

THE IMPLEMENTATION REGULATIONS

2014-2015

**MASTER OF SCIENCE
CHEMICAL ENGINEERING**

DELFT UNIVERSITY OF TECHNOLOGY

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Article 1 – The study load

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

Article 2 – Tracks and Specializations

1. The programme comprises the following tracks:
 - Chemical Product Engineering,
 - Process Engineering,
 - Nuclear Science & Engineering.
2. The core programme of each track comprises 90 credits and is the same for each student:
 - Obligatory core modules (15 credits),
 - Obligatory track modules (15 credits),
 - Obligatory design modules (20 credits),
 - MSc thesis project (40 credits).The obligatory modules are listed in articles 5 - 7.
3. Combining the core programme with 30 credits Scientific and Social Orientation (elective part) completes the master programme. The student may opt for:
 - Research and Development (Industrial Internship and Electives),
 - Study Abroad,
 - Education,
 - Entrepreneurship,
 - Technology in Sustainable Development,
 - Management of Technology,
 - Double degree.Details are listed in article 8.

Article 3 – The composition

1. The study programme is compiled in the following way:
 - a. In the first year: core subjects, subjects belonging to the chosen track, and subjects belonging to the orientation part of the programme and/or a design project.
 - b. In the second year: a master thesis project, and subjects belonging to the orientation part of the programme and/or a design project.

Article 4 – Registering the track and compiling the examination programme

1. Only one track is mentioned on the diploma. Courses of a second track can be done as electives, or within an honours programme. Students are responsible for registering the track of their choice. The final choice must be made before handing in the diploma application form.
2. Any amendments made to the approved examination programme or to the approved graduation committee should be presented to the board of examiners.
3. Students who opt for a Scientific and Social Orientation other than Research and Development must have approval in advance (article 8). Students who opt for Research and Development must have approval of the industrial internship in advance.
4. The student should at least have completed the following modules before starting the Master Thesis Project:
 - a. have passed all bridging/homologation modules or other obligations from the bachelor programme,
 - b. the obligatory core and track modules,
 - c. the design project and/or subjects belonging to the orientation part of the programme.

Article 5 – The Chemical Product Engineering track

1. The Chemical Product Engineering track has the following specialisations (ChemE):
 - Product and Process Engineering,
 - Advanced Soft Matter,
 - Catalysis Engineering,
 - Materials for Energy Conversion and Storage,
 - Opto-electronic Materials,
 - Organic Materials and Interfaces.
2. Additional to the list mentioned under 1. the student may choose another option for his/her thesis work. However, this choice has to be approved by the board of examiners before the start of the project.
3. The core programme consists of the following course modules:

Code	Course Module	Credits
	Obligatory Core Modules	15
CH3131a	Applied Numerical Mathematics	6
CH3141	Molecular Thermodynamics	6
CH3151	Molecular Transport Phenomena	3
	Obligatory Track Modules	15
CH3162a	Design and Synthesis of Advanced Chemical Products	6
CH3173a	Structure/Property Relationships of Advanced Chemical Products	6
CH3372a	Soft Matter for Chemical Products	3
	Obligatory Design Modules	20
CH3804	Product & Process Design	5
WM0320TU	Ethics and Engineering	3
CH3843	Design project	12
CH3901	MSc Thesis work	40

Article 6 – The Process Engineering track

1. The Process Engineering track has the following specialisations (ChemE):
 - Product and Process Engineering,
 - Advanced Soft Matter,
 - Catalysis Engineering,
 - Materials for Energy Conversion and Storage,
 - Opto-electronic Materials,
 - Organic Materials and Interfaces,
 - Transport Phenomena;and Intensified Reaction & Separation Systems (P&E, 3mE)
2. Additional to the list mentioned under 1. the student may choose another options for his/her thesis work. However, this choice has to be approved by the board of examiners before the start of the project.
3. The core programme consists of the following course modules:

Code	Course Module	Credits
	Obligatory Core Modules	15
CH3131a	Applied Numerical Mathematics	6
CH3141	Molecular Thermodynamics	6
CH3151	Molecular Transport Phenomena	3
	Obligatory Track Modules	15
CH3043a	Process Dynamics & Control	3
CH3053	Applied Transport Phenomena	6
CH3681a	Reactors & Kinetics	6
	Obligatory Design Modules	20
CH3804	Product & Process Design	5
WM0320TU	Ethics and Engineering	3
CH3843	Design project	12
CH3901	MSc Thesis work	40

