Faculty of
Science & Technology

UNIVERSITY OF TWENTE.

Programme-specific appendix to the programme section of the students' charter, including the education and examination regulations Chemical Engineering (ChE) Master's Programme

(art. 7.13 and 7.59 WHW)

Contents

Preamble

a. The rules in this appendix apply to the full-time master's programme Chemical Engineering (Croho number 60437).
b. Together with the General Section, this programme-specific appendix forms the programme section of the student charter including the Education and Examination Regulations for the master's programme Chemical Engineering of the faculty Science and Technology at the University of Twente.
c. The programme is subject to the legislation of the Dutch Higher Education and Research Act (WHW).

Reference: TNW/20.487/ae/vdh
Date: 14 July 2020

Article 1 Programme Mission and Objectives

The mission for the UT Chemical Engineering master's programme is:

'to educate students at an internationally renowned master's level to become entrepreneurial researchers, designers and engineers or organisers and managers who are capable of developing, conveying and applying innovative knowledge according to academic standards in one of the two areas: Molecular & materials science and technology or Chemical process engineering'.

The objectives of the master's programme in Chemical Engineering are:

a. to develop the knowledge, skills and insight of students up to a high academic level at which graduates have sufficient competencies to act professionally and autonomously in Chemical Science and Engineering and related disciplines;

b. to offer specialisations in one of the disciplines: chemistry, materials science or process engineering,

c. to allow graduates to successfully enter professional fields like scientific research, process and product development or professional teaching.

Article 2 Intended learning outcomes

The intended learning outcomes have been described on the basis of the 3TU Academic Competencies, better known as the Meijers' Criteria[1]. These criteria have been approved by the NVAO[2] and provide an excellent framework that systematically defines the general intended learning outcomes of an academic master's programme, in which specific aspects for individual programmes may also be included.

A university graduate in a technical field can be characterised using seven competence areas. He or she:

1. is competent in one or more scientific disciplines
2. is competent in doing research
3. is competent in designing
4. has a scientific approach
5. possesses basic intellectual skills
6. is competent in cooperating and communicating
7. takes account of the temporal and the social context

These competence areas can be divided into three groups (see Fig. 1):

(a) domain of the programme (1, 2, 3)
(b) academic method of thinking and acting (4, 5, 6)
(c) context in which scientific research is conducted (7)

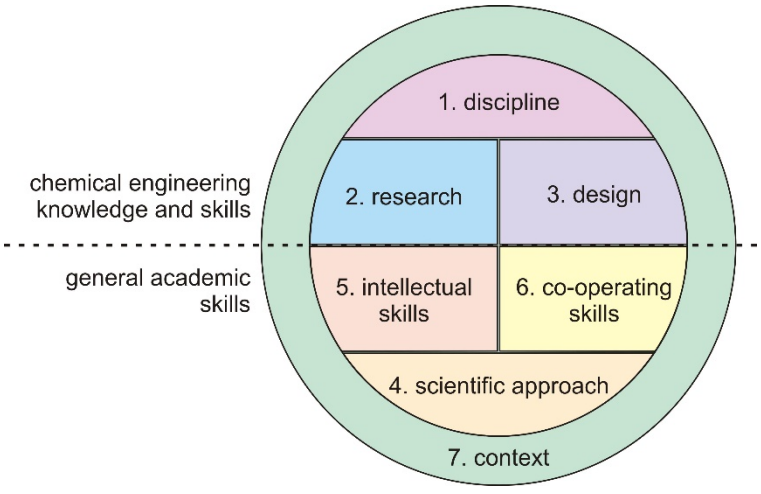

Figure 1. Seven competence areas according to the Meijers' Criteria.

[1] Meijers, A. W. M., Borghuis, V. A. J., Mutsaers, E. J. P. J., Overveld, van, C. W. A. M., & Perrenet, J. C. (2005). Criteria voor academische bachelor en master curricula = Criteria for academic bachelor's and master's curricula. (2e, gew. dr. ed.) Eindhoven: Technische Universiteit Eindhoven.

[2] Accreditation Organisation of the Netherlands and Flanders (NVAO).

For the master's programme in Chemical Engineering the competence areas are elaborated in the various competences. Each competence area comprises a combination of knowledge (k) and/or skills (s) and/or attitude (a).

The master graduate Chemical Engineering:

1. *Is specialised in a specific field of chemical science and engineering.*

   A master graduate ChE is familiar with existing scientific knowledge, and is able to increase and develop this through study.

1a.	Has a thorough mastery of parts of the relevant fields extending of the forefront of knowledge of: • chemical science and engineering, • the underlying disciplines of (bio)nanotechnology, (biomedical) materials science and technology or process engineering, and understands the relevant key-concepts, theories, methods, and techniques. [ks]
1b.	Looks actively for structure and connections in these relevant fields. [ksa]
1c.	Has knowledge, skill and attitude to apply: • truth-finding and the development of theories and models, • interpretations of texts, problems, data, and results, • experiments, gathering of data and modelling, • decision-making based on data and modelling, independently in the context of more advanced ideas or applications in chemical engineering. [ksa]
1d.	Has extended experimental skills of parts of the relevant fields: • chemistry and materials science: synthesis and qualitative and quantitative determination of properties of chemical substances, • process engineering: synthesis and qualitative and quantitative characterisation of chemical processes. [ksa]
1e.	Has the ICT skills to process text, data and models. [ksa]
1f.	Is able to reflect on standard methods and their presuppositions; is able to question these; is able to propose adjustments, and to estimate their implications. [ksa]
1g.	Is able to spot gaps in his/her own knowledge, and to revise and extend knowledge through study. [ksa]

2. *Has the knowledge and the skills for doing research in a specific field of chemical science and engineering.*

   A master graduate ChE is able to acquire new scientific knowledge through research. For this purpose, research means: the development of new knowledge and new insights in a purposeful and methodical way.

