Scheikunde OW 2012

Faculty of Science and Technology,
University of Twente

QANU, October 2012

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This report was finalized on 25 October 2012.

Report on the bachelor's programme Chemical Engineering and the master's programme Chemical Engineering of the University of Twente

This report takes the NVAO's Assessment framework for limited programme assessments as a starting point.

Administrative data regarding the programmes

Bachelor's programme Chemical Engineering

Name of the programme:	Scheikundige Technologie
CROHO number:	56960
Level of the programme:	bachelor's
Orientation of the programme:	academic
Number of credits:	180 EC
Specializations or tracks:	Not applicable
Location(s):	Enschede
Mode(s) of study:	full time
Expiration of accreditation:	31-12-2013

Master's programme Chemical Engineering

Name of the programme:	Chemical Engineering
CROHO number:	60437
Level of the programme:	master's
Orientation of the programme:	academic
Number of credits:	120 EC
Specializations or tracks:	Molecules & Materials, Process Technology
Location(s):	Enschede
Mode(s) of study:	full time
Expiration of accreditation:	31-12-2013

The visit of the assessment committee Scheikunde OW 2012 to the Faculty of Science and Technology of University of Twente took place on June 15th 2012.

Administrative data regarding the institution

Name of the institution:	University of Twente
Status of the institution:	publicly funded institution
Result institutional quality assurance assessment:	applied (pending)

Quantitative data regarding the programmes

The required quantitative data regarding the programmes are included in Appendix 5.

Composition of the assessment committee

The committee that assessed the bachelor's programme Chemical Engineering and the master's programme Chemical Engineering consisted of:

- Prof. dr. E. Schacht, Honorary Professor Organic Chemistry, Ghent University, Belgium, chairman;
- Dr. ir. P.J. Jansens, R&D director DSM Chemtech Center & Corporate Scientist Process Technology;
- Prof. dr. J.A. van Bokhoven, SNF-Professor in Heterogeneous Catalysis at the Institute for Chemical and Bioengineering, ETH-Zürich, Switzerland;
- Prof. dr. J. Heck, professor 'Organometallchemie', department of Chemistry, Hamburg University, Germany;
- Maja Medic, master student Life Science and Technology, Leiden University.

The committee was supported by drs J. van Zwieten, who acted as secretary.

Appendix 1 contains the curricula vitae of the members of the committee.

Working method of the assessment committee

Preparation
The assessment of the Chemical Engineering programmes of the University of Twente is part of a cluster assessment of 33 chemistry degree programmes offered by ten universities. The entire cluster committee consists of twelve members. The kick off meeting for the cluster assessment was scheduled on 22 March 2012. During this meeting the committee members received an introduction into the assessment framework and evaluation procedures and the committee agreed upon its general working method. For each visit a subcommittee is composed that ensures the necessary expertise to evaluate the programme. Furthermore the domain specific requirements and the most recent developments concerning the Chemistry domain were discussed. These domain specific requirements and the actual context form the starting point for the evaluation of the quality of the degree programmes.

The committee chair and the co-ordinator preserved the consistency in evaluation in the cluster project. The cluster co-ordinator for QANU was dr. B.M. van Balen.

In preparation of the assessment of the programme a self-assessment report was prepared by the programme management. This report was sent to QANU and, after a check by the secretary of the Committee to ensure that the information provided was complete, forwarded to the Committee members. The Committee prepared the site visit by studying the self-assessment report and a number of Bachelor's and Master's theses. The secretary of the committee selected fifteen theses randomly and stratified out of a list of all graduates of the last two years per programme. The following stratification is used: five theses for each degree programme with low grades (6-6,5), five theses with middle ranged grades (7-8) and five theses with high grades. QANU asked the programmes to send the theses including the assessment by the supervisor and examiner and divided them among the subcommittee members; each committee member therefore assessed three theses per programme.

When a thesis was assessed as questionable or unsatisfactory by a committee member, a reassessment was done by another committee member. In the case that more than 10% of the theses were assessed as questionable or unsatisfactory by two committee members the selection of theses for the programme was extended to 25.

Site visit
The Committee members formulated questions raised by studying the self-assessment report in advance. These questions were circulated in the committee.

The Committee visited the programme on June 15th of 2012. The programme of the site visit was developed by the Committee's secretary in consultation with the programme management and the chair of the Committee. The Committee interviewed, next to students, teachers and alumni, the programme management and representatives of the Faculty Board, the Examination Board and the student and teacher members of the Programme Committee. An open office hour was scheduled and announced (but not used).

During the site visit the Committee studied additional material made available by the programme management. Appendix 7 gives a complete overview of all documents available during the site visit. The last hours of the site visit were used by the Committee to establish the assessments of the programme and to prepare the presentation of the findings of the Committee to the representatives of the programme.

Report
The secretary wrote a draft report on basis of the findings of the committee. The draft report has been amended and detailed by the committee members. After approval of the draft report by the committee it was sent to the Department for a check on facts. The comments by the Department were discussed in the committee, this discussion resulted in some changes in the report, and subsequently the committee established the final report.

The assessment was performed according to the NVAO (Accreditation Organization of the Netherlands and Flanders) framework for limited programme assessment (as of 20 November 2011). In this framework a four-point scale is prescribed for both the general assessment and assessment of each of the three standards. The committee used the following definitions for the assessment of both the standards and the programme as a whole:

Generic quality
The quality that can reasonably be expected in an international perspective from a higher education bachelor's or master's programme.

Unsatisfactory
The programme does not meet the current generic quality standards and shows serious shortcomings in several areas.

Satisfactory
The programme meets the current generic quality standards and shows an acceptable level across its entire spectrum.

Good
The programme systematically surpasses the current generic quality standards across its entire spectrum.

Excellent
The programme systematically well surpasses the current generic quality standards across its entire spectrum and is regarded as an (inter)national example.

General Assessment

- When standard 1 or standard 3 is assessed as 'unsatisfactory', the general assessment of a programme is 'unsatisfactory'.

- The general assessment of the programme can be good when at least two standards, including standard 3, are assessed as 'good',

- The general assessment of the programme can be excellent when at least two standards, including standard 3, are assessed as 'excellent'.

Summary judgement

Intended learning outcomes
The bachelor's programme Chemical Engineering at the UT aims at a broad, but thorough education at a basic level. The bachelor's programme offers a combination of basic skills and knowledge that prepares students primarily for the master's programme and secondarily for the labour market for chemical engineers in industry, research and teaching. The objectives of the master's programme in Chemical Engineering are to develop the knowledge, skills and understanding in chemical technology at such a level that graduates have the competencies for professional, autonomous practice in chemical engineering and related fields. The graduates can successfully enter professional fields like scientific research, process and product development or professional teaching in one of the disciplines chemistry, materials science and process technology.

The assessment committee concluded from the self-evaluation report and the meetings with the various panels that the bachelor's and master's programme at the UT have learning objectives and intended learning outcomes that describe the content, level and orientation of the programmes in a very clear way.