Article 7 – The Nuclear Science & Engineering track

1. The Nuclear Science & Engineering track has the following specialisations (RST):
 - Fundamental Aspects of Materials and Energy,
 - Neutron and Positron Methods in Materials,
 - Nuclear Energy and Radiation Applications,
 - Radiation Detection and Medical Imaging,
 - Radiation and Isotopes for Health.
2. Additional to the list mentioned under 1. the student may choose another option for his/her thesis work. However, this choice has to be approved by the board of examiners before the start of the project.
3. The core programme consists of the following course modules:

Code	Course Module	Credits
	Obligatory Core Modules	15
CH3131a	Applied Numerical Mathematics	6
CH3141	Molecular Thermodynamics	6
CH3151	Molecular Transport Phenomena	3
	Obligatory Track Modules	15
CH3771	Nuclear Chemistry	6
CH3782	Chemistry of the Nuclear Fuel Cycle	3
CH3792	Introduction to Nuclear Science and Engineering	6
	Obligatory Design Modules	20
CH3804	Product & Process Design	5
WM0320TU	Ethics and Engineering	3
CH3843	Design project	12
CH3901	MSc Thesis work	40

Article 8 – Scientific and Social Orientation

Combining the core programme with 30 credits Scientific and Social Orientation (elective part) completes the master programme. The student may opt for:

1. Research and Development

This programme is especially tailored for students who will work in industry after completing their master education. It consists of:

- Industrial Internship (CH3702, 18 credits),
- Electives (12 credits):
 - . Suggested Chemical Engineering electives or homologation modules : 6-12 credits
 - . MSc level modules offered by other TU Delft programmes : 0-6 credits

Suggested Chemical Engineering electives are obligatory track modules from a second track and modules from the list below. The choice of electives has to be approved by the board of examiners if less than 6 credits are mentioned on the list of suggested electives or homologation modules.

Code	Course Module	Credits
	Process Engineering Track	
CH3011	Interfacial Engineering	3
CH3062	Multiphase Reactor Engineering	3
CH3073	Separation Processes, Design and Operation	3
CH3082	Chemical Technology	3
CH3101	Heterogeneous Catalysis	3
CH3181	Scale Up / Scale Down	3
CH3291	International Design Contest	3
CH3301	Foreign Excursion Tour TG	3
CH3421	Computational Transport Phenomena	6
CH3531	Functional Ceramics	3
CH3562	Nanoparticle Technology	3
CH3622	Process Intensification	3
CH3622-P	Process Intensification - Project	3
CH3861	Hydro Carbon Processing	3
CH3982	Literature Study	3-6
AP3171	Advanced Physical Transport Phenomena	6
ME1540	Turbulent Reacting Flows	3
SET3041	Energy from Biomass	4
	Chemical Product Engineering Track	
CH3011	Interfacial Engineering	3
CH3101	Heterogeneous Catalysis	3
CH3301	Foreign Excursion Tour TG	3
CH3531	Functional Ceramics	3
CH3562	Nanoparticle Technology	3
CH3632	Chemistry of Solar Cells	6
CH3661	Supra-molecular Chemistry	3
CH3672	Computational Materials Science	3
CH3861	Hydro Carbon Processing	3
CH3982	Literature Study	3-6
LM3311	Green Chemistry and Sustainable Technology	3
LM3731	Biocatalysis	6
	Nuclear Science and Engineering Track	
AP3241	Particle Radiotherapy	3
AP3371	Radiological Health Physics	6
CH3301	Foreign Excursion Tour TG	3
CH3582	Chemistry and Physics of Actinides	3
CH3982	Literature Study	3-6

2. Study Abroad

This programme is especially recommended for students who will do a PhD after completing their master education. It consists of a semester, project and/or courses, at a foreign university. The programme has to be approved in advance by the board of examiners.

3. Education (only Dutch students)

The educational programme is aimed at Dutch-speaking students only, because they are oriented towards the Dutch school system and because it includes internships (Schoolpracticum) at Dutch secondary schools. Consequently the educational specialisation modules are taught in Dutch. The programme consists of Basisdeel/Ed1 (30 EC) and Verdiepingsdeel/Ed2 (30 EC).

The minor Education (Basisdeel/Ed1) can be done during the bachelor programme and leads to certification as a tweedegraads secondary school teacher with limited qualification (beperkte bevoegdheid). If a student has done the minor Education, only the Verdiepingsdeel/Ed2 of 30 EC remains for the master programme specialisation. The combination of the minor Education and Ed2 specialisation leads to certification as a fully-qualified eerstegraads (grade-one) secondary school teacher. The certificate will be attached to the master diploma. Students that did not take the minor Education can follow the Basisdeel/Ed1 specialisation as part of their master programme and then do the Verdiepingsdeel/Ed2 as a post-master course in order to become fully qualified. The programme has to be approved by coordinator, M.A.F.M. Jacobs.

