

THE IMPLEMENTATION REGULATIONS

2015-2016

**MASTER OF SCIENCE
CIVIL ENGINEERING**

DELFT UNIVERSITY OF TECHNOLOGY

Section 1 – Compiling the study programme

Article 1 – The study load

The study load for the Master's degree course is 120 credits. None of the components of the course may have formed part of the Bachelor's degree course in Civil Engineering.

Teaching and Education Regulations MSc Article 8 subsection 3:

"It is not permitted for any subject in the study programme to have been part of the Bachelor's degree programme on the basis of which the student was admitted to the degree programme. If a compulsory subject was already completed in the aforementioned Bachelor's degree programme, the board of examiners will designate an alternative subject in its place. If an elective subject in the study programme was already completed in the aforementioned Bachelor's degree programme, the student will choose an alternative elective subject."

Article 2 – Tracks, specialisations and annotations

1. The course comprises the following tracks:
 - Structural Engineering
 - Building Engineering
 - Hydraulic Engineering
 - Water Management
 - Transport and Planning
 - Geo-Engineering
 - Geoscience and Remote Sensing
 - the Erasmus Mundus programme: Coastal and Marine Engineering and Management
2. The Erasmus Mundus MSc programme Coastal and Marine Engineering and Management is subject to the programme-specific "Education and Examination Guidelines CoMEM" and the connected "Implementations Regulations for the MSc Degree CoMEM". These guidelines and regulations replace the present Teaching and Education Regulations and Implementation Regulations for the MSc degree in Civil Engineering in the case of CoMEM only.
3. Within a track the student has to complete the common compulsory block. Furthermore the student can choose for one of the specialisations as mentioned in Articles 5 to 11 or for a free specialisation. The student makes sure he will ask for approval in time as is stipulated in Article 4 subsection 1.
4. Within a track or within a specialisation the student may opt for the following annotations mentioned in Articles 12A – 12F:
 - Technology in Sustainable Development
 - Entrepreneurship
 - Urban Planning and Engineering ("Stadsingenieur")
 - Infrastructure Planning and Environmental Engineering ("Infrastructuur en milieu")
 - Integral Design Management
 - Rail.

Article 3 – The composition

1. The study programme tracks are compiled in the following way:
 - a. 4 credits: the subject Philosophy, Technology Assessment and Ethics for CT (WM0312CIE) or the subject Climate Change: Science & Ethics (CIE4510). Geoscience and Remote Sensing students do CIE4613¹ (5 credits), Climate Change: Science and Ethics, instead.
 - b. 56 credits²: track-linked subjects belonging to the chosen track. The track-linked subjects may be subdivided into those that are general track-linked subjects (the common compulsory block) and those that belong to a specialisation as stipulated in Articles 5 to 11 or a free specialisation. Track-linked credits, exceeding 56 credits, will be considered as credits achieved for electives mentioned under c.
 - c. 20 credits as follows³:
 - * 20 credits electives. The student has to choose 10 credits offered in conjunction with the degree course. For the other credits the student may choose:
 - all subjects offered in conjunction with the degree course,
 - all subjects offered in conjunction with other Master's degree courses at a Dutch university,

¹ Not combined with CIE4510

² Geoscience and Remote sensing students do 55 credits

³ Not for Building Engineering students, see Article 6 subsection 1.

- the specialisation subjects included in the list “keuzelijst specialisatievakken” as intended in Article 3 of the Implementation Regulations for the Bachelor’s degree course in Civil Engineering at Delft University of Technology, as far as they are considered to be convergence subjects,
 - interfaculty Master’s-level electives at Delft University of Technology with a “WM-code” to a maximum of 6 credits.
- Before any other subjects can be studied the approval of the board of examiners is required.

OR

* two of the possibilities listed below:

- 10 credits: Internship (CIE4040-09)
- 10 credits: Multidisciplinary Project (CIE4061-09)
- 10 credits: electives. What is determined above for the other electives is similarly applicable.
- 10 credits: Additional Master Thesis Project (CIE5050-09). The Additional Master Thesis Project may or may not be related to the Master Thesis Project mentioned under d but it may, in any case, be separately distinguished.

d. 40 credits: a track-linked Master Thesis Project (CIE5060-09). The Master Thesis Project consists of a final project, a thesis, a summary of the thesis and a final presentation. The project is subject to a strict planning and time table; specific dates and deadlines need to be set for the evaluation(s) and the final presentation of the project. The planning will be monitored by the graduation coordinator.

2. In Article 20 as well as in the Rules and Guidelines laid down by the board of examiners, further stipulations have been laid down in relation to the Internship, the Multidisciplinary Project, the Additional Master Thesis Project and the Master Thesis Project.

Article 4 – Registering the tracks and compiling the examination programme

1. At the beginning of his/her study the student must register himself/herself with Studielink as a prospective graduate of the track of his/her choice. After that the student notifies the graduation coordinator with the specialisation he/she has chosen. As soon as possible, but no later than after twelve months after the beginning, the track-linked subjects of his/her examination programme will be determined in consultation with the coordinator. In case of a free specialisation the specialisation will preferably also be approved by a Civil Engineering professor, involved in the specialisation’s topic.
2. In accordance with what is determined in subsection 1, but in any case before the Master Thesis Project or the Additional Master Thesis Project is started on, the student must draw up his/her entire examination programme before then presenting it – together with the assessment committee’s compilation – to the board of examiners for approval.
3. Any amendments made to the approved examination programme or to the approved assessment committee should be presented to the board of examiners.
4. Students who opt for an annotation mentioned in Articles 12A – 12F must also have the discussion mentioned in subsection 1 with the referent, coordinator or programme director for the chosen annotation.

Article 5 – The Structural Engineering track

1. The Structural Engineering track has six specialisations:
 - Structural Mechanics
 - Concrete Structures
 - Steel and Timber Construction
 - Materials and Environment
 - Road and Railway Engineering
 - Hydraulic Structures

The compulsory programme for each specialisation consists of a common Structural Engineering block of 32 credits and an additional block of 24 credits.