2a.	Is aware of the research methodology of complex nature in the field of chemical engineering [ksa]
2b.	Is, independently, able to do research at a master's level: • analyse research problems in the field of chemical engineering of more complex nature, • use the relevant knowledge base, • formulate the research objectives and, if relevant, the appropriate hypothesis, • formulate a research plan including the required theoretical and experimental steps, assumptions and approaches, • execute the different activities of the research plan, • analyse and evaluate the research results in respect to the defined problem, • assess research results on its scientific value, • defend this results against the parties involved. [ksa]
2c.	Is observant, and has the creativity and the capacity to discover certain connections and new viewpoints and is able to put these viewpoints into practice for new applications. [ksa]
2d.	Is able to work at different levels of abstraction and detail. Given the process stage of the research problem, chooses the appropriate level of abstraction. [ks]

2e.	Is able to recognise, systematically collect, analyse and process relevant scientific information [ks]
2f.	Is able, and has the attitude to, where necessary, draw upon other disciplines in his or her own research. [ksa]
2g.	Is able to deal with the changeability of the research process through external circumstances or advancing insight. Is able to steer the process on the basis of this. [ksa]
2h.	Is, independently, able to contribute to the development of scientific knowledge in one or more areas of the disciplines involved in chemical engineering. [ks]

3. *In the Chemical Process Engineering track has extended skills for process designing in a specific field of chemical engineering.*

   As well as carrying out research, some master graduates ChE will also carry out design work. Designing is a synthetic activity aimed at the realisation of new or modified artefacts or systems with the intention of creating value in accordance with predefined requirements and desires towards products and processes (safety, economics, environment etc.).

3a.	Is aware of the design methodology of complex nature in the field of chemical engineering and is aware of design being a cyclic process [ksa]
3b.	Is, independently, able to design at master's level: • analyse product and process design problems in the field of chemical engineering of more complex nature, • integrate the relevant knowledge base in a design, • formulate the design requirements, objectives and boundaries, taking into account safety, sustainability, environmental and economic aspects and describe and translate these requirements in quantitative engineering parameters, • formulate a design plan including the required global and detailed steps, assumptions and approaches, • execute the different activities of the design plan, • analyse and evaluate the design and design decisions in a systematic manner in respect to the defined requirements, • make a technical, economical and energy analysis of the chosen design, • defend this results against the parties involved. [ksa]
3c.	Is able to play an active role in production innovation processes. [ksa]
3d.	Is able to systematically collect, analyse and process relevant design information from literature, patents, databases and web-sites and is able to estimate leaking information [ks]
3e.	Has creativity and synthetic skills with respect to design problems. [ksa]
3f.	Given the process stage of the design problem, chooses the appropriate level of abstraction. [ksa]
3g.	Is able to deal with the changeability of the design process through external circumstances or advancing insight. Is able to steer the process on the basis of this. [ksa]
3h.	Is able, and has the attitude, where necessary, to draw upon other disciplines in his or her own design. [ksa]
3i.	Is able to formulate new research questions on the basis of a design problem. [ks]

4. *Has a scientific approach.*

   A master graduate ChE has a systematic approach characterised by the development and use of theories, models and coherent interpretations, has a critical attitude, and has insight into the nature of chemical science and engineering.

4a.	Is able to identify and take part in relevant developments (life-long learning attitude). [ksa]
4b.	Is able to critically examine existing theories, models or interpretations in the area of his or her graduation subject. [ksa]
4c.	Has great skill in, and affinity with the use, development and validation of models; is able consciously to choose between modelling techniques. [ksa]

4d.	Has insight into the nature of sciences and technology (purpose, methods, differences and similarities between scientific fields, nature of laws, theories, explanations, role of the experiment, objectivity etc.) and has knowledge of current debates about this. [k]
4e.	Has some insight into scientific practice (research system, relation with clients, publication system, importance of integrity etc.) and has knowledge of current debates about this. [k]
4f.	Is able to document adequately the results of research and design and is able to publish these results. [ksa]

5. *Possesses intellectual skills.*

   A master graduate ChE has skills in reasoning, reflecting, and forming a judgment. These are skills which are learned, or sharpened, in the context of the chosen area of the ChE discipline, and which are generically applicable from then on.

5a.	Is, independently, able to reflect critically on his/her own thinking, decision making and acting, and able to adjust his/her behaviour on the basis of this reflection. [ks]
5b.	Is able to reflect on his/her more strong and weak capabilities with regard to his/her research, design, organisation, and teaching/advising and is able to adjust on the basis of this reflection.
5c.	Is able to: • recognise fallacies, • reason logically and apply methods of reasoning such as induction, deduction, analogy. [ks]
5d.	Is able to ask adequate questions, and has a critical yet constructive attitude towards analyzing and solving complex problems in chemical engineering. [ks]
5e.	Is able to form a well-reasoned opinion in the case of incomplete or irrelevant data or uncertainty, taking account of the way in which that data came into being. [ks]
5f.	Is able to take a standpoint with regard to a scientific argument in chemical engineering and is able to assess this critically as to its value. [ksa]
5g.	Possesses basic numerical skills and has an understanding of orders of magnitude. [ks]

6. *Is able to cooperate in projects, and communicate with specialists in the chosen track and other stakeholders.*

   A master graduate ChE is able to work with and for others. This requires not only adequate interaction, a sense of responsibility, and leadership, but also good communication with colleagues and other stakeholders. He is also able to participate in a scientific or public debate in English.