The committee encourages the management to proceed and complete the process of developing a vision on the position that they want to have in the field of chemical engineering and on the way they want to shape the programmes. According to the committee, intended restructuring of the bachelor's programme can have positive effects on the study results.

Teaching learning environment
The bachelor's programme consists of 180 EC, of which 140 EC are compulsory courses. In the third year of the programme, students choose a minor of 20 EC. There is one elective course. The Bachelor Assignment of 15 EC forms the completion of the bachelor's programme.

The bachelor's programme contains several learning trajectories. First, there are seven Chemical engineering learning trajectories. Second, there are learning lines for research skills, design skills and information acquisition skills. The learning trajectories make up for a coherent programme. Theoretical courses and research or lab courses are scheduled parallel from the beginning of the curriculum.

The committee observed the contents and structure of the curriculum as a framework that make it a very complete programme. All core disciplines are covered by the programme. The working methods are very well balanced. Students become acquainted with research early in the programme. The committee concludes that the foundation of academic skills in the programme is very solid and transcends average quality on this matter.

The master's programme is offered in two different tracks: 'Process Technology' and 'Molecules & Materials'. These tracks derive from the research expertise of the Chemical Engineering department. Each track contains several track-specific compulsory courses, optional profile courses, an internship and a final assignment. Students and alumni are very satisfied with the programme. They mention that during their internship, they perceive that they have a profound knowledge base that they can apply in their experience in the professional practice.

Staff members are committed to realising high quality programmes. There is sufficient knowledge and teaching quality within the teaching staff. The facilities for students are of high quality: laboratories are new, clean and well equipped. The committee establishes that this is a good improvement that motivates both students and staff. Students are well supervised by tutors and the study advisor; there is frequent contact with tutors.

Assessment and achieved learning outcomes
The committee has established that the programmes have an adequate assessment system and assessment procedures. During the programmes students are assessed by a variety and combination of test methods: attendance, participation, written exams, presentations and assignments. The committee views the mix of assessment methods used throughout the programmes to be balanced and appropriate.

Theses are adequately assessed by a committee including a member of the Board of Examiners. The committee advises the Board of Examiners to consistently apply the assessment forms for theses. The committee assessed a random selection of bachelor's and master's theses and concluded that all theses met the requirements.

Overall, the committee concludes that the course tests, the theses and the performance of graduates in and after the master's programme demonstrate an adequate achieved level of the bachelor's and master's programmes Chemical Engineering.

Bachelor's programme Chemical Engineering:

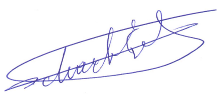
Standard 1: Intended learning outcomes	**satisfactory**
Standard 2: Teaching-learning environment	**good**
Standard 3: Assessment and achieved learning outcomes	**satisfactory**
General conclusion	**satisfactory**

Master's programme Chemical Engineering:

Standard 1: Intended learning outcomes	**satisfactory**
Standard 2: Teaching-learning environment	**satisfactory**
Standard 3: Assessment and achieved learning outcomes	**satisfactory**
General conclusion	**satisfactory**

The chair and the secretary of the committee hereby declare that all members of the committee have studied this report and that they agree with the judgements laid down in the report. They confirm that the assessment has been conducted in accordance with the demands relating to independence.

Date: 25 October 2012



Prof. dr. E. Schacht

Drs. J. van Zwieten

Description of the standards from the Assessment framework for limited programme assessments

Standard 1: Intended learning outcomes

The intended learning outcomes of the programme have been concretised with regard to content, level and orientation; they meet international requirements.

Explanation:
As for level and orientation (bachelor's or master's; professional or academic), the intended learning outcomes fit into the Dutch qualifications framework. In addition, they tie in with the international perspective of the requirements currently set by the professional field and the discipline with regard to the contents of the programme.

Findings

Bachelor's Programme

The self evaluation report of the bachelor's programme Chemical Engineering at the University of Twenty (UT) states the following mission for this programme: *to educate students at an internationally renowned bachelor's level to become entrepreneurial researchers, designers and engineers who are capable of developing, conveying and applying innovative knowledge according to academic standards in three areas: Chemistry, Materials science and Process technology.*

This mission statement is translated in objectives for the bachelor's programme, which have been formulated in the Course and Examination Regulations. They aim at a broad education at a basic level. The bachelor's programme offers a combination of skills and knowledge that prepares students primarily for the master's programme and secondarily for the labour market for chemical engineers in industry, research and teaching.

Final qualifications for Chemical Engineering bachelor's programmes have been formulated in the national reference framework in 2001 and reconfirmed in 2011. Additionally, together with the two other technical universities in the Netherlands the UT formulated the '3TU Academic Criteria'. These criteria for academic bachelor and master degree curricula in chemical engineering comprise of seven competence areas:

1. Competence in one or more scientific disciplines,
2. Competence in doing research,
3. Competence in designing,
4. Mastering a scientific approach,
5. Possession of some basic intellectual skills,
6. Competence in cooperating and communicating,
7. Taking the temporal and social context into account.

Appendix 3 presents the learning outcomes within these areas. In the self-evaluation report, the department shows how these learning outcomes relate to the national reference framework.

At the start of the visit the programme director and the dean of the faculty displayed the plans to restructure the bachelor's programme. In brief, the new program will follow the university-wide educational model. This model needs to support the ambition to improve the study progress, to stimulate entrepreneurial students and to offer more possibilities to enter different master's programmes. For chemical engineering, this will reflect in a programme divided in quartiles within each year. Every quartile will have a theme in which theoretical courses and projects are related to each other. During these theme-modules, there will be continuous, cumulative testing. Additionally, the new curriculum will contain an explicit learning trajectory in skills. Finally, it will offer more electives in the second and third year of the programme.

Master's programme
According to the self evaluation report the objectives of the master's programme in Chemical Engineering are to develop the knowledge, skills and understanding in chemical technology at such a level that graduates have the competencies for professional, autonomous practice in chemical engineering and related fields. The graduates can successfully enter professional fields like scientific research, process and product development or professional teaching in one of the disciplines chemistry, materials science and process technology.

The UT's Chemical Engineering master's programme aims at training students to practice their profession independently, to develop skills in, knowledge of and insights into a specialism of the discipline. The learning outcomes of the master's programme in Chemical Engineering derive from the same seven competence categories as the bachelor's programme. The learning outcomes are included in Appendix 3 of this report. In brief, the master graduate Chemical Engineering:

- Is specialised in a specific field of chemical engineering;
- Has the knowledge and the skills for doing research in a specific field of chemical engineering;
- Sometimes has extended skills for process designing in a specific field of chemical engineering;
- Has a scientific approach;
- Possesses intellectual skills; is able to cooperate and communicate with specialists in the chosen track and other stakeholders;
- Has the ability to integrate insights in the temporal social, environmental, sustainability and safety context into his or her scientific work.