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

- Students with a relevant foreign Bachelor of Science degree will, if required by intake, do CIE4145-09 (Dynamics and Introduction to Continuum Mechanics) as a compulsory elective subject.
- Students who have not done CT3150 or CTB3335 (Concrete Structures 2) in the Bachelor’s phase will have to do CIE3150 as a compulsory elective subject.
- Students who have not done CT3109-09 or CTB3330 (Structural Mechanics 4) in the Bachelor’s phase are strongly advised to take CIE3109-09 as an elective subject.

2. Common compulsory block Structural Engineering

All students opting for the track Structural Engineering must complete the following subjects adding up to 32 credits:

<u>code</u>	<u>subject</u>	<u>ECs</u>
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CIE4100	Materials and Ecological Engineering	4
CIE4110	Timber and Timber Structures 1	4
CIE4115	Steel Structures 2	4
CIE4121	Steel Structures 3	4
CIE4140	Structural Dynamics	4
CIE4160	Prestressed Concrete	4
CIE4180	Plates and Slabs	4
CIE4190	Analysis of Slender Structures	4

3. Additional block Structural Mechanics

Students who have opted for the specialisation Structural Mechanics must complete the following subjects adding up to 24 credits:

<u>code</u>	<u>subject</u>	<u>ECs</u>
CIE4130	Probabilistic Design and Risk Management	4
CIE4143	Shell Analysis, Theory and Application	4
CIE4150	Plastic Analysis of Structures	4
CIE5123	Introduction to the Finite Element Method	4
CIE5145	Random Vibrations	4
CIE5148	Computational Modelling of Structures	4

4. Additional block Concrete Structures

Students who have opted for the specialisation Concrete Structures must complete the following subjects adding up to 24 credits:

<u>code</u>	<u>subject</u>	<u>ECs</u>
CIE4170	Construction Technology of Civil Engineering Structures	4
CIE4281	Building Structures 2	4
CIE5110	Concrete – Science and Technology	4
CIE5127	Concrete Bridges	4
CIE5130	Capita Selecta Concrete Structures	4
CIE5148	Computational Modelling of Structures	4

5. Additional block Steel and Timber Construction

Students who have opted for the specialisation Steel and Timber Construction must complete the following subjects adding up to 24 credits:

<u>code</u>	<u>subject</u>	<u>ECs</u>
CIE4125	Structural Design - Case Study Steel, Timber or FRP	3
CIE5122	Capita Selecta Steel and Aluminium Structures	4
CIE5124	Timber and Timber Structures 2	4
CIE5125	Steel Bridges	4
CIE5126	Fatigue	3
CIE5128	Fibre-Reinforced Polymer (FRP) Structures	3
CIE5131	Fire Safety Design	3

6. Additional block Materials and Environment

Students who have opted for the specialisation Materials and Environment must complete the following subjects adding up to 24 credits:

<u>code</u>	<u>subject</u>	<u>ECs</u>
CIE4030	Methodology for Scientific Research	3
CIE5100	Repair and Maintenance of Construction Materials	4
CIE5102	Forensic Building Materials Engineering	3
CIE5110	Concrete – Science and Technology	4
CIE5126	Fatigue	3
CIE5130	Capita Selecta Concrete Structures	4
CIE5146	Micromechanics and Computational Modelling of Building Materials	3

7. Additional block Road and Railway Engineering

Students who have opted for the specialisation Road and Railway Engineering must complete the following subjects adding up to 24 credits:

<u>code</u>	<u>subject</u>	<u>ECs</u>
CIE4860	Structural Pavement Design	6

CIE4870	Structural Design of Railway Track	4
CIE4880	Road Paving Materials, Laboratory Experiment included	7
CIE5850	Road Construction	3
CIE5871	Capita Selecta Railway and Road Structures	4

8. Additional block Hydraulic Structures

Students who have opted for the specialisation Hydraulic Structures must complete the following subjects adding up to 24 credits:

<u>code</u>	<u>subject</u>	<u>ECs</u>
CIE3310-09 ⁴	Open Channel Flow	4
CIE3330 ⁵	Hydraulic Structures 1	4
CIE4130	Probabilistic Design and Risk Management	4
CIE4170	Construction Technology of Civil Engineering Structures	4
CIE4310	Bed, Bank and Shoreline Protection	4
CIE4345 ⁶	River Engineering	4

9. Structural Engineering electives

All subjects listed above can be chosen as electives. In addition the following subjects are also available:

<u>code</u>	<u>subject</u>	<u>ECs</u>
CIE4510	Climate Change: Science and Ethics	4

Of particular interest for Structural Mechanics students:

CIE4353	Continuum Mechanics	6
CIE5142	Computational Methods in Non-linear Solid Mechanics	3
CIE5144	Stability of Structures	3

Of particular interest for Hydraulic Structures students:

CIE4305	Coastal Dynamics 1	6
CIE4325	Ocean Waves	6
CIE5304	Waterpower Engineering	3
CIE5310	Probabilistic Design in Hydraulic Engineering	3
CIE5313	Hydraulic Structures 2	3
CIE5314	Flood Defences	3

For foreign students only:

CIE4145-09	Dynamics and Introduction to Continuum Mechanics	4
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Article 6 – The Building Engineering track

1. The Building Engineering track has two specialisations:

- Building Technology and Physics
- Structural Design

The compulsory programme for each specialisation consists of a common Building Engineering block of 17 credits and an additional block of 39 credits.

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

- Contrary to Article 3 subsection 1c Building Engineering students must follow AR0026 (Mega, 12 credits) in collaboration with the Architectural department instead of CT4061-09 (Multidisciplinary Project). In addition, students are free to choose for Internship, Additional Thesis and/or electives adding up to 20 credits.
- Students who have not done CT3221 (Building Physics and Building Technology) or CTB3345 (Building Physics and Facades) in the Bachelor's phase will have to do CIE3345 (Introduction Building Physics and Facades) as a compulsory elective subject.

