455                   | 2.97                 |
| Sediment Dynamics                          | dr.ir. B.C. van Prooijen                           | B.C.vanProoijen@tudelft.nl                           | +31 15 2783365                   | S3.0.080             |
| Numerical Modelling                        | dr.ir. M. Zijlema                                  | M.Zijlema@tudelft.nl                                 | +31 15 2783255                   | 2.92                 |
| <b>Hydraulic Structures and Flood Risk</b> |  |  |                                  |                      |
| Hydraulic Structures                       | prof.dr.ir. S.N. Jonkman<br>ir. W.F. Molenaar      | S.N.Jonkman@tudelft.nl<br>M.W.Folenaar@tudelft.nl    | +31 15 2785278<br>+31 15 2789447 | 3.73.1<br>3.75       |
| Flood Risk                                 | prof.dr.ir. M. Kok                                 | Matthijs.Kok@tudelft.nl                              | +31 15 2789456                   | 3.79                 |

## 9. Courses offered by Hydraulic Engineering

In the tables below, all courses offered by sections of the department of Hydraulic Engineering are listed, together with the responsible instructors. For completeness, the lists include Bachelor courses.

### Section Coastal Engineering

| code    | EC | title   | responsible instructor        |
|---------|----|---|-------------------------------|
| CTB2410 | 5  | Introduction to Hydraulic Engineering         | ir. T.J. Zitman               |
| CT3367  | 4  | Introduction to Water and Climate             | dr.ir. M.A. de Schipper       |
| CIE4301 | 5  | Building with Nature in Hydraulic Engineering | prof.dr.ir. S.G.J. Aarninkhof |
| CIE4305 | 6  | Coastal Dynamics 1                            | ir. J.S. Bosboom              |
| CIE4309 | 5  | Coastal Dynamics 2                            | dr.ir. S. de Vries            |
| CIE4310 | 4  | Bed, Bank and Shore Protection                | dr.ir. B. Hofland             |
| CIE5308 | 4  | Breakwaters and Closure Dams                  | ir. J.P. van den Bos          |
| CIE5318 | 4  | Fieldwork Hydraulic Engineering               | dr.ing. M.Z. Voorendt         |

### Section Hydraulic Structures and Flood Risk

| code    | EC | title   | responsible instructor    |
|---------|----|---|---------------------------|
| CIE3330 | 4  | Hydraulic Structures 1                        | dr.ing. M.Z. Voorendt     |
| CIE4130 | 4  | Probabilistic Design and Risk Management      | dr.ir. O. Morales-Nápoles |
| CIE5304 | 3  | Waterpower Engineering                        | dr. J.D. Bricker          |
| CIE5305 | 4  | Bored and Immersed Tunnels                    | ir. K.J. Reinders         |
| CIE5310 | 3  | Probabilistic Design in Hydraulic Engineering | dr.ir. O. Morales-Nápoles |
| CIE5313 | 3  | Hydraulic Structures 2                        | ir. W.F. Molenaar         |
| CIE5314 | 3  | Flood Defences                                | prof.dr.ir. S.N. Jonkman  |

### Section Environmental Fluid Mechanics

| code    | EC | title   | responsible instructor     |
|---------|----|---|----------------------------|
| CTB2110 | 5  | Fluid Mechanics                               | dr.ir. B.C. van Prooijen   |
| CTB3350 | 4  | Open Channel Flow                             | dr.ir. R.J. Labeur         |
| CIE4308 | 3  | Sediment Dynamics                             | dr.ir. B.C. van Prooijen   |
| CIE4325 | 6  | Ocean Waves                                   | dr.ir. M.F.S. Tissier      |
| CIE4340 | 4  | Computational Modelling of Flow and Transport | dr.ir. M. Zijlema          |
| CIE5302 | 3  | Stratified Flows                              | prof.dr. J.D. Pietrzak     |
| CIE5312 | 3  | Turbulence in Hydraulics                      | prof.dr.ir. J.S. Uijtewaal |
| CIE5315 | 3  | Computational Hydraulics                      | dr.ir. M. Zijlema          |
| CIE5317 | 3  | Physical Oceanography                         | prof.dr. J.D. Pietrzak     |

### Section Rivers, Ports, Waterways and Dredging Engineering

| code    | EC | title                                | responsible instructor  |
|---------|----|--------------------------------------|-------------------------|
| CIE4330 | 4  | Ports and Waterways 1                | prof.ir. T. Vellinga    |
| CIE4345 | 4  | River Engineering                    | dr.ir. A. Blom          |
| CIE5300 | 4  | Dredging Technology                  | prof.dr.ir. C. van Rhee |
| CIE5306 | 4  | Ports and Waterways 2                | prof.ir. T. Vellinga    |
| CIE5311 | 4  | River Dynamics                       | dr.ir. E. Mosselman     |
| OE44010 | 3  | Introduction to Dredging Engineering | dr.ir. S.A. Miedema     |
| OE44145 | 6  | Research Exercise                    | prof.dr.ir. C. van Rhee |

### Section Offshore Engineering

| code | EC | title | responsible instructor |
|------|----|-------|------------------------|
|------|----|-------|------------------------|

|                |          |   |                              |
|----------------|----------|---|------------------------------|
| <b>CIE4140</b> | <b>4</b> | <b>Structural Dynamics</b>                                    | <b>prof.dr. A. Metrikine</b> |
| OE44015        | 6        | Survey of Offshore Engineering Projects                       | ir. G. Tol                   |
| OE44030        | 4        | Offshore Geotechnical Engineering                             | dr. F. Pisanò                |
| <b>OE44055</b> | <b>4</b> | <b>Load Identification and Monitoring of Structures</b>       | <b>dr.ir. E. Lourens</b>     |
| OE44095        | 5        | Bottom Founded Offshore Structures                            | ir. J.S. Hoving              |
| OE44090        | 4        | Introduction to Computational Dynamics of Offshore Structures | prof.dr. A. Metrikine        |
| OE44105        | 4        | Marine Pipelines  | ir. A. Jarquin Laguna        |
| <b>OE44115</b> | <b>4</b> | <b>Arctic Engineering</b>                                     | <b>ir. J.S. Hoving</b>       |
| OE44120        | 4        | Offshore Wind Farm Design                                     | dr.ir.E. Lourens             |
| OE44135        | 4        | Offshore Wind Support Structures                              | dr.ir.E. Lourens             |
| AT327-12       | 6        | Arctic Offshore Engineering (Spitsbergen)                     | ir. J.S. Hoving              |

Courses printed grey in the above table on Offshore Engineering, are not linked to the track Hydraulic Engineering, neither as a compulsory course nor as an elective.