The master's programme at the UT offers two tracks: Process Technology and Molecules & Materials. At the beginning of the visit, the programme management explained that for Process Technology, management and staff are in the middle of a process of repositioning of this track. After the departure of a core staff member, management is obliged to reconsider this profile. The track should differentiate from other programmes by means of its research profile and will be more connected to materials sciences. The management set out that the focus has been established at catalysis, sustainable energy, micro-systems and membranes. The committee obtained a clear overview of the design and objectives of the master tracks.

Additionally, the master's programme will be more connected to the Twente Graduate School, in order to attract more international students for the master's programme and PhD positions. The committee was not informed beforehand about the existence of this graduate school and asked for more information. The programme management provided the committee with an explanation of the programme and with some information brochures. However, for the committee, this information was still a bit unclear as they could not establish a good impression of the way the graduate school's master's programme corresponds with or distinguishes from the regular programme.

Considerations
The assessment committee concluded that the bachelor's and master's programme at the UT have learning objectives and intended learning outcomes that describe the content, level and orientation of the programmes in a clear way. The learning outcomes are formulated within the framework of 3TU-Academic Criteria. By following these learning outcomes, the programmes fulfil the international academic and professional criteria for chemical engineering programmes.

The committee has the opinion that it is useful for the programme managements to hold a clear vision on the position that they want to have in the field of chemical engineering and on the way they want to shape the programmes. According to the committee, the management of the programmes at the UT is in a process of developing this vision. The committee encourages the management to proceed and complete this process. They advise the management to involve representatives of the industry actively and formally (e.g. in an Advisory Board) in this process.

According to the committee, the intended restructuring of the bachelor's programme can have positive effects on the study results by combining theory and practice and by testing more frequently. However, the committee remarked that this should not decrease the degree to which students develop an academic attitude. During their education academic students should increase their ability to work and study self-directed.

The committee has formed an opinion on the design and the objectives of the regular master's programme. The committee concludes that this programme has clear objectives that are in line with the international academic and professional criteria for chemical engineering programmes. The committee was not able to judge whether the master's programme within the graduate school fulfils the (inter)national requirements. In order to take this programme into account, the committee should have been informed on this programme in the self-evaluation report. The information given during the visit was not clear enough to judge the quality of this programme. Therefore, the committee explicitly distances itself from any judgement concerning the graduate school's master's programme.

Conclusion
Bachelor's programme Chemical Engineering: the committee assesses Standard 1 as satisfactory.
Master's programme Chemical Engineering: the committee assesses Standard 1 as satisfactory.

Standard 2: Teaching-learning environment

The curriculum, staff and programme-specific services and facilities enable the incoming students to achieve the intended learning outcomes.

Explanation:
The contents and structure of the curriculum enable the students admitted to achieve the intended learning outcomes. The quality of the staff and of the programme-specific services and facilities is essential to that end. Curriculum, staff, services and facilities constitute a coherent teaching-learning environment for the students.

Findings

Bachelor's programme

Curriculum
The bachelor's programme consists of 180 EC, of which 140 EC are compulsory courses. In the third year of the programme, students choose a minor of 20 EC. There is one elective course of 5 EC where students choose between a process technology course or a molecules & materials course. The Bachelor Assignment of 15 EC forms the completion of the bachelor's programme.

The bachelor's programme contains several learning trajectories. First, there are seven Chemical engineering learning trajectories:

- Organic & Inorganic Materials Science
- Atoms & Molecules Spectrometry
- Organic & Inorganic Chemistry, Binding & Reactivity
- Thermodynamics & Physical Chemistry
- Process Technology
- Sustainable Industrial Chemistry & Catalysis
- Mathematics & Modelling

Second, there are learning trajectories for research skills, design skills and for information acquisition skills. Each of these learning trajectories consists of four courses. In this last learning trajectory, students start with learning to distinguish scientific from popular information and finally perform an individual literature search as part of the bachelor assignment.

The self-valuation report shows how individual courses contribute to the final skills qualifications of the domain-specific reference framework. For example, planning skills are developed in the courses 'Project Orientation Science & Technology', 'Project Chemical Technology' and in the bachelor assignment.

The learning trajectories make up for a coherent programme. Theoretical courses and research or lab courses are scheduled parallel from the beginning of the curriculum. The learning trajectory in Mathematics provides a solid basis in this related discipline. Additionally, some courses provide students with insight in the coherence between chemistry-related learning trajectories and the process technology learning trajectory. With these courses, for example 'Industrially applied chemistry', students learn the implications of chemical theory on industrial, technological application.

In the first year, the curriculum contains an introductory course of every learning trajectory. Advanced courses that require more than high-school level previous knowledge, have been placed in the second and third year of the bachelor curriculum. In the discussions with students, they mentioned that they appreciate the coherence of the program. They emphasize that the program is very complete. During internships they perceive that they have a good overview of the field of chemistry and chemical engineering. Students report as well that the curriculum evolves and deepens through the years: advanced courses build on the knowledge that they gained in previous courses.

During the visit, the committee was especially interested in the attention for sustainability in the programme. Awareness of sustainability aspects of chemistry and technology is part of the intended learning outcomes. In the bachelor curriculum two courses are focussed on sustainable energy and sustainable process technology. Students report that some of the other bachelor courses address sustainability issues as well. During lab-courses, students get feedback on sustainability aspects of their experiments.

Teaching concept and teaching formats
The UT developed a new educational model, which will reflect in a new bachelor curriculum from the academic year 2013-2014 (see: Standard 1). Currently, the program has adopted different types of courses: lectures, tutorials, laboratory courses and projects. Some of the courses combine theory and practice, by working in tutorials and lab classes in the span of one course or by using practical cases during theoretical courses. With the mixture of working methods, the programme balances theory and practice as well as individual and group work.

16% of the bachelor curriculum consists of project-work. In these projects, students learn to apply knowledge and integrate the sub-disciplines of chemical engineering. The projects are organised so that students develop social and planning skills. Additionally, they are provided with an extensive skills-manual.

To improve study results, supervised self-study is scheduled in the first year. During these self-study hours, senior students help first year students with their work. The programme intends to help students with this facility to habituate to a full-time study-week. In the second and third year of the programme, the amount of scheduled hours is reduced to approximately 40% of a full-time study-week.

Lab-courses in the bachelor's programme are research orientated and have a different approach than traditional lab courses. Students are not provided with a 'cookbook' with detailed procedures. Instead, they get an assignment to prepare their own work-plan for the experiment. They should base their work-plan on relevant literature and handbooks. After they prepared their assignment, lab-supervisors provide them with feedback. In the conversations with students, they report that all supervisors provide them with extensive feedback on these work-plans. In this feedback, safety and environmental issues are explicitly addressed.

The bachelor assignment is the final part of the programme. Students work individually within one of the research groups of the department. At the beginning of the third year, all students get a tour along all research groups to get an impression of the different research possibilities. At the beginning of their bachelor assignment, students perform an independent literature search and make a research plan. At the end of their assignment they present their results in a report and in a presentation session.