2. Common compulsory block Building Engineering

All students opting for the track Structural Engineering must complete the following subjects adding up to 17 credits:

<u>code</u>	<u>subject</u>	<u>ECs</u>
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⁴ Not if CT3310-09 has been completed in the Bachelor's phase

⁵ Not if CT3330 has been completed in the Bachelor's phase

⁶ Not if CT3340 or CIE4345MI has been completed in the Bachelor's phase

CIE4201	Architectural History of Buildings	4
CIE4215	Façade Design Plus	3
CIE4240	Forensic Structural Engineering	3
CIE5981	Forms of Collaboration in Civil Engineering	4
ID4010	Design Theory and Methodology	3

3. Additional block Building Technology and Physics

Students who have opted for the specialisation Building Technology and Physics must complete the following subjects adding up to 33 credits:

<u>code</u>	<u>subject</u>	<u>ECs</u>
CIE4225	Advanced and Applied Building Physics	6
CIE5100	Repair and Maintenance of Construction Materials	4
CIE5131	Fire Safety Design	3
AR0115	Technoledge Façade Design	6
AR0531	Innovation and Sustainability (theory)	6
Extra electives, as mentioned in Article 3 subsection 1c		8

4. Additional block Structural Design

Students who have opted for the specialisation Structural Design must complete the following subjects adding up to 33 credits:

<u>code</u>	<u>subject</u>	<u>ECs</u>
CIE3109-09 ⁷	Structural Mechanics 4	4
CIE3150 ⁸	Concrete Structures 2	4
CIE4115	Steel Structures 2	4
CIE4190	Analysis of Slender Structures	4
CIE4281	Building Structures 2	4
CIE5151-09	Structural Design, Special Structures	5
choose one out of:		
CIE4110	Timber and Timber Structures 1	4
CIE4285	Structural Glass	3
Extra electives, from the list below		4 or 5

If one or more of the above-mentioned subjects CIE3109-09, CIE3150, CIE4115 and CIE4190 has been done in the Bachelor's phase, the student may choose from:

<u>code</u>	<u>subject</u>	<u>ECs</u>
CIE4121	Steel Structures 3	4
CIE4125	Structural Design - Case Study Steel, Timber or FRP	3
CIE4140	Structural Dynamics	4
CIE4160	Prestressed Concrete	4
CIE4170	Construction Technology of Civil Engineering Structures	4
CIE4362	Soil Structure Interaction	3
CIE4363	Foundations and Deep Excavations	4
CIE5124	Timber and Timber Structures 2	4
CIE5125	Steel Bridges	4
CIE5127	Concrete Bridges	4
CIE5131	Fire Safety Design	3
CIE5148	Computational Modelling of Structures	4

Article 7 – The Hydraulic Engineering track

1. The Hydraulic Engineering track has four specialisations:

- Coastal Engineering
- Rivers, Ports and Waterways, with fields River Engineering, Dredging Engineering and Ports and Waterways
- Environmental Fluid Mechanics
- Hydraulic Structures and Flood Risk, with fields Hydraulic Structures and Flood Risk

and one specialisation in a double degree programme with the National University of Singapore (NUS), mentioned in subsection 9:

- Hydraulic Engineering and Water Resources Management (the TUD-NUS specialisation)

⁷ Not if CT3109-09 has been completed in the Bachelor's phase

⁸ Not if CT3150 has been completed in the Bachelor's phase

The compulsory programme for each specialisation, except for the TUD-NUS specialisation, consists of a common Hydraulic Engineering block of 18 credits (14 credits if CT3340 or CIE4345MI has been completed in the Bachelor's phase), an additional specialisation block and Hydraulic Engineering electives adding up to a total of 56 track-linked credits.

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 CIE4145-09 (Dynamics and Introduction to Continuum Mechanics) as a compulsory elective subject.
- Students who have not done CT3310-09 or CTB3350 (Open Channel Flow) in the Bachelor's phase will have to do CIE3310-09 as a compulsory elective subject.
- Students who have not done CT3330 or CTB3355 (Hydraulic Structures 1) in the Bachelor's phase will have to do CIE3330 as a compulsory elective subject.

2. Common compulsory block Hydraulic Engineering

All students opting for the track Hydraulic Engineering must complete the following subjects adding up to 18 credits:

<u>code</u>	<u>subject</u>	<u>ECs</u>
CIE4130	Probabilistic Design and Risk Management	4
CIE4305	Coastal Dynamics 1	6
CIE4310	Introduction to Bed, Bank and Shoreline Protection	4
CIE4345 ⁹	River Engineering	4

3. Additional block Coastal Engineering

Students who have opted for the specialisation Coastal Engineering must complete the following subjects adding up to 23 credits:

<u>code</u>	<u>subject</u>	<u>ECs</u>
CIE4309	Coastal Dynamics 2	5
CIE4325	Ocean Waves	6
CIE4330	Ports and Waterways 1	4
CIE4340	Computational Modelling of Flow and Transport	4
CIE5308	Breakwaters and Closure Dams	4

4. Additional block Rivers, Ports and Waterways

Students who have opted for the specialisation Rivers, Ports and Waterways must complete the following subjects adding up to 26 credits (field River Engineering 25 credits):

<u>code</u>	<u>subject</u>	<u>ECs</u>
CIE4325	Ocean Waves	6
CIE4330	Ports and Waterways 1	4
CIE4340	Computational Modelling of Flow and Transport	4
CIE5300	Dredging Technology	4
CIE5311	River Dynamics	4

and choose one field:

field River Engineering:

CIE5315	Computational Hydraulics	3
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field Dredging Engineering:

OE4626	Dredging Processes	4
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field Ports and Waterways:

CIE5306	Ports and Waterways 2	4
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5. Additional block Environmental Fluid Mechanics

Students who have opted for the specialisation Environmental Fluid Mechanics must complete the following subjects adding up to 22 credits:

<u>code</u>	<u>subject</u>	<u>ECs</u>
CIE4325	Ocean Waves	6
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

6. Additional block Hydraulic Structures and Flood Risk

⁹ Not if CT3340 or CIE4345MI has been completed in the Bachelor's phase

Students who have opted for the specialisation Hydraulic Structures and Flood Risk must complete the following subjects adding up to 27 credits (field Hydraulic Structures 29 credits):