6a.	Is able to perform project-based work for complex projects: is able to develop a project plan and planning, is able to deal with limited sources, is able to deal with risks. [ks]
6b.	Has insight into, and is able to deal with, team roles and social dynamics; is able to work within an team with great disciplinary diversity; is pragmatic and has a sense of responsibility; is able to make compromises. [ksa]
6c.	Is able to communicate in writing and verbally in English about research and solutions to problems with colleagues, non-colleagues and other involved parties. [ksa]
6d.	Is able to interpret English written scientific literature and textbooks and to understand discussions and scientific debates in English. [s]
6e.	Behaves professionally. This includes: reliability, commitment, accuracy, perseverance and independence as well as respect for others irrespective of their age, social economic status, education, culture, philosophy of live, gender, race or sexual nature. [ksa]

7. *Has the ability to integrate insights in the temporal social, environmental, sustainability and safety context into his or her scientific work.*

   Chemistry, materials science and process engineering are not isolated, and always have a temporal and social context. Beliefs and methods have their origins; decisions have social consequences in time. A master graduate ChE is aware of this, and has the ability to integrate these insights into his or her scientific work.

7a.	Is aware of the social, environmental, sustainability and safety aspects of the chemical and related industries. [ks]
7b.	Has an eye for the different roles of chemical engineering professionals in society: researcher, designer, manager, advisor/teacher and chooses a professional position in society. [ksa]
7c.	Is able to analyze the place of chemical engineering in society and to discuss the social, environmental, sustainability and safety consequences of new developments in relevant fields with colleagues and non-colleagues and integrates these consequences in scientific work. [ksa]
7d.	Is able to analyze and to discuss the ethical and the normative aspects of the consequences and assumptions of scientific thinking and acting with chemical engineering colleagues and non-colleagues (in research, designing and applications) and integrates these ethical and normative aspects in scientific work. [ksa]
7e.	Is familiar with and has experience with the technological organisational processes of a chemical engineering company. [ksa]

Article 3 Admission to the Programme

1. Direct admission to the programme is granted to students who possess:
   a. a degree in one of the bachelor's programmes in Chemical Engineering[3] at a Dutch university, or
   b. a proof of admission to the programme, issued by the admission committee.
2. During assessment of the application for admission to the master's programme, the admission committee can demand that some subjects must be passed before the proof of admission to the master's programme can be issued.
3. When a proof of admission to the master's programme is issued, the admission committee may decide to grant exemption for particular parts of the programme, with exception of the final master's project. This decision requires the approval of the Examination Board.
4. A student with a bachelor degree in one of the bachelor's programmes of the University of Twente, who has passed one or more compulsory parts of the master's programme Chemical Engineering before entering the programme or passed courses that may be approved by the Examination Board as an elective in the master's programme Chemical Engineering, may be granted exemption for those parts by the Examination Board. The exemption is only for the parts concerned; the student will not be granted a reduction of the total study load of 120 EC of this master's programme.
5. A proof of admission to the master's programme may be subject to the condition of a particular content of the student's master's programme, dependent on the track a student chooses. In some cases the total programme may exceed 120 EC, while in other cases particular content can be part of the elective space of the student's curriculum.
6. The following applies for students with a qualification in higher professional education (university of applied sciences; HBO) in "Chemie" or "Chemische Technologie":
   a. Students with a qualification in HBO "Chemie" will be admitted to the Molecular & Materials Engineering and the Materials Science & Engineering transfer programme. Students with a qualification in HBO "Chemische Technologie" will be admitted to the Chemical & Process Engineering transfer programme. Exceptions can be made by the admission committee.
   b. They will be admitted to a transfer programme of at least 24 EC.

   The transfer programmes selected for the student by the Examination Board are defined in Article 6 of this programme-specific appendix. After successfully completing the transfer programme students will be admitted to the master's programme.

[3] The bachelor programmes Chemical Science and Engineering (Univ. of Twente), Chemical Engineering & Chemistry (TU Eindhoven), Molecular Science and Technology (TU Delft/Univ. Leiden) and Chemistry (Univ. Groningen).

7. Students with another bachelor's degree than mentioned in paragraph 6 of this article can also be admitted to the transfer programme after approval of the admission committee. After successfully completing the transfer programme they will be admitted to the master's programme.

8. Subject to conditions, students may be admitted to the Double Degree Program with the University of Parma. This programme is defined in Article 8 of this programme-specific appendix.

9. Subject to conditions, students with a relevant bachelor's degree may be admitted to the Erasmus Mundus Master Membrane Engineering programme (EM3E-4SW). This programme is defined in Article 9 of this programme-specific appendix.

10. Students in possession of a degree of the bachelor's programme Chemical Science and Engineering of the University of Twente and in possession of a second-degree teaching qualification in Chemistry after successfully completing the Educative Minor (2 x 15 EC), may be admitted to the 'Master's programme with first-degree teaching qualification'. This programme is defined in Article 10 of this programme-specific appendix. After successful completion of this programme, the student will receive the master qualification Chemical Engineering with a statement that he/she has a first-degree teaching qualification in Chemistry.

11. Students with a qualification in a technical subject or physics and a job in the industry, can be admitted to the 'Process Technology course' programme. This programme is defined in Article 11 of this programme-specific appendix. After successful completion of the courses Basic Process Technology, Advanced Process Technology and Design Process Technology, students can be admitted to the master's exam of the programme. The procedure for admission to the master's exam for students in possession of the certificates Basic Process Technology, Advanced Process Technology and Design Process Technology is defined in Article 12 of this programme-specific appendix.

12. Students in possession of a degree for the bachelor's programme Advanced Technology may be admitted to the regular master's programme if their bachelor's programme meets the conditions specified in Article 13 of this programme-specific appendix. The contexts of the transfer programme attended by the student will determine whether the student is admitted to the track Molecular and Materials Engineering (MME), to the track Chemical and Process Engineering (CPE), or to the multidisciplinary track Materials Science & Engineering (MSE).

13. Students with a previous education at a foreign institution must demonstrably have sufficient language skills in spoken and written English. A requirement for their admittance to the programme may be a sufficient score in a recognized test. This means a total score of 6.5 or higher for the IELTS test, or a score of 90 or higher for the Internet-based TOEFL test[4]. Students in possession of a bachelor's degree from a country where English is the main language in higher education[5] are exempt from this requirement.