The committee spoke with alumni from the programme. They highly valued the different work forms and the project work in their education. They reported that the social skills developments in the project work are very useful and that they would have appreciated more attention for this type of skills education.

Even though the bachelor's programme is not primary aimed at preparing for the labour market, there are some parts that bring students in contact with the professional practice. There are guest lectures, industrial site visits (for the Project Chemical Technology), excursions and in the third year an international study tour. Students who follow the minor 'Learning to teach' obtain experience as a chemistry teacher.

Study progress
The programme management strives for better study results and lower drop-out rates in the bachelor's programme. Their ambition is to have a drop-out rate of at most 30%, fully concentrated in the first year. The average drop-out rate has decreased from an average of 43% in 2001-2004 to 33% in 2005-2010.

During the first year of study, students get three study advice letters: after the first block, after the first three blocks and in august, after the exam results. This last advice-letter has a formal status, the so called 'Binding Study Advice (BSA). Chemical Engineering participated in the universities pilot with the BSA in 2009. Investigation of study results showed that 99% of students who obtained less than 40 EC in their first year dropped out. The BSA of 40 EC is considered a minimum threshold. The results of the pilot have been evaluated. It appears that more students with poor study results continue their study elsewhere within or directly after the first year. Starting from the academic year 2012-2013 the BSA will be increased from 40 EC to 45 EC.

The average study duration of the bachelor's programme has decreased from 4.6 for the first 50 graduates to 4.2 for the last 50 graduates. Studying the study results during the first three years points out that most study delay incurs in the third year. The self-evaluation report mentions that in this year, many students deploy extra-curricular activities.

Students report during the visit that they are well supported by the staff during their study. Alumni mention a few courses that require a lot of effort, but in general students and alumni are satisfied with the programme and mention that the study load is not too heavy. Most of the students are in favour of the increase of the BSA to 45 EC. They perceive that students, who obtain less than 45 EC in their first year, drop out more often. A BSA of 45 EC demands a more dedicated study attitude during the whole year.

Master's programme

Curriculum
The two year master's programme 'Chemical Engineering' at the UT is offered in two different tracks: Process Technology' (PT) and 'Molecules & Materials' (M&M). The M&M track focuses on design, preparation, processing, application and analysis of novel materials with high tech properties. The PT master track focuses on the design of processes that function optimally in their technological, economic, environmental and social aspects. These tracks derive from the research expertise of the Chemical Engineering department. The tracks have the following structure:

- Track-specific compulsory courses (20 EC (PT) or 25 EC (M&M));
- Design assignment (PT) or practical projects (M&M) of 10 EC;
- 5 (PT) or 4 (M&M) optional profile courses of 5 EC each;
- An internship of 20 EC;
- Assignment of 45 EC.

Appendix 4 provides an overview of the curricula.

All compulsory courses are scheduled in the first year of the master's programme. The M&M track is more research oriented whereas the PT track has relatively more design content. In the M&M track, the student has several courses with a strong research orientation, whereas in the PT track, the student has to deliver designs in the *Process plant design* project as well as in three of the four compulsory courses. In both tracks, the master assignment is research oriented. Optional profile courses are mainly in the field of science and technology, but the programme also allows a free selection of a limited number of optional courses that are non-technological. As can be found in the self-evaluation report, students most frequently choose technological courses.

Students are stimulated to perform their internship in industry or a research centre outside the university, preferably abroad. Approximately 50% of the students go abroad for their internship. A member of the teaching staff is assigned as a supervisor who stays in contact with the student during the internship, as well as with the supervisor at the internship-organisation. Students finish their internship with a written report. Usually, they present this report at their internship-organisation.

The master-assignment generally takes place in one of the research groups of the UT. Students become a member of this research group and are supervised by a staff member of the research group. The supervisor coaches the student intensively in the execution of their research.

The coherence of the master tracks is ensured by the composition of the compulsory parts of the program. With the optional courses, students choose a research area in which they deepen their knowledge. The chair holder of the research group in which they enrol has the responsibility to ensure the coherence of the students programme. The self-evaluation report states that students and staff are satisfied with the balance in the programme, according to their comments in evaluation sessions.

Teaching concept and teaching formats
The master's programme has a stronger focus on self-directed and autonomous studying than the bachelor's programme. This results in less scheduled hours for students. The scheduled hours comprise a few lectures, a combination of lectures and tutorials and a substantial amount of project work. The specialised courses offered by the research groups have a direct link with the research activities of the lecturers and follow the developments in the research programme. Individual assignments and group assignments are common examination methods. A substantial part of the master's programme is covered by the MSc assignment, where students are supervised in a so-called 'master-apprentice' relation.

Admission to the UT Chemical Engineering programme has no restrictions for students from the UT bachelor's programme, as well as for Chemical Engineering bachelors from Delft University of Technology and from Technological University Eindhoven. Students with a bachelor degree from another chemical programme at a Dutch university or Higher

Vocational Education (HBO) are obliged to follow a pre-master's programme of maximum 30 EC. HBO-students follow an additional competence programme of 20 EC instead of the internship of the master's programme as well. The programme director decides on the admission of these students. For international students the programme director forms an admission committee with the Internationalisation coordinator and a member of the research group where the student will be hosted. About 50% of the intake comes from the UT bachelor's programme; approximately 30% of the intakes are international students.

Students and alumni are very satisfied with the programme. They mention that during their internship, they perceive that they have a profound knowledge base that they can apply in their experience in the professional practice. Students that enter the master's programme coming from HBO or abroad are satisfied with the process of admission and the information during their education. They told the committee that contacts with the UT during this process and during their education are constructive and positive.

Less than 5% of master students drop out during the programme. The average study duration of students with a UT BSc in Chemical Engineering is 2,1 year. Overall 90% of the master students achieve the MSc degree within 3 years.

Teaching staff
The UT states that the presence of highly qualified staff with a scientific background is of paramount importance to secure the nature and level of the academic programmes. Therefore, newly appointed scientific staff members should have a PhD degree and participate in scientific research. An academic atmosphere and ambiance supported by a research infrastructure is required. The Chemical Engineering expertise of the staff is of high quality, which can be illustrated by the very high to excellent assessment at the national research review in 2009.

The department of Chemical Engineering aims at improving the didactic qualities where necessary, as well as the educational achievements of individual lecturers. Teaching staff have to qualify themselves for their educational tasks by attending the lecturer training programme of the UT (BKO). Assessment of educational skills is always incorporated in the application procedure for new staff and in the appraisal and performance reviews with current staff members. These evaluations may result in an advice for improving teaching skills.

Teaching and supervisory tasks are almost completely fulfilled by full professors, associate and assistant professors. PhD students contribute for a maximum of 10% of their time to education, always under supervision of a staff member. Based upon an assumed teaching load of 40% for scientific staff, an indication of the student-staff ratio is 15 students per FTE teaching time of the staff.