<u>code</u>	<u>subject</u>	<u>ECs</u>
CIE4170	Construction Technology of Civil Engineering Structures	4
CIE4325	Ocean Waves	6
CIE5313	Hydraulic Structures 2	3
and choose one field :		
field Hydraulic Structures :		
CIE3109-09 ¹⁰	Structural Mechanics 4	4
CIE3150 ¹¹	Concrete Structures 2	4
CIE4140	Structural Dynamics	4
CIE4160	Prestressed Concrete	4
field Flood Risk:		
CIE3325 ¹²	Mechanics and Transport by Flow in porous Media	4
CIE4367	Embankments and Geo-synthetics	4
CIE5310	Probabilistic Design in Hydraulic Engineering	3
CIE5314	Flood Defences	3

7. Hydraulic Engineering electives

Apart from what is stipulated in subsections 2 to 7, Hydraulic Engineering students should make sure they get - depending on their specialisation and in consultation with the graduation professor - a total of 56 track-linked credits by choosing from the above listed subjects or from the list below:

<u>code</u>	<u>subject</u>	<u>ECs</u>
CIE3310-09 ¹³	Open Channel Flow	4
CIE3330 ¹⁴	Hydraulic Structures 1	4
CIE3365-13	Coupled Processes in Subsurface	6
CIE3410-09 ¹⁵	Water Control	4
CIE3420	Introduction to Water Treatment	4
CIE4030	Methodology for Scientific Research	3
CIE4115 ¹⁶	Steel Structures 2	4
CIE4145-09 ¹⁷	Dynamics and Introduction to Continuum Mechanics	4
CIE4180	Plates and Slabs	4
CIE4190 ¹⁸	Analysis of Slender Structures	4
CIE4308	Sediment Dynamics	3
CIE4361	Behaviour of Soils and Rocks	6
CIE4362	Soil-Structure Interaction	3
CIE4363	Deep Excavations	4
CIE4365-13	Coupled Processes in Subsurface	6
CIE4366	Numerical Modelling in Geo-Engineering	6
CIE4390	Geo-risk Management	3
CIE4400	Water Quality Modelling	4
CIE4410	Water Systems, People and Society	4
CIE4420 ¹⁹	Geohydrology 1	4
CIE4431	Hydrologic Models	4
CIE4440	Hydrological Measurements	4
CIE4450	Integrated Water Management	4
CIE4460	Polders and Flood Control	4
CIE4480	Integral Systems Design	4
CIE4491	Urban Drainage and Water Management	4
CIE4495-13	Fundamentals of Water Treatment	4
CIE4760	Infrastructure Projects: Assessment and Planning	6
CIE4780	Trending Topics in Geo-Engineering	4
CIE5304	Waterpower Engineering	3

¹⁰ Not if CT3109-09 has been completed in the Bachelor's phase

¹¹ Not if CT3150 has been completed in the Bachelor's phase

¹² Not if CTB3390 has been completed in the Bachelor's phase

¹³ Not if CT3310-09 has been completed in the Bachelor's phase

¹⁴ Not if CT3330 has been completed in the Bachelor's phase

¹⁵ Not if CT3410-09 has been completed in the Bachelor's phase

¹⁶ Not if CT3121 has been completed in the Bachelor's phase

¹⁷ For foreign students only

¹⁸ Not if CT3110 has been completed in the Bachelor's phase

¹⁹ Not combined with CIE3325

CIE5305	Bored and Immersed Tunnels	4
CIE5307	Coastal Zone Management	3
CIE5318	Fieldwork Hydraulic Engineering	4
CIE5320	Site Characterisation, Testing and Physical Model	6
CIE5340	Soil Dynamics	3
CIE5401	Spatial Tools in Water Resources Management	3
CIE5421	Water and Health	4
CIE5440	Geohydrology 2	2
CIE5450	Hydrology of Catchments, Rivers and Deltas	4
CIE5471	Hydrological and Ecological Fieldwork in River Systems	4
CIE5490	Operational Water Management	4
CIE5500	Water Law and Organisation	4
CIE5510	Urban Water Management	4
CIE5541	Urban Drainage Monitoring and Modelling	3
CIE5560	Civil Engineering in Developing Countries	4
CIE5580	Ecology and Geomorphology	5
CIE5741	Trenchless Technologies	4
CIE5981	Forms of Collaboration in Civil Engineering	4
AES1630	Engineering Geology	4
AES1730 ²⁰	Introduction to Geotechnical Engineering	3
AES1750-09	Geology for Engineers	4
CME2300	Financial Engineering	4
OE4624	Offshore Soil Mechanics	3
OE4625	Dredge Pumps and Slurry Transport	4

and from the following subjects offered by the National University of Singapore:

<u>code</u>	<u>subject</u>	<u>ECs</u>
CE5307NUS	Wave Hydrodynamics and Physical Oceanography	6
CE5308NUS	Coastal Processes and Sediment Transport	6
CE5310NUS	Hydro Informatics	6
CE5311NUS	Environmental Modelling with Computers	6
CE5312NUS	River Mechanics	6
CE5603NUS	Engineering Economics and Project Evaluation	6
CE5710NUS	Design of Floating Structures	6
CE5711NUS	Offshore Moorings and Risers	6
ESE4001 (NUS)	Basic Environmental Science and Engineering	6
ESE5402 (NUS)	Water Treatment Processes	6
ESE5601 (NUS)	Environmental Risk Assessment	6
ESE5602 (NUS)	Environmental Management System	6
ESE5901 (NUS)	Environmental Technology	6
IE5303 (NUS)	Decision Analysis	6

8. Hydraulic Engineering and Water Resources Management (the TUD-NUS HE programme)

The Hydraulic Engineering and Water Resources Management programme holds a mixture of subjects of Delft University of Technology (TUD) and the National University of Singapore (NUS).

The TUD-NUS HE programme consists of a common compulsory block of 46 credits and electives adding up to a total of 56 track-linked credits.