Article 4 Admission Committee

1. An admission committee is appointed by the dean of the faculty of Science and Technology for the admission to the master's programme of students who are not directly admitted in conformity with Article 3, paragraph 1a.

2. The Executive Board has delegated the authority to accept or reject students (S&C/387.191/lk) to the board mentioned under paragraph 1.

3. The admission committee consists of at least two members, including:
   a. the Programme Director;
   b. in case of foreign students, the Programme Coordinator;
   c. in case of students with a qualification in higher professional education, the Higher Professional Education Coordinator;

   The admission committee is chaired by the Programme Director.
   If the chair deems it necessary, the secretary of the Examination Board and/or the study advisor can join the admission committee.

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[4] IELTS: International English Language Testing System; TOEFL: Testing of English as a Foreign Language; see the UT website on admittance to the master's programme's: https://www.utwente.nl/en/education/master/admission-requirements/international-degree

[5] The list of countries can be found at https://www.utwente.nl/en/education/master/admission-requirements/international-degree/countries/.

Article 5 Regular Master's Programme

The programme outlined in this article applies to cohort 2020/2021 and later.
The programme applicable to cohorts 2019/2020 and earlier is outlined in the programme-specific appendix dated 19/07/2019 (TNW/19290/ae/vdh), supplemented by a transitional arrangement drawn up by the Programme Director.

1. The Chemical Engineering master's programme has two regular specializations ('tracks'):
   a) Molecular and Materials Engineering (MME),
   b) Chemical and Process Engineering (CPE),

   and one multidisciplinary-oriented specialization ('track'):

   c) Materials Science & Engineering (MSE).

Molecular and Materials Engineering (MME)
The Molecular & Materials Engineering track focuses on the design, manufacture, application and characterization of new materials and (bio)molecular structures with high-tech features from a chemical science & engineering perspective.

The MME programme has the following structure:

- 32.5 EC compulsory courses
  - AMM Organic materials science (193700030; 5 EC)
  - AMM Characterization (193700010; 5 EC)
  - AMM Inorganic materials science (193700040; 5 EC)
  - AMM Molecular and biomolecular chemistry and technology (193700020; 5 EC)
  - AMM Project Organic materials (193700050; 5 EC)
  - AMM Project Inorganic materials and molecular science and technology (193700070; 5 EC)
  - Statistical Thermodynamics (201800332; 2.5 EC)
- 10 EC in electives in line with the chair of the MSc assignment;
- an Internship & Job Orientation Project of 20 EC with an external company or institution;
- a final master's project of 45 EC in the selected track;
- other electives to make the total scope of the programme add up to at least 120 EC.

Chemical and Process Engineering (CPE)
Chemical & Process Engineering focuses on developing and designing chemical processes that deliver optimum performance in terms of technology, economy, environment and meeting society's needs.

The CPE programme has the following structure:

- 32.5 EC compulsory courses
  - Advanced chemical reaction engineering (201600151; 5 EC)
  - Advanced molecular separations (201300049; 5 EC)
  - Advanced catalysis (201600152; 5 EC)
  - Process dynamics & control (201800324; 2.5 EC)
  - Process plant design incl. thermodynamics and flow sheeting (201300045; 15 EC)
- 10 EC in electives in line with the chair of the MSc assignment;
- an Internship & Job Orientation Project of 20 EC with an external company or institution;
- a final master's project of 40 EC in the selected track;
- other electives to make the total scope of the programme add up to at least 120 EC.

Material Science & Engineering (MSE)
Materials Science & Engineering is a multidisciplinary-oriented specialization with emphasis on the development of materials science and engineering skills at the interface of chemical science and engineering, applied physics and mechanical engineering.

The MSE programme has the following structure:

- 37.5 EC compulsory courses
  - AMM Organic materials science (193700030; 5 EC)
  - AMM Characterization (193700010; 5 EC)
  - AMM Inorganic materials science (193700040; 5 EC)
  - AMM Project Organic materials (193700050; 5 EC)
  - AMM Project Inorganic materials and molecular science and technology (193700070; 5 EC)
  - Statistical Thermodynamics (201800332; 2.5 EC)
  - Surfaces of Thin Layers (193550020; 5 EC)
  - Phase Transformation and Manufacturing (2019xxxxx; 5 EC)
- 12.5 EC elective courses from other MSc programmes than Chemical Engineering (in particular, but not limited to the programmes Mechanical Engineering and Applied Physics), that fit topically within the multidisciplinary materials engineering theme of the MSE track;
- an Internship & Job Orientation Project of 20 EC with an external company or institution;
- a final master's project of 40 EC in the selected track;
- other electives to make the total scope of the programme add up to at least 120 EC.

The Contract Research Assignment for the trip to a foreign country can be registered as Capita Selecta of a group (elective) or as a separate elective 193799700 CR Study Tour Assignment.

The combination of subjects requires the approval of the supervising professor and the Examination Board.

2. Deficiency courses
   a) International students who do not have proven skills in the basics of chemical reaction engineering and/or Matlab, also have to take the course Chemical Reaction Engineering (3.5 EC; 201600218) and/or Matlab for pre-masters ET (201600055 or 201600056), respectively.
   b) International students and students with a bachelor's degree of a University of Applied Sciences have to follow a workshop on academic skills (0.5 EC; 201700158).

3. The Internship & Job Orientation Project
   a) The objective of the Internship & Job Orientation Project is to let the students gain experience in the field of Chemical Science and Engineering and apply the knowledge and skills they have acquired thus far into practice, by completing a project in an external organisation.
   b) The Internship & Job Orientation Project must be of chemistry-technical nature and must be supervised by a research group that is represented in the discipline committee Chemical Engineering. In case the project should be supervised by another research group, the student should ask the Examination Board for permission.
   c) The Internship & Job Orientation Project can be done at a company or research institute abroad or in the Netherlands, or at a foreign university.
   d) For students following a two master's programme the Internship and Job Orientation Project has to have two supervisors: one representing the Chemical Engineering programme and one representing the second MSc programme.