Students state that the quality of the teaching staff is good. They are very satisfied with their expertise, didactic qualities and the command of English language. Intense supervision, instruction and guidance are given by the scientific staff. Moreover, the staff is easily accessible for the students. Students state that there are low barriers in the contacts between students and lecturers. They explain that they evaluate courses and the teachers frequently. When they make critical notes on teaching quality, they feel that there is always a follow up on their remarks.

Programme-specific services and facilities
The Chemical Engineering programmes are housed in two buildings. In the 'Horsttoren' there are two 'year-rooms' for first and second year bachelor students. In these rooms all teaching and other study-related activities, except for practicals, take place. An additional 12 project rooms are available for Chemical Engineering and two other programmes. In the 'Carré' building, which opened in April 2011, three new chemical laboratories are available for education and research. One of the laboratories is especially equipped for synthesis classes. For the design courses of Process Technology a permanent class room is available, as well as project rooms and specialized software. During the BSc assignment and MSc assignment, students work within one of the research groups. They have a private working place in or nearby the laboratory of this research group.

During the visit, the committee had a guided tour along the facilities of the programmes. They were impressed by the modern and trim laboratories and classrooms.

Information for students is available and provided in several ways. The programme website and e-mail are the primary means of informing students. There are study guides for both programmes that contain information on the programme, staff, examination, facilities and relevant policies. Additionally the study association Alembic issues the 'Ervaringenwijzer', a guide for fist year students that describes experiences and problems of senior students and how to tackle them. First year students are welcomed with a two day introduction in August. Later in the education programmes there are several information sessions, including a research group tour, a minor market and information sessions on the master tracks. The international office organises a special introduction for international students.

Tutoring and study advice is provided by different counselling systems. First, every student has a *(staff) tutor*. In a group of about 10 students, the tutor organises at least three discussion sessions with students in their first year. In these sessions, study progress, the BSA, study methods and planning are points of discussion. After the first year, tutors have a more passive role, where students can contact them when necessary. Twice a year, they are provided with an overview of possible problematic study progress off their students. If a students has an average cumulative study speed below 60-65% of the formal study speed or has attained less than 5 EC in the last block, then the study advisor informs the tutor, who will speak with the student and give feedback of that conversation to the study advisor.

First year students have a *student-tutor* as well. These tutors can help students with small problems regarding their study or student life. Both student tutors and staff tutors are trained. The study advisor coordinates their activities.

This *study advisor* is appointed to pro-actively support student monitoring. Students can consult the advisor regarding any issues that concern the study programme and studying in general. The study advisor can help to make special arrangements by discussions with lecturers and the programme director. As explained earlier, first year bachelor students receive three study advice letters during the first year. The last one has a binding status (BSA): students who have attained less than 40 EC cannot proceed their education in Chemical Engineering at UT.

For master students, the track coordinators are available for advice about the choice of a track, optional courses and labour market prospects. For international students the coordinator internationalisation serves as a tutor who has a progress meeting with the students each block. For HBO-students, there is a coordinator who has a meeting with them each block during their pre-master phase. The study advisor and counsellors at university level are available for all students as well.

Considerations

Bachelor's programme

The committee concludes that the contents and structure of the curriculum make it a very complete programme that enables students to achieve the intended learning outcomes. All core disciplines are covered by the programme. The learning lines make up for a coherent programme. The committee appreciates the solid learning line in mathematics. The working methods are well balanced. Students become acquainted with research early in the programme. The committee concludes that the foundation of academic skills in the programme is very solid and transcends average quality on this matter.

Students are well supervised by tutors and the study advisor, there is frequent contact with tutors. The committee recommends that the investments in the pedagogical qualities of the tutors remain a constant point of interest.

The committee has established that sustainability forms part of the curriculum. With the restructuring of the programme, it is important that this theme is well represented in courses and learning lines of the programme.

Master's programme

The committee establishes that the master's programme offers a complete curriculum that enables students to realise an advanced level of knowledge and skills in chemical engineering. The committee appreciates the substantial amount of compulsory courses in the master tracks, as well as the rich offer of relevant electives. Together, they give students a broad education in Chemical Engineering.

According to the committee, students receive good supervision during their internship and their master's assignment. The development of their research skills within the research groups is sufficient.

In the last few years, some of the core staff members within the Process Technology discipline have left the UT. The committee establishes that the experience in this domain has decreased with their departure. The research lines in Process Technology are not yet distinctive in the national field. Still, the committee concludes that there is sufficient knowledge and teaching quality within the teaching staff.

Bachelor's and Master's programme

The committee perceived that students and alumni are satisfied and enthusiastic about the programmes, staff and atmosphere at the UT. The committee appreciates the means by which the programme management and Education Committee evaluate the programme, as well as the active follow up on these evaluations.

Staff members are committed to realising a high quality programme. The facilities for students are of high quality: laboratories are new, clean and well equipped. The committee establishes that this is a good improvement that motivates both students and staff.

Conclusion

Bachelor's programme Chemical Engineering: the committee assesses Standard 2 as good.
Master's programme Chemical Engineering: the committee assesses Standard 2 as satisfactory.

Standard 3: Assessment and achieved learning outcomes

The programme has an adequate assessment system in place and demonstrates that the intended learning outcomes are achieved.

Explanation:
The level achieved is demonstrated by interim and final tests, final projects and the performance of graduates in actual practice or in post-graduate programmes. The tests and assessments are valid, reliable and transparent to the students.

Findings

The UT has formulated a framework for educational programmes to develop an assessment policy according to the new Dutch law. This policy defines six requirements:

1. The subjects of the assessment should cover the learning objectives of a course.
2. The form of the assessment should be derived from and in agreement with the learning objectives and didactical concept of the course.
3. The scheduling of all assessments should be in balance with the study load.
4. The examiners should be qualified.
5. The regulations and the way the cutting score will be determined should be clear and published in advance.
6. The quality, execution and evaluation of the assessments have to be monitored and required actions for improve taken.

Based on these requirements, the Chemical Engineering programmes have implemented the framework by defining products to support the requirements and by assigning responsibilities regarding these products. These products are:

- Learning objectives per course;
- Assessments plans per course;
- An assessment policy on programme level;
- Assessment protocols for each work form;
- Recent exams;
- A semester exam schedule;
- The Education and Examination Regulations (OER);
- Assessment evaluations.

Lecturers or the programme management issue these products, the Board of Examiners approves them.

The system of assessments and examinations should provide an effective indication of whether students have obtained the learning objectives of the course programme. Therefore, all courses have a final assignment to test whether the students have indeed learnt what is expected of them. There is a variety of assessment methods matching the different types of educational methods related to the learning objectives. For every course this is described in the assessment plan.

Most of the theoretical courses are assessed by means of a written examination, sometimes in combination with interim examinations during a course. The type and level of the problems are comparable with those of the exercises in the tutorials. Within the bachelor's programme oral examinations are used incidentally. Practical training and laboratory work require a compulsory participation of the student to ensure that the required skills and attitude will be acquired. The assessment of practical training is often based on a written report about the process and the experimental results. In case of projects the assessment must also recognize that the project has an integrative character and that it is the result of working in a team. The assessment is based upon a written report and an oral or poster presentation of the work. In some cases the students are assessed individually.