Common compulsory block TUD-NUS HE programme

All students opting for the TUD-NUS HE programme must complete the following subjects adding up to 46 credits:

<u>code</u>	<u>subject</u>	<u>ECs</u>
CIE4130	Probabilistic Design and Risk Management	4
CIE4305	Coastal Dynamics 1	6
CIE4310	Introduction to Bed, Bank and Shoreline Protection	4
CIE4330	Ports and Waterways 1	4
CIE4340	Computational Modelling of Flow and Transport	4
CIE4345 ²¹	River Engineering	4
and choose four out of:		
CE5307NUS	Wave Hydrodynamics and Physical Oceanography	6

²⁰ Not for students who completed a soil mechanics subject in their Bachelor's degree course.

²¹ Not if CT3364 or CIE4345MI has been completed in the Bachelor's phase

CE5308NUS ²²	Coastal Processes and Sediment Transport	6
CE5310NUS	Hydro Informatics	6
CE5311NUS	Environmental Modelling with Computers	6
CE5312NUS ²³	River Mechanics	6

TUD-NUS HE programme electives

TUD-NUS HE programme students should make sure they get a total of 56 track-linked credits by choosing from the above in subsections 3 to 7 listed subjects.

Article 8 – The Water Management track

1. The Water Management track has three specialisations:
 - Hydrology
 - Water Resources Management
 - Sanitary Engineering

The Water Management track is a Campus degree programme as well as an online degree programme. Each online course is given parallel to the Campus course, within the same period, ending with exams together with Campus students.

The compulsory programme for each specialisation consists of a common compulsory Water Management block of 16 credits and 40 credits Water Management specialisation electives.

Students with a Dutch higher vocational institute Bachelor degree ("HBO") must complete CIE3410-09, Water Control, 4 ECs as a Water Management specialisation elective and AES1730, Introduction to geotechnical Engineering, 3 ECs, as a free elective.

2. Common compulsory block Water Management
All students opting for the track Water Management must complete the following subjects adding up to 16 credits:

<u>code</u>	<u>subject</u>	<u>ECs</u>
CIE4440	Hydrological Processes and Measurements	4
CIE4450	Integrated Water Management	4
CIE4491	Urban Drainage and Water Management	4
CIE4495-13	Fundamentals of Water Treatment	4

3. Water Management specialisation electives
Depending on their specialisation and in consultation with the chairperson of the assessment committee Water Management students are required to complete a selection of the following electives adding up to 40 credits from the following five categories. Electives from the categories b, c, d and e can only be included in this selection upon approval from the chairperson of the assessment committee.

Category a:

<u>code</u>	<u>subject</u>	<u>ECs</u>
CIE3365 ²⁴	Introduction in Water Treatment	4
CIE3410-09 ²⁵	Water System Analysis	4
CIE4400	Water Quality Modelling	4
CIE4410	Water Systems, People and Society	4
CIE4415	Design of Drinking Water and Wastewater Treatment Plants	5
CIE4420	Geohydrology 1	4
CIE4431	Hydrological Models	4
CIE4460	Polders and Flood Control	4
CIE4486	Industry Water	4
CIE4475	Drinking Water Treatment	5
CIE4485	Wastewater Treatment	5
CIE5401	Spatial Tools in Water Management	3
CIE5421	Water and Health	4
CIE5440	Geohydrology 2	4
CIE5450	Hydrology of Catchments, Rivers and Deltas	4

²² Not combined with CIE4305

²³ Not combined with CIE4345

²⁴ Not if an equivalent subject has been completed in the Bachelor's phase

²⁵ Idem as 24

CIE5471	Hydrological and Ecological Fieldwork in River Systems	4
CIE5490	Operational Water Management	4
CIE5500	Water Law and Organisation	3
CIE5510	Urban Water Management	4
CIE5541	Urban Drainage Monitoring and Modelling	3
CIE5550	Pumping Stations and Transport Pipelines	4
CIE5560	Civil Engineering in Developing Countries	4
CIE5580	Ecology and Geomorphology	5

Category b:

The Hydraulic Engineering subjects mentioned in Article 7 subsections 2 to 8.

Category c:

Master of Science subjects offered in the Faculty Applied Sciences.

Category d:

The Geoscience and Remote Sensing subjects mentioned in Article 11.

Category e:

The following subjects offered in the Faculty of Architecture:

<u>code</u>	<u>subject</u>	<u>ECs</u>
BK7250	Sustainable Urbanism	3
AR1U130	Sustainable Urban Engineering of Territory	3

4. Hydraulic Engineering and Water Resources Management (the TUD-NUS WM programme):

The Hydraulic Engineering and Water Resources Management programme holds a mixture of subjects of Delft University of Technology (TUD) and the National University of Singapore (NUS).

The TUD-NUS WM programme consists of a common compulsory block of 48 credits and electives adding up to a total of 24 credits.

Common compulsory block TUD-NUS programme

All students opting for the TUD-NUS programme Water Management must complete the following subjects adding up to 48 credits:

<u>code</u>	<u>subject</u>	<u>ECs</u>
CIE4440	Hydrological processes and measurements	4
CIE4450	Integrated Water Management	4
CIE4491	Urban drainage and Water Management	4
CIE4495-14	Fundamentals of Water Treatment	4

and choose four out of:

CE5307NUS	Wave Hydrodynamics and Physical Oceanography	6
CE5308NUS	Coastal Engineering and Sediment Transport	6
CE5310NUS	Hydroinformatics	6
CE5311NUS	Environmental Modelling with Computers	6
CE5312NUS ²⁶	River Mechanics	6

and choose 2 subjects with a total of at least 8 credits from the above in subsection 3 listed Water Management subjects.

TUD-NUS WM programme electives

TUD-NUS WM programme students select for 24 credits from subjects as listed under subsection 3, categories a to e. These specialisation electives are chosen in consultation with the chairperson of the assessment committee.