4. The Final master's project
   a) The objective of the final master's project is for students to learn how to independently complete a research project of a certain size and degree of complexity.
   b) The final master's project is assessed with two grades:
      1. One for the chemical-technical research component (201300054, 25 EC (MME) & 201800413, 20 EC (CPE & MSE)): The chemical-technical research consists of the problem analyses (familiarising oneself with a particular field of study, recognizing problems and formulating the research questions and approach), the realisation (the theoretical and experimental approach and realisation), and the results analysis (analysis of the results and their relevance);
      2. One for the general aspects of the assignment (201300055, 20 EC): The general aspects consist of independence, involvement, collaboration, originality and creativity. Reporting consists of the oral reporting (presentation and discussion of the research) and the written report (the final master's project report). For students in the MME track, part of the general aspects also comprises an analysis of the societal implications and embedding of the project. To help students with this part a couple of lectures are planned in the third quarter. This part

of the master's project has to be handed in separately.

c) Approval of the final master's project by the Examination Board must be requested in time by means of the form 'MSc final project contract and course list Chemical Engineering' (no later than 1 month before the start of the project). The final master's project must be of a chemistry-technical nature. If the project is not carried out with a research group that is represented in the discipline committee Chemical Engineering, the student must indicate the chemistry-technical aspects of the project in the proposal.
d) The final master's project has to be carried out at a research group within the Chemical Engineering discipline of the University of Twente. A student can ask the Examination Board for permission to carry out the final master's project outside the Chemical Engineering discipline groups or outside the University of Twente, provided that there is already a strong and existing (research) collaboration between the external party and the research chair of the group in which the student formally graduates. In all cases, the research chair is responsible to guarantee the quality of the project, as described in the learning outcomes.
e) It is not possible to carry out the MSc assignment at the same organisation where the internship took place.

Article 6 Programme for students with a qualification in higher professional education

1. The transfer programme is as follows:

Transfer programme MME & MSE track		**Transfer programme CPE track**	
Name	*EC*	*Name*	*EC*
Calculus A	4	Calculus A	5
Calculus B	4	Calculus B	3
Matlab for pre-masters ET[1]	2 or 2.5	Matlab for pre-masters ET[1]	2 or 2.5
Catalysis and reaction kinetics[2]	4.5	Numerical methods	4
Industrial chemistry and processes[2]	4.5	Catalysis and reaction kinetics[2]	4.5
Advanced materials science[3]	3.5	Introduction Chemical Reaction Engineering[4]	4
Chemistry and technology of materials[3]	4	Fluid dynamics[5]	3.5
Fundamentals of Solids[3]	3.5	Heat and Mass Transfer for PT-course[6]	4
Workshop Academic Skills	0.5	Workshop Academic Skills	0.5
Total	30.5/31	*Total*	30.5/31

[1] Depending on the capacity of the course students will follow this course either during Q1 (2 EC) or during Q2 (2.5 EC)
[2] Part of module 5 of the B-CSE
[3] Part of module 6a of the B-AT
[4] Part of module 8a of the B-CSE
[5] Part of module 6 of the B-CSE
[6] Part of the Basic Course of the Process Technology Course

The transfer programme of the MME and MSE programme is offered during the first semester. The transfer programme of CPE is given in the course of the entire academic year.

2. Students must complete the transfer programme within a period of 1 year and will be given 2 opportunities to pass each exam.
3. After completion of the transfer programme, if the student is in possession of a qualification in higher professional education in Chemistry or Chemical Technology, he/she will be admitted to the Chemical Engineering master's programme.
4. Instead of the transfer programme mentioned above, students of the University of Applied Sciences can also attend a transfer minor of 30 EC (Kies-Op-Maat minor) during their higher professional education. To be admitted to the master's programme, paragraph 2 and 3 also apply to these students.

The programme of the transfer minor is:

Transfer programme MME & MSE track		**Transfer programme CPE track**	
Name	*EC*	*Name*	*EC*
Calculus A	4	Calculus A	5
Calculus B	4	Calculus B	3
Matlab for pre-masters ET[1]	2 or 2.5	Matlab for pre-masters ET[1]	2 or 2.5
Catalysis and reaction kinetics[2]	4.5	Catalysis and reaction kinetics[2]	4.5
Industrial chemistry and processes[2]	4.5	Introduction to Chemical Reaction Engineering	3.5
Advanced materials science[3]	3.5	Fluid dynamics, heat and mass transfer[4]	7.5
Chemistry and technology of materials[3]	4	Numerical methods[4]	4
Fundamentals of Solids[3]	3.5	Workshop Academic Skills	0.5
Workshop Academic Skills	0.5		
Total	30.5/31	*Total*	30/30.5

[1] Depending on the capacity of the course students will follow this course either during Q1 (2 EC) or during Q2 (2.5 EC)

[2] Part of module 5 of the B-CSE.

[3] Part of module 6a of the B-AT.

[4] Part of module 6 of the B-CSE.

Article 7 Two master's degree programme

A two-masters degree programme is a combination of two separate UT master's programmes which the student follows in parallel and involves a joined final master's project and a joined internship and job orientation project.
When the student has successfully met all requirements for his two master's programme, the student will be granted a certificate for both master's programmes.