Based on course evaluations, a sub-commission of the Board of Examiners investigates possible impediments in the assessments and reports to the Board about indications for improvement. For functional reasons a Board of Examiners for both the bachelor's and master's programme has been appointed consisting of two chair holders (one of them is chairman), secretary, and three lecturers. All members have an educational task in the bachelor and/or the master's programme. The programme director and the study advisor have an advisory role. The Board of Examiners meets at least six times a year to:

- Discuss and officially confirm the secretary's reported decisions and actions;
- Monitor the assessment policy according to their and guards the quality of the assessments;
- Sssess '*bindend studie-advies*', final qualifications for certification of students, requested alternative study routes and adequacy of requests for BSc assignments outside the university;
- Determine the various student admission procedures for assessments and courses;
- Practice its responsibility for the discipline during examinations and the judgment of student complaints or exam fraud.

The Board of Examiners annually publishes a report of its activities.

The committee met the Board of Examiners during the site visit and discussed the activities the Board carries out in regard to the quality assurance of the exams. The Board reported that it monitors the assessment quality by studying course evaluations and tracking impediments. Starting in the study year 2012-2013 the Board will randomly select two courses per study year of which they will establish whether the assessment plan is correctly implemented.

Bachelor's programme
The BSc Assignment is the final part of the programme where the acquired knowledge is integrated and applied. In the assignment, students need to show to what extent they have acquired the final qualifications. According to the Board of Examinors, in the bachelor's assignment, the focus is on the research process of the students, more than on the research results. The assignment is a learning process for students where they develop their ability to execute a complete research. Students work in a real research environment on a research subject that is part of the research programme of the group where the student is accommodated.

The assignment is assessed with an assessment checklist containing five parts: literature study, research qualities, report, colloquium and general aspects. The final assessment is done by a Bachelor Assignment Committee of at least three members, appointed by the Board of Examiners. Chairman of the committee is the chair holder or an associated professor where the student's final assignment is situated. At least one of the members of the committee must be a staff member from another research group to assure an independent vote and consistency between the assessments. Each committee has a member of the Board of Examiners as well.

About 90% of the bachelor graduates have entered the master's programme of Chemical Engineering at the UT. Except one graduate, the rest of the graduates went to another UT master or to a master's programme outside the UT.

Master's programme
The Master's Assignment is the final part of the programme where the integration and application of acquired knowledge are central. In the assignment, students need to show to what extent they have acquired the final qualifications. The master assessment comprises a written report and an oral presentation, both in English for an academic audience, with the focus on the scientific reasoning and the experimental methods and results. The Master's Assignment is assessed by a Master Assignment Committee. The Board of Examiners appoints the assignment committee. This committee is chaired by the chair holder where the student's final assignment is executed. The supervisor from the tenured staff is also a member. An independent staff member from another chair within the discipline is added to the committee to assure an independent vote and to attain consistency between the assessments. Often, also other experts (staff members or, if applicable external supervisors) are added to the committee. At least one of the committee members needs to be a member of the Board of Examiners.

The committee uses a checklist with criteria for the assessment. The assignment is assessed with two grades; one for the scientific contents and one for the report, presentation and other academic skills. This assessment form has been implemented only recently. It contains four aspects of assessment:

- Research process;
- Research qualities;
- Report design and lay-out;
- Presentation and discussion.

The WO-monitor is used to measure alumni satisfaction and careers. According to the self-evaluation report, the last WO-monitor reported that 100% of the alumni found a job within six months after graduation. 85% of the respondents report that they work as an academic chemical engineer in the area they specialized in during their study. 80% or more of the alumni would choose Chemical Engineering again, approximately 70% states that Chemical Engineering did prepare them sufficient or good for their job.

The committee assessed fifteen recent bachelor theses (Bachelor Assignment) and fifteen master theses (Master Assignment) and established that all theses met the requirements for graduation. On average the theses are of good quality, some of the theses the committee has assessed were very good. The committee has not seen any thesis that was on the whole unsatisfactory. The theses illustrate that the students have achieved the intended learning outcomes as formulated by the programme. However, only a few theses were accompanied by an assessment form with argumentation on the marks.

Considerations
The committee has established that the programmes have an adequate assessment system and assessment procedures. The assessment procedures are sufficiently implemented in the programme. The theses are adequately assessed by a committee including a member of the Board of Examiners.

The committee has seen that bachelor and master students finish each course with a test. During the programmes students are assessed by a variety and combination of test methods: attendance, participation, written exams, presentations and assignments. The committee studied the overview of assessment methods carefully and also looked into several tests. The committee views the mix of assessment methods used throughout the programmes to be balanced and appropriate. The given variety and combination of testing provides for assessing knowledge, understanding, applying knowledge and skills sufficiently.

The committee advises the Board of Examiners to consistently apply the assessment forms for theses. The recent introduction of this form is considered by the committee to be a late implementation of a good and legally required policy. Without this form, there is insufficient justification for final marks of students.

Overall, the committee concludes that the course tests, the bachelor theses and the performance of graduates in the master's programme demonstrate the achieved level of the bachelor's programme Chemical Engineering.

The committee also concludes that the master thesis and the performance of graduates in the labour market demonstrate an adequate achieved level of the master's programme Chemical Engineering at the UT.

Conclusion
Bachelor's programme Chemical Engineering: the committee assesses Standard 3 as satisfactory.
Master's programme Chemical Engineering: the committee assesses Standard 3 as satisfactory.

General conclusion

The committee concludes that the intended learning outcomes of the bachelor and the master's programme have been concretised well in terms of content, level and orientation. The committee views that the intended learning outcomes meet the international requirements fully.

According to the committee there are strong didactic points in the plans to restructure the bachelor's programme. However, the committee emphasizes that it is important in the process of restructuring both programmes to have a clear vision on the position of the programmes in the field of Chemical Engineering in the future. Developing this vision should be a process of the programme management, staff and a representation of the industry as well.

The committee concludes that the content and structure of the curricula of the Chemical Engineering programmes at the UT and the available staff, services and facilities constitute a coherent, attractive and challenging teaching-learning environment for the students.

Overall, the committee concludes that the programmes have an adequate assessment system in place and demonstrate sufficiently that the intended learning outcomes are achieved.

Conclusion
The committee assesses the *bachelor's programme Chemical Engineering* as satisfactory.
The committee assesses the *master's programme Chemical Engineering* as satisfactory.