Article 9 – The Transport and Planning track

The Transport and Planning track has one specialisation:

- Transport and Planning

Common compulsory block Transport and Planning

All students opting for the track Transport and Planning must complete the following subjects adding up to 48 credits:

<u>code</u>	<u>subject</u>	<u>ECs</u>
CIE4760	Infrastructure Projects: Assessment and Planning	6

²⁶ Not combined with CIE4345

CIE4801	Transport and Spatial Modelling	6
CIE4811-09	Design and Control of Public Transport Systems	6
CIE4821-09	Traffic Flow Theory and Simulation	6
CIE4822-09	Traffic Management and Control	6
CIE4831-09	Empirical Analysis for Transport and Planning	6
CIE4840	Freight Transportation Systems: Analysis and Modelling	4
CIE5730	Spatial and Transport Economics	4
CIE5810-09	Traffic Safety	4

Additional block Transport and Planning

choose two out of:

CIE5750	Transport and Spatial Planning for urbanised regions	4
CIE5802-09	Advanced Transportation Modelling	4
CIE5803-09	Railway Traffic Management	4
CIE5804-09	Innovations in Dynamic Traffic Management	4
CIE5805	Intelligent Vehicles	4
CIE5811	Transport Safety	4

Article 10 – The Geo-Engineering track

The Geo-Engineering track has one specialisation:

- Geo-Engineering

Common compulsory block Geo-Engineering

All students opting for the track Geo-Engineering must complete the following subjects adding up to 32 credits:

<u>code</u>	<u>subject</u>	<u>ECs</u>
CIE4361	Behaviour of Soils and Rocks	6
CIE4365-13	Coupled Processes in Subsurface	6
CIE4366	Numerical Modelling in Geo-Engineering	6
CIE4395	Risk and Variability in Geo-Engineering	4
CIE5320	Site Characterisation, Testing and Physical Modelling	6
AES1630	Engineering Geology	4

If the Bachelor's phase did not include the contents of the following subjects, these subjects are compulsory:

<u>code</u>	<u>subject</u>	<u>ECs</u>
AES1730	Introduction to Geotechnical Engineering	4
CIE4420	Geohydrology 1	4

Additional block Geo-Engineering

Students are required to complete a selection of the following subjects adding up to a total of 56 track-linked credits.

<u>code</u>	<u>subject</u>	<u>ECs</u>
CIE4353	Continuum Mechanics	6
CIE4362	Soil-structure Interaction	3
CIE4363	Deep Excavations	4
CIE4367	Embankments and Geosynthetics	4
CIE4390	Geo-risk Management	3
CIE4780	Trending Topics in Geo-Engineering	4
CIE5305	Bored and Immersed Tunnels	4
CIE5340	Soil Dynamics	3
CIE5741	Trenchless Technologies	4
OE4624	Offshore Soil Mechanics	3
AES1501	Methods of Exploration Geophysics	4
AES1640-11	Environmental Geotechnics	4
AES1720-11	Rock Mechanics Applications	5
AESM2901	Geoscience and Engineering Fieldwork	6

Article 11 – The Geoscience and Remote Sensing track

The Geoscience and Remote Sensing track has one specialisation:

- Geoscience and Remote Sensing

Common compulsory block Geoscience and Remote Sensing

All students opting for the track Geo-Engineering must complete the following subjects adding up to 28 credits:

<u>code</u>	<u>subject</u>	<u>ECs</u>
CIE4601	Physics of the Earth and Atmosphere	5
CIE4603	Geo-signal Analysis	5
CIE4604	Simulation and Visualization	5
CIE4606	Geodesy and Remote Sensing	5
CIE4611	Geo-measurement Processing	5
CIE4615	GRS Fieldwork	3

Additional block Geoscience and Remote Sensing

Students are required to complete a selection of the following subjects adding up to a total of 55 credits.

Choose at least 12 credits out of:

<u>code</u>	<u>subject</u>	<u>ECs</u>
CIE4522-15	GPS for Civil Engineering and Geosciences	4
CIE4602	Ice, Snow and Climate Change: Observation and Modelling	4
CIE4605	Atmospheric Science	4
CIE4607	Oceans, Sea-level and Bathymetry	4
CIE4608	Atmospheric Observation	4
CIE4609	Geodesy and Natural Hazards	4
CIE4610	Mass Transport in the Earth's System	4
CIE4614	Land Surveying and Civil Infrastructure	4

and choose adding up to a total of 55 credits out of:

CIE4612	Research Seminar Geoscience and Remote Sensing II	1
CIE5601	Journal Club on Climate Change and Geoscience	3
CIE5602	Research Seminar Geoscience and Remote Sensing I	1
CIE5603	Advanced project on GRS	3

any Master's degree course subject Civil Engineering or Applied Earth Sciences

Section 2 – Annotations and Honours Programme

Article 12A – The Technology in Sustainable Development annotation

- The examination programme for students who have opted for the annotation Technology in Sustainable Development must at least include the following:
 - a sustainable development colloquium of 5 credits: WM0939TU, Engineering for Sustainable Development,
 - subjects within or outside the realm of the degree course adding up to a total of at least 10 credits to be selected from the two clusters:
 - Design, Analysis and Tools
 - Organisation and Society.At least 3 credits should derive from each of the clusters.
Further information on the subjects to be selected and on the clusters is available from the referent, from the manual and from the website of Delft University of Technology.
 - a Master Thesis Project carrying 40 credits in line with what is stipulated in Article 3 subsection 1 clause d. The Master Thesis Project must partly focus on the topic of sustainable development. The referent will test the hypothesis of the project and the way in which it has been tackled against the extent to which sustainable development issues have been integrated into the project.
- Students who complete the annotation successfully, receive an annotation Technology in Sustainable Development with their degree certificate.

Article 12B – Entrepreneurship annotation

- The examination programme for students who have opted for the annotation Entrepreneurship must at least include the following:
 - electives related to entrepreneurship adding up to a total of 15 credits, 10 of which are extracurricular,
 - a Master Thesis Project carrying 40 credits in line with what is stipulated in Article 3 subsection 1 clause d, partly focusing on the topic of entrepreneurship.

2. The examination programme for the Entrepreneurship annotation needs the prior approval by a coordinator of Delft Centre for Entrepreneurship and the board of examiners.
3. Students who complete the annotation successfully, receive an annotation Entrepreneurship with their degree certificate.