1. Article 2.1 paragraph 7 from the general section of the Education and Examination Regulations is applicable:
   'The student who is following two master programmes, the administration provided by CES and if applicable the admission committee, are required to inform the Boards of Examiners concerned as soon as possible of the fact that the student is following two master programmes.'
2. Students have to make a planning for their two masters study programme and discuss it with the study adviser.
3. For the exam programme of a two master's degree programme, the following rules apply:
   a. The total programme is 180 EC,
   b. The study load of the joined final master's project is 60 EC,
   c. The composition of the assessment committee of the final master's project should meet the requirements of Rules of the Examination Board,
   d. The study load of the joined internship and job orientation project is 30 EC; the joined internship and job orientation project should have two assessors. The two assessors should originate from and be representative for the two master's programmes concerned.
   e. The internship and the examiners should meet the requirements of Rules of the Examination Board.
4. Students of the CPE track who are combining their master's programme with the programme Sustainable Energy Technology of the University of Twente will follow the following programme:
   a. 32.5 EC compulsory courses of the CPE track
   b. 50 EC compulsory courses of the SET master's programme
   c. 20 EC Internship & Job Orientation Project
   d. 60 EC MSc assignment
   e. 17.5 EC electives

Article 8 Double Degree programme with University of Parma

The Double Degree programme of the University of Twente (UT) and the University of Parma (UNIPR) is a joint 120 EC master's programme in the field of chemistry, industrial chemistry and biomolecular chemistry. The programme consists of 2 semesters of the MSc programme Chemical Engineering, track Molecules & Materials Engineering (ChE/MME) at the UT, and 2 semesters of chemistry at the UNIPR. For students starting the programme at the UT (ChE students), the language of instruction of the programme is English. For students starting at UNIPR, the languages of instruction of the programme are Italian and English.

ChE students first spend two semesters at the University of Twente (55 EC), followed by two semesters at the UNIPR (65 EC). ChE students choose between 2 DD specializations ('tracks'):

- DD Master in Chemistry & Chemical Engineering
- DD Master in Industrial Chemistry & Chemical Engineering

The first year programme for ChE students comprises of the following courses:

Quartile	Courses	EC
Quartile 1	AMM Molecular & Biomolecular CT (5 EC), AMM Characterization (5 EC)	10
Quartile 2	AMM Organic Materials Science (5 EC), Statistical Thermodynamics (2.5 EC)	7.5
Quartile 3	AMM Inorganic Materials Science (5 EC), AMM Project Organic Materials (5 EC)	10
Quartile 4	Internship and Job Orientation Project (20 EC)	20
Quartile 1, 2 and/or 3	1 Elective from list of non-technical courses (list on Canvas site of CHE programme) 1 Elective course	5 2.5

The second year programme for ChE students in the Chemistry track comprises:

Semester	Courses	EC
Semester 1	Computational Chemistry (6 EC)	6
Semester 2	Solid State Chemistry (6 EC) Bio-inorganic chemistry (6 EC) Functional Materials (9 EC)	21
Semester 1+2	Research Project	38

The second year programme for ChE students in the Industrial Chemistry track comprises:

Semester	Courses	EC
Semester 1	Computational Chemistry (6 EC) Sustainable technologies and alternative sources (6 EC) Chemistry and technology of glasses (6 EC)	18
Semester 2	Functional Materials (9 EC)	9
Semester 1+2	Research Project	38

Students from the UNIPR first spend two semesters at the UNIPR (57 EC), followed by two semesters at the UT (65 EC). Master students from the UNIPR choose between 3 DD tracks:

- DD Master in Biomolecular chemistry & Chemical Engineering
- DD Master in Industrial Chemistry & Chemical Engineering
- DD Master in Materials Chemistry & Chemical Engineering

The first year programme for UNIPR students in the biomolecular chemistry track comprises:

Semester	Courses	EC
Semester 1	Computational Chemistry (6 EC), Chimica Metallorganica (6 EC), Chimica Organica Superiore (6EC), Tecniche e Metodologie Analitiche in Spettrometria di Massa (6EC), Inglese Livello B2 (3 EC)	27
Semester 2	Chimica Strutturale (6 EC), Spettroscopia Molecolare (6 EC), Bioinorganic Chemistry (6 EC), Chimica Organica delle Biomolecole (6 EC), Metodi Fisici in Chimica Organica (6 EC)	30

The first year programme for UNIPR students in the Industrial Chemistry track comprises:

Semester	Courses	EC
Semester 1	Computational Chemistry (6 EC), Chimica Organica Avanzata (6 EC), Chimica Organica Industriale (6 EC), Strategie Sintetiche Moderne in Chimica Organica (6 EC), Inglese Livello B2 (3 EC)	27
Semester 2	Chimica e Tecnologia dei Processi Industriali e delle Formulazioni (9 EC), Functional Materials (9 EC), Chimica Fisica Applicata (6 EC), one elective course (6 EC)	30

The first year programme for UNIPR students in the Materials Chemistry track comprises:

Semester	Courses	EC
Semester 1	Chimica Metallorganica (6 EC), Chimica Organica Superiore (6 EC), Computational Chemistry (6 EC), Tecniche e Metodologie Analitiche in Spettrometria di Massa (6 EC), Inglese Livello B2 (3 EC)	27
Semester 2	Chimica Strutturale (6 EC), Spettroscopia Molecolare (6EC), Bioinorganic Chemistry (6 EC), Chimica Organica delle Biomolecole (6 EC), Metodi Fisici in Chimica Organica (6 EC)	30

The second year programme for UNIPR students in the Biomolecular Chemistry track comprises:

Quartile	Courses	EC
Quartile 1	AMM Molecular & Biomolecular CT (5 EC), Advanced Colloids and Interfaces (5 EC) Nanoscience (5 EC)	15
Quartile 2	Lab on a Chip (5 EC), Fabrication of Nanostructures (7.5 EC) Preparation MSc assignment (2.5 EC)	15
Quartile 3 + 4	MSc assignment	35

The second year programme for UNIPR students in the Materials Chemistry and Industrial Chemistry tracks comprise:

Quartile	Courses	EC
Quartile 1	AMM Molecular & Biomolecular CT (5 EC), Advanced Colloids and Interfaces (5 EC) Advanced Catalysis (5 EC)	15
Quartile 2	Electrochemistry (5 EC), AMM Organic Materials Science (5 EC) Preparation MSc assignment (5 EC)	15
Quartile 3 + 4	MSc assignment	35

Students for the DD programme are selected by each party according to criteria agreed and set by the competent bodies of each party.