Code	Course Module	Credits
	Education Basis	
SL3031	Didactical Skills	3
SL3041	Orienterende Stage	3
SL3111	Research Methodology in Social Sciences	3
SL3132	Didactics Chemistry 1	2
SL3174	Field Orientation Chemistry A	9
SL3342	Didactics Chemistry 2	4
SL3462	Educational Science	6
	Education Verdieping	
SL3012	Integration SC/SE	3
SL3021	The Designing of Communication and Education Products	6
SL3311	Research of Education	6
SL3381	Didactics Chemistry 3	3
SL3424	Field Orientation Chemistry B	12

4. Entrepreneurship

This programme is especially tailored for students who want to start a company work after completing their master education. It consists of:

- Obligatory Entrepreneurship Modules (10 credits),
- Electives (20 credits); at least 14 credits from the list below. Up to 6 credits of regular chemical engineering electives can be chosen

The programme has to be approved by the coordinator, Linda Kamp. Electives not mentioned on the list below have to be approved by the board of examiners.

Code	Course Module	Credits
	Obligatory Entrepreneurship Modules	10
WM4001TU	Entrepreneurship Annotation Week	2
WM4003TU	Additional Entrepreneurship Annotation Final Thesis	8
	Suggested Elective Modules	20
ET4247	HighTech Start Ups	5
ID4315	New Product Commercialization	6
ID4330	New Product Economics	3
ID5600SET	Smart Energy Products	4
MOT9556	Corporate Entrepreneurship	6
WM0506TU	Ready to startup	6
WM0516TU	Turning Technology into Business	6
WM0521TU	Business Analysis of Entrepreneurship	6
WM0563TU	Starting New Ventures	3

5. Technology in Sustainable Development

This is a university-wide initiative. Approval of the Master's thesis work and the internship by the coordinator, C.R. Kleijn, is required.

It consists of:

- . Internship within a R&D institution with a clear relation to sustainability (CH3701, 15 credits),
- . Colloquium 'Technology in Sustainable Development' (WM0939TU, 5 credits)
- . TiSD cluster-A electives (3-7 credits; see www.tudelft.nl/tisd for the list),
- . TiSD cluster-B electives (3-7 credits; see www.tudelft.nl/tisd for the list).

The thesis project must be focussed on sustainable development or the development of knowledge and technology aimed at a more sustainable future.

6. Management of Technology

Coordinator: dr. R.M. Verburg

This orientation is offered by the faculty of Technology, Policy and Management. The programme consists of either the first semester or the second semester of the MSc Management of Technology. A mixture of courses from both semesters is only permitted if it is a coherent set of modules that is approved by the MoT programme coordinator in advance.

1st SEMESTER MoT Modules (30 EC)

MOT1412, Technology Dynamics, 5EC
MOT1421, Economic Foundations, 5EC
MOT1442, Social and Scientific Values, 5EC
MOT1461, Corporate Finance, 5EC
MOT1524, Leading and Managing People, 5EC
MOT1532, High-tech Marketing, 5EC

2nd SEMESTER MoT Modules (30 EC)

MOT1003, Integration Moment, 5EC
MOT1434, Technology Strategy and Entrepreneurship, 5EC
MOT1451, Inter- and Intra-organisational Decision Making, 5EC
MOT1531, Business Process Management & Technology, 5EC
MOT2312, Research Methods, 5EC
MOT2421, Emerging and breakthrough Technologies, 5EC

7. Students who opt for a **double degree** (second master) and have obtained permission are allowed to spend the Scientific and Social Orientation on modules from the second master programme.

Double degree programmes combining chemical engineering with other master programmes, such as Management of Technology, are always subject to the restrictions imposed by the university. The main restrictions are that the double degree programme comprises at least 180 EC and that there are two identifiable final project reports for both degrees.

Formal admission by the deans of the faculties is required. The programme has to be approved by the board of examiners (if it differs from the standard programme).

Article 9 - Honours programme

The Honours programme consists of at least 20 EC on top of the regular master programme of 120 EC. The full Chemical Engineering programme including the additional honours track should be finished according to schedule. It is an individual programme that contains a 5 EC specially developed course for all TU Delft honours track students plus a coherent package of at least 15 EC of challenging course modules or projects composed by the student.