Article 12C – The Urban Planning and Engineering annotation (“Stadsingenieur”)

1. The examination programme for students who have opted for the annotation Urban Planning and Engineering must at least include the following:
 - a. 20 credits as mentioned in Article 3 subsection 1 clause c, relating to one or more of the following fields:
 - Urban and Regional Planning
 - Infrastructure Planning
 - Real Estate
 - Site Development
 - Land Clearing
 - Urban Civil Engineering.
 - b. a Master Thesis Project carrying 40 credits in line with what is stipulated in Article 3 subsection 1 clause d, partly focusing on the topic of at least one of the above mentioned fields.
The annotation can be obtained within the examination programme (120 credits) if the student uses the electives and/or the possibilities mentioned in Article 3 subsection 1 clause c, otherwise these electives and/or possibilities will be extracurricular.
2. The examination programme for the Urban Planning and Engineering annotation needs the prior approval by the board of examiners, who will seek the programme director’s advice.
3. Students who complete the annotation successfully, receive an annotation Urban Planning and Engineering with their degree certificate.

Article 12D – The Infrastructure Planning and Environmental Engineering annotation (“Infrastructuur en milieu”)

1. The examination programme for students who have opted for the annotation Infrastructure Planning and Environmental Engineering must at least include the following:
 - a. 20 credits as mentioned in Article 3 subsection 1 clause c, relating to one or more of the following fields:
 - Infrastructure Planning
 - Regional Planning
 - Environmental Engineering
 - Cost Benefit Analysis
 - Risk Analysis
 - Financial Engineering
 - Policy and Decision Making
 - Project and Process Management.
 - b. a Master Thesis Project carrying 40 credits in line with what is stipulated in Article 3 subsection 1 clause d, partly focusing on the topic of at least one of the above mentioned fields.
The annotation can be obtained within the examination programme (120 credits) if the student uses the electives and/or the possibilities mentioned in Article 3 subsection 1 clause c, otherwise these electives and/or possibilities will be extracurricular.
2. The examination programme for the Infrastructure Planning and Environmental Engineering annotation needs the prior approval by the board of examiners, who will seek the programme director’s advice.
3. Students who complete the annotation successfully, receive an annotation Infrastructure Planning and Environmental Engineering with their degree certificate.

Article 12E – The Integral Design Management annotation

1. The examination programme for students who have opted for the annotation Integral Design Management must include the following:
 - a. subjects within or outside the compulsory or elective subjects of the chosen track and/or specialisation adding up to a total of 8 credits (4 credits if CTB3380 has been completed in the Bachelor’s phase):

<u>code</u>	<u>subject</u>	<u>ECs</u>
CIE3380	Infrastructure Management	4
CIE4480	Integral Design and Management	4

- b. subjects from the list below within or outside the compulsory or elective subjects of the chosen track and/or specialisation adding up to a total of at least 6 credits (10 credits if CTB3380 has been completed in the Bachelor's phase):

<u>code</u>	<u>subject</u>	<u>ECs</u>
CIE4120 ²⁷	Information Systems for Infrastructures and Buildings	4
CIE4130	Probabilistic Design and Risk Management	4
CME1210	Infrastructure Asset Management	7
CME2300	Financial Engineering	4
EPA1322	Continuous Systems Modelling	5
SPM8000	Project Management	7
AR8002TU	Legal and Governance	7
IN4170	Databases and Data Mining	6
IN4325	Information Retrieval	4
WI2608	Optimization	6
WI4051	Introduction to Operations Research	4
WI4138	Decision Theory/Expert Judgement	4

- c. a Multidisciplinary Project (CIE4061-09) carrying 10 credits as mentioned in Article 3 subsection 1 clause c. The Multidisciplinary Project must focus on the topic of integral design management. The coordinator will test the hypothesis of the project and the way in which it has been tackled against the extent to which integral design management issues have been integrated into the project.
- d. a Master Thesis Project carrying 40 credits in line with what is stipulated in Article 3 subsection 1 clause d. The Master Thesis Project must partly focus on the topic of integral design management. The coordinator will test the hypothesis of the project and the way in which it has been tackled against the extent to which integral design management issues have been integrated into the project.

2. Students who complete the annotation successfully, receive an annotation Integral Design Management with their degree certificate.

Article 12F – The Rail annotation

1. The examination programme for students who have opted for the annotation Rail must include the following:

- a. subjects within or outside the compulsory or elective subjects of the chosen track and/or specialisation adding up to a total of 8 credits:

<u>code</u>	<u>subject</u>	<u>ECs</u>
CIE4872	Railway Operations and Control	4
CIE4874	Elements of Railway Engineering	4

- b. subjects from the list below within or outside the compulsory or elective subjects of the chosen track and/or specialisation adding up to a total of at least 14 credits:

<u>code</u>	<u>subject</u>	<u>ECs</u>
CIE4811-09	Design and Control of Public Transport Systems	6
CIE4870	Structural Design of Railway Track	4
CIE4873	Wheel-Rail Interface	4
CIE4871	Design and Maintenance of Railway Vehicles	4
CIE5803-09	Railway Traffic Management	4
CIE5811	Transport Safety	4
CIE5875	Railway Asset Management	4
CIE5874	Mechanical and Material Engineering in Railway Asset Management	4

2. a Master Thesis Project carrying 40 credits in line with what is stipulated in Article 3 subsection 1 clause d, focusing on the topic of railway operations and/or railway engineering. The annotation coordinators will test the hypothesis of the project and the way in which it has been tackled against the extent to which railway operations and/or railway engineering has been integrated into the project.
3. Students who complete the annotation successfully, receive an annotation Rail with their degree certificate.

Article 13 – Honours Programme Master

²⁷ as of 1 September 2015

1. Motivated students who have finished their Bachelor's degree course with a weighed averaged mark of 7.5 or higher, and students who have excelled during the first semester (no fails and a weighed average of 7.5 or higher) are eligible for a special individual programme of 20 credits on top of the Master's degree course: the Honours Programme Master.
2. The content of the Honours Programme Master should be thematically consistent. The subject WM0355HT, Critical Reflection on Technology, 5 credits, is compulsory to the Honours Programme Master.
3. Students who fulfil, or will fulfil, the requirements laid down in subsection 1, and are interested in the Honours Programme Master can send their application to the programme coordinator together with an essay in English, containing their motivation and a proposal for the programme. The programme has to be approved by a scientific staff member and the programme coordinator.
4. The Honours Programme Master has to be completed during the course of the student's Master's programme. None of the results may be lower than 6,0.
5. The various parts of the programme will be assessed by the respective examiner(s). The fulfilment of all criteria to the Honours Programme Master will be assessed by the board of examiners.
6. Students who have successfully completed the Honours Programme Master will receive a special certificate from the university with their degree certificate.