Appendices

Appendix 1: Curricula vitae of the members of the assessment committee

Prof. dr. Jeroen van Bokhoven is currently SNF-Professor in Heterogeneous Catalysis at the Institute for Chemical and Bioengineering at ETH-Zurich. He studied Chemistry at Utrecht University and obtained his Ph.D. in inorganic chemistry and catalysis with distinction in 2000. From 1999 until 2002 he was head of the XAS (X-rayabsorption spectroscopy) users - support group at Utrecht University. In 2002, he moved to the ETH, where he worked as senior researcher in the group of Prof. Prins. Van Bokhoven works in the field of heterogeneous catalysis and (X-ray) spectroscopy. His goal is the determination of structure-performance relationships, which aid the design and construction of better catalysts for cleaner and more efficient processes. His main interests are heterogeneous catalysts and developing advanced tools in X-ray spectroscopy to study the catalyst structure under catalytic relevant conditions. Their combination provides insight into the structure and function of the catalytically active sites.

Prof. dr. Jürgen Heck studied Chemistry at the TU Braunschweig and acquired the diploma of Diplomchemiker (Dipl. Chem.) in 1978 at the University of Marburg, where he also obtained a Ph.D. for his research on inorganic (organometallic) chemistry and en EPR spectroscopy (1982). After his postdoctoral study at the University of Zürich, he started his research for a 'Habilitation' at the University of Marburg in 1983. Additionally, he organized and supervised an advanced inorganic-chemical practical. He obtained his 'Habilitation' in 1989 and became 'Universitair Hoofddocent' Inorganic Chemistry at the KU Nijmegen (now Radboud University). Since 1992, he has been the holder of the chair 'organometallic chemistry' at the Chemistry department at the University of Hamburg. In this period, he has been the director of the 'Institut für Anorganische und Angewandte Chemie' twice and has been vice-dean en dean of the Chemistry department of the University of Hamburg. His scientific research is aimed at metal-metal-interactions in di- and oligonuclear organometallic complexes.

Peter Jansens is R&D director DSM Chemtech Center & Corporate Scientist Process Technology at DSM. He studied Chemical Engineering at Delft University of Technology (1989) and obtained his Ph.D. cum laude in 1994 on 'Fractional Melt Crystallization of Organic Compounds'. From 1994 until 1997 he worked at Shell International Chemicals B.V. on several projects and from 1998-2000 at Shell Eastern Petroleum Co. in Singapore. From 2000-2008 he was a professor Separation Technology at Delft University of Technology and from 2003 scientific director of Delft Research Centre for Sustainable Industrial Processes.

Maja Medic is masterstudent Life Science and Technology University Leiden, Leiden. She received her bachelor degree Life Science and Technology (cum laud) from the University Leiden and Technical University Delft in 2011. In 2009 she received the 'Jong Talent' grant from the Royal Dutch Society of Sciences. She is student member of the master's programme committee Life Science and Technology (since 2011), member of the Symposium committee of the Study Association LIFE (since 2010) and was student member of the bachelor's programme committee Life Science and Technology.

Etienne Schacht is honorary full professor in Polymer Science at the Department of Organic Chemistry of the University of Gent, Belgium. He is founder of the Polymer Chemistry & Biomaterials Research Group of the University Gent, co-author of more than 440 peer reviewed international papers, promoter of more than 50 Ph.D. works; co-founder and former president of the Belgian Polymer Group (BPG); honorary member of the BPG council and currently coordinator of the BPG ThinkTank group: co-founder and former president of IBITECH, the Institute for Biomedical Technology University Gent; honorary member of the Romanian Society for Biomaterials. He has been involved in a large number of European and national and regional research projects. Prof. Schacht was for 12 years member of the Council of the European Society for Biomaterials, where he was responsible for the European Doctoral Award programme. He is member of the editorial board of several international research journals and served as external expert for several European organizations. He was external coordinator of the 2011 assessment of the research at the Department of Engineering of the Free University Brussel. At present Prof. Schacht is chairman of a committee of the FRS-F.N.R.S of the French community in Belgium.

Appendix 2: Domain-specific framework of reference

De regiecommissie van de VSNU Kamer Scheikunde heeft in overleg met het afnemend veld onderstaand referentiekader voor de bachelor- en masteropleidingen Scheikunde, Scheikundige Technologie, Moleculaire Levenswetenschappen, Natuurwetenschappen en (Bio)-Farmaceutische Wetenschappen opgesteld. De opleidingen worden gezamenlijk aangeduid als '*chemie en verwante moleculaire opleidingen*'.

Deze bijlage bevat het referentiekader voor de bacheloropleidingen.

Karakterisering van universitaire bacheloropleidingen binnen het domein *chemie en verwante moleculaire opleidingen* in Nederland

In de Nederlandse structuur is een bacheloropleiding in de eerste plaats gericht op doorstroming naar een masteropleiding, waarbij sprake moet zijn van verbreding van de keuzemogelijkheden. Zo hebben studenten de mogelijkheid om na hun bacheloropleiding bij een andere universiteit een (Engelstalige) masteropleiding te volgen. De bacheloropleiding zal dus breed en oriënterend moeten zijn met de mogelijkheid tot differentiatie, zonder dat dit de mogelijkheden van keuze voor een masteropleiding binnen de *chemie en verwante moleculaire opleidingen* te veel beperkt. Daarnaast is uitstroom na de bacheloropleiding mogelijk, zodat de opleiding tevens een afgerond karakter dient te hebben. De bacheloropleiding dient tevens gericht te zijn op de ontwikkeling van algemene academische vaardigheden en een academische attitude, zodat afgestudeerde bachelorstudenten kunnen doorstromen naar functies in de maatschappij waarvoor dit soort vaardigheden worden gevraagd[1].

De aanwezigheid van hooggekwalificeerde docenten met een universitaire achtergrond is van groot belang voor de aard en het niveau van het wetenschappelijk onderwijs in de bacheloropleiding. Docenten zijn gepromoveerd, hebben ervaring met en zijn betrokken bij het wetenschappelijk onderzoek. Daarnaast is een academische ambiance wat betreft infrastructuur en onderzoeksomgeving vereist.

Tegen deze achtergrond zijn onderstaande eindkwalificaties voor een Nederlandse universitaire bacheloropleiding *chemie en verwante moleculaire opleidingen* geformuleerd. Het diploma dat wordt behaald is een Bachelor of Science (BSc) in scheikunde, chemische technologie, moleculaire levenswetenschappen, natuurwetenschappen, of (Bio)-farmaceutische wetenschappen.

Eindkwalificaties van de universitaire bacheloropleiding Scheikunde/Scheikundige Technologie

Vakverbonden kennis en vaardigheden

De Bachelor of Science in Chemistry/Chemical Engineering:

- Heeft voldoende inzicht in de diverse specialisaties van de Scheikunde/Scheikundige Technologie die voortbouwen op de bachelorfase om een verantwoorde keuze te maken voor een vervolgopleiding;

[1] Bij het arbeidsmarktperspectief voor de BSc in *chemie en verwante moleculaire opleidingen* dient rekening te worden gehouden met de typisch Nederlandse situatie dat grote werkgevers voor posities, waarvoor bachelors (BSc) in aanmerking zouden kunnen komen, de voorkeur geven aan bachelors of applied science (BASc ('hbo'ers')). Deze laatsten zijn doorgaans meer opgeleid in de praktische vaardigheden, en als beroepsopleiding meer toegespitst op het werken in de chemische industrie. De meeste andere Europese landen (met uitzondering van Duitsland en Engeland) hebben geen opleidingen vergelijkbaar met de Nederlandse bachelor of applied science.