Collective Part (5 EC)

WM0355HT, Critical Reflection on Technology, 5EC, obligatory

Individual Part (15 EC)

Example:

TNW1000HPM, Company Oriented Honours Programme of Applied Sciences, 15EC

Article 10 – Bridging and homologation programmes

1. Students who have been admitted in the Chemical Product Engineering track or the Nuclear Science and Engineering track on the basis of a Bachelor of Science university degree in Chemistry must complete a homologation programme consisting of the following engineering modules:

Code	Course Module	Credits
CH3073	Separation Processes, Design and Operation	3
4052CHREKY	Chemical Reactor Engineering	6
SET3021	Transport Phenomena	4
WB4429	Thermodynamics of Process & Energy	3

It is strongly recommended to follow extra math courses in linear algebra and differential equations before the master programme is started.

Homologation modules are not required if a student eliminates deficiencies before enrolling in the master programme, by completing the following bachelor courses:

Code	Course Module	Credits
4052FYSTRY	Fysische Transportverschijnselen	6
4052CHREKY	Chemische Reactorkunde	6
4052SCHTEY	Scheidingstechnologie	6

2. Students who have been admitted on the basis of a Dutch institute of Higher Education (HBO) Bachelor of Engineering degree Chemical Technology (or equivalent) and are eligible for an exemption for the Industrial Internship based on work completed during their HBO education, have to complete a bridging programme consisting of the following Dutch or English modules before they can enrol in the master programme:

Code	Course Module	Credits
	Mathematics (in Dutch)	12
4052LADIFY	Lineaire algebra en differentiaalvergelijkingen	6
4051CALC1Y	Calculus 1	6
	Mathematics (in English)	15
WI1421LR	Calculus 1	6
WI1403LR	Linear Algebra	5
WI2180LR-I	Differential Equations	4

and must complete the following homologation modules as part of the master programme:

Code	Course Module	Credits
CH3073	Separation Processes, Design and Operation	3
4052CHREKY	Chemical Reactor Engineering	6
SET3021	Transport Phenomena	4
WB4429	Thermodynamics of Process & Energy	3

Homologation modules are not required if a student eliminates deficiencies before enrolling in the master programme, by completing the following bachelor courses:

Code	Course Module	Credits
4052FYSTRY	Fysische Transportverschijnselen	6
4052CHREKY	Chemical Reactor Engineering	6
4052SCHTEY	Scheidingstechnologie	6

3. Students who have been admitted on the basis of a Dutch Institute of Higher Education (HBO) Bachelor of Engineering degree Chemistry (or equivalent) or do not satisfy to requirements in article 10.2, have to complete a bridging programme consisting of the following Dutch or English modules before they can enrol in the master programme:

Code	Course Module	Credits
	Mathematics en Chemical Engineering	30
4052LADIFY	Lineaire algebra en differentiaalvergelijkingen	6
4051CALC1Y	Calculus 1	6
4052FYSTRY	Fysische Transportverschijnselen	6
4052CHREKY	Chemical Reactor Engineering	6
4052SCHTEY	Scheidingstechnologie	6
	Mathematics and Chemical Engineering (in English)	31
WI1421LR	Calculus 1	6
WI1403LR	Linear Algebra	5
WI2180LR-I	Differential Equations	4
CH3073	Separation Processes, Design and Operation	3
4052CHREKY	Chemical Reactor Engineering	6
SET3021	Transport Phenomena	4
WB4429	Thermodynamics of Process & Energy	3

4. Students holding a Bachelor of Science degree in Aerospace Engineering, Applied Earth Sciences, Applied Physics, Life Science and Technology, Mechanical Engineering from Delft University of Technology are not always qualified for direct admission. In general a Chemical Engineering bridging (minor) programme will be done before they can enroll in the master programme. A maximum of 12 credits of homologation courses can be done as part of the master's programme.

- a) Minimum bridging programme for BSc Aerospace Engineering, for track Process Engineering.

Code	Course Module	Credits
4051ALACHY	Algemene en Anorganische Chemie	6
4051OCSTRY	Organische Chemie en Structuuranalyse	9
4052CHAN3Y	Chemische analysemethoden	6
WB3550	Warmte en stofoverdracht	3
4052CHREKY	Chemical Reactor Engineering	6
4052SCHTEY	Scheidingstechnologie	6
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- b) Bridging programme for BSc Applied Earth Sciences, for track Process Engineering.