Section 3 – Transitional programme

Article 14 – Transitional programme for students with a Dutch higher vocational institute Bachelor degree ("HBO")

1. Students who want to be admitted to the Master's degree course on the basis of a relevant Dutch higher vocational institute Bachelor degree have to complete a transitional programme **first** consisting of a common deficiency block of 26 credits and an additional track-linked block of 12 to 16 credits.

Students participating in the transitional programme as part of their relevant higher vocational education, have to complete the common deficiency block within their higher vocational education examination programme. Furthermore they have to complete the additional track-linked block **before** they will be admitted to the Master's degree course.

2. Common deficiency block

<u>code</u>	<u>subject</u>	<u>ECs</u>
CTB1210	Dynamics and Modelling	5
CTB2400	Numerical Methods for differential Equations	3
CTB2001HBO	Computer Programming HBO	3
WI1708TH1	Analysis 1	3
WI1708TH2	Analysis 2	3
WI1708TH3	Analysis 3	3
WI1808TH1	Linear Algebra (part 1) (not for GRS)	3
WI1909TH	Differential Equations	3
WI2031TH	Kansrekening en statistiek voor hbo-instromers	3

3. Additional track-linked block

Furthermore the following subjects have to be completed within the transitional programme:

In case the track Structural Engineering has been chosen:

<u>code</u>	<u>subject</u>	<u>ECs (total 26 + 15)</u>
CTB2210	Structural Mechanics 3	5
CTB2300	Dynamics of Systems	3
CTB3330	Structural Mechanics 4	4
CTB1730HBO	Introduction to geotechnical Engineering	3

In case the track Building Engineering has been chosen:

<u>code</u>	<u>subject</u>	<u>ECs (total 26 + 15)</u>
CTB2210	Structural Mechanics 3	5
CTB2300	Dynamics of Systems	3
CTB3340-15	Building Structures 1	4
bestaande uit:		
CTB3340-15 D1	Constructies van gebouwen 1/ Building Structures 1, deel 1	2
CTB3340-15 D2	Constructies van gebouwen 1/ Building Structures 1, deel 2	2
CTB1730HBO	Introduction to geotechnical Engineering	3

In case the track Hydraulic Engineering has been chosen:

<u>code</u>	<u>subject</u>	<u>ECs</u> (total 26 + 16)
CTB2110	Fluid Mechanics	5
CTB2210	Structural Mechanics 3	5
CTB2300	Dynamics of Systems	3
CTB1730HBO	Introduction to geotechnical Engineering	3

In case the track Water Management has been chosen:

<u>code</u>	<u>subject</u>	<u>ECs</u> (total 26 + 14)
CTB2110	Fluid Mechanics	5
CTB2420	Hydrology	5
CTB3365-14	Introduction in Water Treatment	4

In case the track Transport and Planning has been chosen:

<u>code</u>	<u>subject</u>	<u>ECs</u> (total 26 + 15)
CTB3370	Geometrical Design of Roads and Railways	4
CTB3380-14	Infrastructure Management	4
CTB3420	Integral Design of Infrastructure	4
CTB1730HBO	Introduction to geotechnical Engineering	3

In case the track Geo-Engineering has been chosen:

<u>code</u>	<u>subject</u>	<u>ECs</u> (total 26 + 12)
CTB2210	Structural Mechanics 3	5
CTB3425	Monitoring and Stability of Dikes and Embankments	4
CTB1730HBO	Introduction to geotechnical Engineering	3

In case the track Geoscience and Remote Sensing has been chosen:

<u>code</u>	<u>subject</u>	<u>ECs</u> (total 29 + 15)
CTB2300	Dynamics of Systems	3
CTB3310	Surveying and Mapping	4
TA2601	Practical Matlab	2
WI1807TH1	Linear Algebra 1	3
WI1807TH2	Linear Algebra 2	3

Section 4 – Deviate from examination programme

Article 15 – The free study programme

1. Students are free to compile examination programmes that are rounded off with a final exam. Such a programme needs **prior approval** by the board of examiners and it must consist entirely or mainly of subjects given in conjunction with the degree course but it can be complemented with subjects provided by or given in other courses.
2. The preliminary approval referred to in subsection 1 must be presented to the board of examiners by the student in the form of a justified request.

Article 16 – Deviate from the examination programme

The board of examiners may allow students to deviate from the examination programme.

Section 5 – Examinations and practicals

Article 17 – Practicals

1. The course teaching takes the form of lectures and/or practicals.

2. Practicals must be completed before students participate in the examination unless otherwise is indicated in the study guide pertaining to that particular subject.

Article 18 – The types of examinations

The examinations linked to the different subjects are to be completed in the way laid down in the study guide pertaining to the subject in question.

Article 19 – The frequencies, times and sequences of the exams

1. Written and oral examinations are to be completed at the end of the teaching period in which the subject was taught.
2. The resit periods for any of the written exams referred to in subsection 1 are at the end of the next teaching period. For subjects taught in the fourth teaching period the resit period is in August.
3. Practicals may be completed in the way laid down in the relevant timetables.

Section 6 – Access to Master Thesis Project

Article 20 – Access to the Master Thesis Project

1. Students may embark on the Final Thesis only when they have no more than 15 credits of uncompleted subjects of the Master's degree course from all their other subjects of the course.
2. Students are only allowed to present their Final Thesis if they have successfully completed all other obligations.

Section 7 – Transition Rulings

Article 21 – The transition ruling 1 September 2009 and before

Transition Rulings of 1 September 2009 and before one can find in the previous Implementation Regulations.