The exams and assessments positively passed by mobility students during their study-abroad period are automatically recognized by the home institution. Master students from the UT carry out their final master's research assignment in a research group at the UNIPR. Master students from the UNIPR carry out their final master's research assignment in a research group at the UT.

A graduation exam is compulsory at UNIPR, and also compulsory at UT. The graduation committees can include up to two lecturers from the partner institution involved in the programme. After successful completion of one of the tracks in the DD programme, a student receives two master's degrees:

- MSc degree Chemistry (UNIPR) & Chemical Engineering, MME track (UT), or
- MSc degree Industrial Chemistry (UNIPR) & Chemical Engineering, MME track (UT).

A separate certificate will be added to the diploma of the UNIPR degree describing the course programme and stating that it is part of the protocol with the UT. In the diploma supplement of the UT degree the programme will be described and it will be stated that it is part of the protocol with UNIPR.

Article 9 Erasmus Mundus Master Membrane Engineering programme

The Erasmus Mundus Master Membrane Engineering programme (EM3E-4SW) is a common master's programme in the field of membrane technology, at the intersection of Materials Science and Process Engineering. It is offered by six universities in five countries, including the University of Twente.
The EM3E-4SW programme can be regarded as a specialization within the departments that deal with membrane technology. The programme consists of four semesters of 30 EC. Participating students will visit three different universities in three countries.[6]

For students admitted to the programme who follow part of their education at the University of Twente, the programme is as follows:

Semester	Unit	Responsible university	EC
Semester 1	Option 1: Fundamentals of chemical engineering	UPS France	30
	Option 2: Fundamentals of materials science	UM2 France	
Semester 2	Fundamentals of technologies and modelling	ICTP Czech Republic	30
Semester 3	Energy and Environment	University of Twente	30
Semester 4	Final master's project	University of Twente	30

The curriculum of the semester at the University of Twente is as follows:

Compulsory subjects EM3E		
Code	*Name*	*EC*
201800083	Advanced colloids and interfaces	5
201200116	Multi-component mass transport in water treatment	5
201200117	Membranes for gas separation	5
201200118	Membrane process plant design	5
201800014	Electrochemistry: fundamentals and techniques	5
201500318	Capita Selecta EM3E project	5

The final master's project will be carried out at the cluster Membrane Science and Technology of the faculty Science and Technology.

After successful completion of this programme, the student will receive a multiple master's degree in Chemical Engineering: One from each university where the student has studied for one semester.

Article 10 Master's programme with first-degree teaching qualification

The structure of the master's programme with a 30 EC educational component is as follows:

1. Compulsory subjects (37,5 EC or 32,5 EC) as stated in Article 5, paragraph 1.
2. 15 EC educational (design) subjects;
3. a number of other optional subjects (also non-technical subjects) to make the total scope of the programme add up to at least 120 EC;
4. an educational internship of 15 EC;
5. a final master's project of 40 (CPE & MSE) or 45 (MME) EC in the selected track.

[6] More information is available at http://www.em3e.eu/

The provisions for the Contract Research Assignment and the final master's project as well as the other provisions for all tracks in Article 5, also apply to this master's programme.

After successful completion of this programme, the student will receive the master qualification Chemical Engineering with a statement that he/she has a first-degree teaching qualification in Chemistry.

Article 11 'Process Technology course' Programme

The faculty offers a Process Technology (PT) course. This course is intended for people with an educational background in technology or physics, working in the industry, and seeking to acquire further knowledge of Process Engineering. The course is also suitable for professional development, continuing education or retraining of engineers (*ir., ing.*) and chemists (*drs., dr.*).

The course consists of three parts: Basic Process Technology, Advanced Process Technology and Design Process Technology. The Basic Process Technology consists of six courses made up of modules from the Chemical Science and Engineering bachelor's programme. Knowledge of these subjects is required for the compulsory subjects of the MSc track Chemical & Process Engineering, some of which are part of Advanced Process Technology. Advanced Process Technology consists of a number of compulsory subjects from the CPE track. Design Process Technology consists of one compulsory subject, two optional subjects, and an individual design assignment. The optional subject can be used to extend knowledge, or as the required basis for the individual assignment.

The individual design assignment is carried out at the company where the participant is employed, and is completed by a written report. Supervision and assessment will be carried out by one of the lecturers of the Chemical & Process Engineering master's programme. Before starting, an abstract must be sent to the course coordinator, and the assignment must be approved by the company and by the supervising lecturer.

This is an overview of the programme for Basic Process Technology, Advanced Process Technology and Design Process Technology:

Basis PT Training	*Parts made up of modules from BSc Chemical Engineering*	
Code		EC
201900235	Catalysis and Reaction Kinetics for PT-course	5
201900236	Fluid Dynamics for PT- course	4
201900237	Heat and Mass Transfer for PT-course	4
201900162	Chemical equilibria and Phase Diagrams for PT-course	4.5
201900238	Industrial Separation Technology for PT-course	3
201900239	Introduction Chemical Reaction Engineering for PT-course	4.5
	Subtotal	**25**

Advanced PT Training	*Compulsory subjects MSc Chemical Engineering (CPE track)*	
Code		EC
201600151	Advanced Chemical reaction engineering	5
201300049	Advanced Molecular Separations	5
201600152	Advanced Catalysis	5
201800324	Process Dynamics & Control	2.5
	Optional subjects	7.5
	Subtotal	**25**

Design PT Training	*Design*	
193735010	Thermodynamics and flowsheeting	5
193799600	Individual assignment (incl. design)	15
	2 optional subjects from the list of optional subjects of the CPE track	10
	Subtotal	**30**