Code	Course Module	Credits
4052STEVMY	Structuur en eigenschappen van materialen	6
4052FYSCY	Fysische Chemie en Kinetiek	6
4052TLEO3Y	Leren Onderzoeken 3 Technologie	6
4052CHREKY	Chemical Reactor Engineering	6
4052SCHTEY	Scheidingstechnologie	6
		30

Students holding a BSc in Applied Earth Sciences with a minimum GPA of 7.5 can be admitted in the master programme without completing a bridging minor. Required homologation courses are:

Code	Course Module	Credits
CH3073	Separation Processes, Design and Operation	3
4052CHREKY	Chemical Reactor Engineering	6
WB4429	Thermodynamics of Process & Energy	3

c) Minimum bridging programme for BSc Applied Physics, for track Process Engineering.

Code	Course Module	Credits
4051ALACHY	Algemene en Anorganische Chemie	6
4051OCSTRY	Organische Chemie en Structuuranalyse	9
4052CHAN3Y	Chemische analysemethoden	6
4052STEVMY	Structuur en eigenschappen van materialen	6
4052CHREKY	Chemical Reactor Engineering	6
4052SCHTEY	Scheidingstechnologie	6
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d) Bridging programme for BSc Life Science and Technology.

Code	Course Module	Credits
4052LADIFY	Lineaire algebra en differentiaalvergelijkingen	6
4052STEVMY	Structuur en eigenschappen van materialen	6
4052TLEO3Y	Leren Onderzoeken 3 Technologie	6
4052CHREKY	Chemical Reactor Engineering	6
4052SCHTEY	Scheidingstechnologie	6
		30

Students holding a BSc in Life Science and Technology with a minimum GPA of 7.5 can be admitted in the master programme without completing a bridging minor. Required homologation courses are:

Code	Course Module	Credits
CH3073	Separation Processes, Design and Operation	3
4052CHREKY	Chemical Reactor Engineering	6
WB4429	Thermodynamics of Process & Energy	3

It is strongly recommended to follow extra math courses in linear algebra and differential equations before the master programme is started.

e) Minimum bridging programme for BSc Mechanical Engineering, for track Process Engineering.

Code	Course Module	Credits
4051ALACHY	Algemene en Anorganische Chemie	6
4051OCSTRY	Organische Chemie en Structuuranalyse	9
4052CHAN3Y	Chemische analysemethoden	6
4052STEVMY	Structuur en eigenschappen van materialen	6
4052CHREKY	Chemical Reactor Engineering	6
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5. Depending on the background of the student the homologation modules fit in the research and development orientation of the programme, either as a replacement for the industrial internship or as (obligatory) electives.

Article 11 – The free study programme

Students may compile a free curriculum concluded by a final exam. Such a curriculum must consist entirely or mainly of modules given in conjunction with the programme. It has to comply with the final attainment levels of the programme. The curriculum must be accompanied by a justified request and submitted to the Board of Examiners for approval.

Article 12 – Transition ruling Chemical Engineering

1. Equivalences:

CH3041 = SC4190CH = CH3042 = CH3043
CH3051TU = CH3052 = CH3053
CH3071 = ME1590CH = CH3072 = CH3073 + WB4429
CH3091 = ME1591CH
CH3161 = CH3162
CH3621 = ME1592CH = CH3622 + CH3622-P
CH3803 = CH3804
CH3842 = CH3843
WM0320TU = WM0329TU
WM0922TU = WM0939TU

Differences in credits may be compensated in the electives. Exception to this rule: CH3042+CH3053 and CH3052+CH3043 always count as 9 credits (and not 6 or 12).

2. Equivalences and alternatives for Bridging/Homologation modules:

4051CALCAY = WI1708TH1
4051CALCBY = WI1708TH2
4051CALC1Y = WI1421LR = WI1401LR = WI1708TH1 + WI1708TH2
4052DIFFVY = MSTTDIF = WI2149ST = WI2029LR = WI2180LR-I
4052LINEAY = MSTTLIN = WI2148ST = WI1403LR
4052LADIFY = 4052LINEAY + 4052DIFFVY
4052FYSTRY = MSTTFTV = ST2122 = TN2785
4052CHREKY = 4052PRTE2Y = MSTTPT2
4052SCHTEY = 4052SCHT3Y + 4052TDFASY = MSTTSCCT
4052TDFASY = WB4429
4052SCHT3Y = WB4436

3. Students who have started their master programme Chemical Engineering before 1 September 2008 and have not finished their first year of their master programme, are advised to contact the programme coordinator to establish on an individual basis a "transition" programme.

4. Students who have started their bridging programme Chemical Engineering before 1 September 2011 can enrol in the Master programme before completing the bridging programme if all remaining bridging courses fit in the homologation programmes mentioned in article 10.

Article 13 – Date of commencement

These regulations will come into effect on 1 September 2014.