Total	**80**

Article 12 Final Master's Exam Procedure for PT students

1. Candidates in possession of certificates Basic Process Technology, Advanced Process Technology and Design Process Technology can submit a written request to the secretary of the Examination Board for admission to the Chemical Engineering master's programme. This request must be accompanied by a CV and a detailed overview of their education and relevant work experience.
2. If the Examination Board honours the request mentioned in the previous paragraph, the candidate is admitted to the Chemical Engineering master's programme and is granted exemption for all parts of the master's exam, except the final master's project.
3. Instead of the regular master's programme, the student will carry out a Final Company Assignment of 40 EC. This consists of a written and oral report on a part of the activities within the company where the candidate is employed. This report must demonstrate that the work is carried out at an academic level. The scope of the work must be comparable to the final master's project of a master student in the regular track of Chemical & Process Engineering and must contain research and/or design aspects.
4. The Examination Board will assign a master project committee for the assessment of the Final Company Assignment, as outlined in the rules of the Chemical Engineering Examination Board.
5. The master project committee will assess whether a student has conducted a chemistry-technical research or created a chemistry-technical design of sufficient scientific merit, and meets the programme targets that also apply to the final master's project of the regular master's programme.
6. If the Final Company Assignment is completed with a sufficient grade, the student meets the requirements for the master's exam defined by the Examination Board of the Chemical Engineering master's programme.

Article 13 Admission Requirements for BSc Students Advanced Technology (AT)

Depending on the selected track, a BSc student AT must attend a programme for admission to the MSc Chemical Engineering.

For the MME & MSE track:

- Materials Science and Engineering (M6a of the B-AT, 202000633, block 1B, language: English) or Materials Science & Technology (M8b of B-CSE, 202000748, block 2B, language: English)
- Molecules and Materials (M7 of B-CSE, 202000740, block 2A, language: English)

For the CPE track:

- Physical Chemistry (part of M6a of the B-AT, block 1B, language: English)
- Basics for Process Design (201500151, 3 EC, 1A, language: English)
- Transport Phenomena module (M6 of the B-CSE, 202000736, block 1B, language: English)
- Process Design module (M8 of the B-CSE, 202000744, block 2B, language: English)

Article 14 Transitional Arrangement

1. In the event of a change to programmes included in Articles 5, 6, 8, 9, 10 and 11 of this appendix, or of a change to one of the other articles in the general part or in this programme-specific appendix, a transitional arrangement will be defined and announced by the Programme Director.
2. Article 8.4 of the general part states the conditions to be met by a transitional arrangement.
3. The transitional arrangement will be published on the website and on Canvas of the master’s programme Chemical Engineering.

Article 15 Safety

Working in a laboratory is subject to safety requirements. Students must acquaint themselves with these rules[7] and abide by them.

Article 16 Sequence of Study Units

1. Prior to starting a programme unit, the student must meet the knowledge requirements of the programme unit.
2. The student can only start the internship & job orientation project when he/she has successfully completed at least 30 EC of the master's programme. A student who is following a two master's programme can only start the Internship & Job Orientation Project after successfully completing at least 45 EC of the master's programme.
3. The student can only start the final master's project when ≤10 EC of the courses of the master's programme (excluding the final master's project) still need to be passed. A student who is following a two master's programme can only start the Final Master's Project when ≤15 EC of courses still need to be passed.
4. Prior to the examination on the final master's project, the student must have successfully completed all other programme units.
5. The Examination Board is authorized to grant exemption from the conditions in paragraphs 1 to 4 of this article if strict application of those terms would result in an unreasonable delay in study progress. The student can submit a request to this end to the Examination Board.

Article 17 Flexible Degree Programme

Contrary to the provisions in articles 5 of this appendix, the student can request the permission of the Examination Board to compose a flexible degree programme in the sense of Art. 7.3h of the law. The Examination Board assesses whether the programme is appropriate and consistent within the domain of the programme and whether the level is high enough in the light of the intended learning outcomes of the programme.

Article 18 Student Counselling

The task of the study advisor is to individually advise students on all aspects of their studies, and to inform the Programme Director on the study progress of the students.

[7] See the rules on occupational health and safety and the environment, at http://www.tnw.utwente.nl/intra/diensten/amh/ .

Article 19 Quality assurance and evaluation

1. The programme management is responsible for the evaluation of the programme.
2. The execution of the evaluation of the education of the master's programme takes place using PDCA procedures by the coordinator Quality Assurance of the Science & Technology faculty/Science & Technology cluster and the Programme Director / Programme Coordinator.
3. The following evaluation tools are used:
    a. Panel meetings with students;
    b. Web surveys of the master's courses[8];
    c. Web survey of the final master's project.
4. The results of the internal quality assurance activities will be published in the following manner:
    a. Summary of the web surveys and response of the lecturer regarding the evaluation will be sent to the programme committee;
    b. Summary of web surveys and the response of the lecturer will be placed in the Canvas course 'Quality Assurance and Evaluation CHE' which is accessible for all students and lecturers of the programme.
5. To evaluate the curriculum and the master's programme in its entirety the following internal and external evaluations are used:
    a. All information obtained using the tools which are mentioned in 19.3;
    b. The National Student Survey (NSE)[9];
    c. The National Alumni Survey (NAE)[10].

    The programme management will respond to the evaluations, and provide a written reaction focusing on plans for improvement.
6. The programme management and the programme committee decide on which actions need to be taken on course level or curriculum level in order to improve the programme. These actions will be recorded in an 'Action List Quality Assurance and Evaluation'.
7. Every year the programme management writes an improvement plan, based on the internal and external evaluations and new insights.
    a. The improvement plan will be discussed with the programme committee;
    b. The improvement plan will be included in the faculty's annual report;
    c. The faculty's annual report will be discussed with the university's executive board by the dean of the faculty and the portfolio holder education during the autumn meetings.

Article 20 Effectuation and Changes

These regulations will come into effect on 1 September 2019 and replace the regulations dated 19 July 2019.

Established by the board of the Faculty, after advice from the Faculty Council and the Programme Committee and after consent of the Programme Committee with articles 2, 5, 6, 8-11, 13, 15 and 19.

Enschede, 14 July 2020.

8 Not all courses are evaluated using a web survey every year.

9 The NSE is taken every year.

10 The NAE is taken every year.