- Heeft een gedegen theoretische en praktische basiskennis van de Scheikunde[2] /Scheikundige Technologie[3] en de hulpvakken Natuurkunde, Wiskunde, Informatica, Biologie/ (Bio)technologie die toereikend is om met succes een masteropleiding op het terrein van de Scheikunde/Scheikundige Technologie te volgen;

- Heeft kennisgemaakt met wetenschappelijke onderzoeksvaardigheden en ontwerpmethoden op het gebied van de Scheikunde respectievelijk de Scheikundige Technologie en heeft daarvan een proeve van bekwaamheid afgelegd;

- Is zich bewust van de mogelijkheden op de arbeidsmarkt na eventuele afsluiting van de studie met een bachelordiploma;

- Heeft kennis van de veiligheids- en milieuaspecten van de scheikunde;

- Is zich bewust van de rol van de scheikunde in de maatschappij en van het internationale karakter van de scheikunde.

Algemene vaardigheden
De Bachelor of Science in Chemistry/Chemical Engineering beheerst de algemene vaardigheden op het gebied van het presenteren en rapporteren, informatie zoeken en verwerken, computergebruik, projectmatig werken en het werken in projectgroepen. Voor een gedetailleerde beschrijving van cognitieve en communicatieve competenties wordt verwezen naar het opleidingsspecifieke deel.

Eindkwalificaties van de universitaire bacheloropleiding Moleculaire Levenswetenschappen Wageningen

Vakverbonden kennis en vaardigheden
De Bachelor of Science in Moleculaire Levenswetenschappen Wageningen:

- Heeft voldoende inzicht in de diverse specialisaties van de moleculaire levenswetenschappen die voortbouwen op de bachelorfase om een verantwoorde keuze te maken voor een vervolgopleiding;
- Heeft een gedegen theoretische en praktische basiskennis van de moleculaire levenswetenschappen[4] en de hulpvakken Natuurkunde, Wiskunde, Informatica, Biologie/ (Bio)technologie die toereikend is om met succes een masteropleiding op het terrein van de moleculaire levenswetenschappen te volgen;
- Heeft kennisgemaakt met wetenschappelijke onderzoeksvaardigheden en ontwerpmethoden op het gebied van de moleculaire levenswetenschappen en heeft daarvan een proeve van bekwaamheid afgelegd;
- Is zich bewust van de mogelijkheden op de arbeidsmarkt na eventuele afsluiting van de studie met een bachelordiploma;
- Heeft kennis van de veiligheids- en milieuaspecten van de scheikunde en genetische modificaties;
- Is zich bewust van de rol van de scheikunde en (bio)technologie in de maatschappij en van het internationale karakter ervan.

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[2] Te weten analytische chemie, anorganische chemie, biochemie, fysische chemie, organische chemie.

[3] Te weten analytische chemie, anorganische chemie, biochemie, fysische chemie, organische chemie, fysische transportverschijnselen, procesontwerp, chemische reactorkunde, scheidingsmethoden, procestechnologie, systeem- en regeltechniek, materiaalkunde.

[4] Te weten analytische chemie, anorganische chemie, biochemie, fysische chemie, organische chemie, microbiologie, biochemie, moleculaire biologie.

Algemene vaardigheden

De Bachelor of Science in Moleculaire Levenswetenschappen Wageningen beheerst de algemene vaardigheden op het gebied van het presenteren en rapporteren, informatie zoeken en verwerken, computergebruik, projectmatig werken en het werken in projectgroepen. Voor een gedetailleerde beschrijving van cognitieve en communicatieve competenties wordt verwezen naar het opleidingsspecifieke deel.

Eindkwalificaties van de universitaire bacheloropleiding Moleculaire Levenswetenschappen Nijmegen

Vakverbonden kennis en vaardigheden
De bachelor of Science in Moleculaire Levenswetenschappen Nijmegen:

- Is in staat, op basis van zijn kennis van de chemie, biologie, medische wetenschappen en bijbehorende hulpwetenschappen, om een onderzoek naar de moleculaire achtergronden van biomedische processen kritisch te analyseren, waarbij hij gebruik weet te maken van de onderlinge verbanden tussen genoemde disciplines;
- Is in staat, gebaseerd op zijn kennis en inzicht in de moleculaire structuur en reactiviteit van zowel de levende als de niet-levende materie, om theoretische en praktische analyses te verrichten aan moleculaire reacties en interacties;
- Is in staat, gebaseerd op zijn kennis en inzicht in de genetische grondslag van levende processen, om de relatie aan te geven tussen genetische informatie en biomedische processen, en daarmee een verklaring te geven voor de rol van individuele moleculen bij ziekteprocessen;
- Is in staat een verscheidenheid aan relevante, basale technieken te hanteren en heeft het vermogen zich nieuwe technische vaardigheden eigen te maken;
- Is in staat, gebaseerd op zijn theoretische en praktische vaardigheden, om een experiment op het gebied van de moleculaire levenswetenschappen probleemgericht op te zetten aan de hand van een door zichzelf gestelde hypothese, daarvan de resultaten systematisch te bewerken en kritisch te interpreteren, en vervolgens conclusies uit dit onderzoek te trekken;
- Is in staat de resultaten van zijn onderzoek op een heldere manier schriftelijk te verwoorden, gebaseerd op de opbouw van een wetenschappelijk artikel;
- Is na een oriëntatie op de mogelijke afstudeervarianten en afweging van maatschappelijke perspectieven in staat om een gefundeerde keuze te maken voor een masteropleiding. Is daarbinnen in staat om zich in een periode van een jaar theoretisch en experimenteel te specialiseren in een vakgebied dat zich bezig houdt met onderzoek aan de moleculaire basis van biologische en biomedische processen.

Algemene vaardigheden
De Bachelor of Science in Moleculaire Levenswetenschappen Nijmegen beheerst de algemene vaardigheden op het gebied van het presenteren en rapporteren, informatie zoeken en verwerken, computergebruik, projectmatig werken en het werken in projectgroepen. Voor een gedetailleerde beschrijving van cognitieve en communicatieve competenties wordt verwezen naar het opleidingsspecifieke deel.

Eindkwalificaties van de universitaire bacheloropleiding Natuurwetenschappen

Vakverbonden kennis en vaardigheden

De Bachelor of Science in Natuurwetenschappen:

- Heeft een algemeen inzicht verworven in de kernbegrippen en kenmerkende werkwijzen van de constituerende disciplines;
- Heeft zich daartoe de belangrijkste algemene biologisch-chemische, fysisch-chemische en biologisch-fysische denk- en werkwijzen hebben eigen gemaakt, nodig om multidisciplinaire natuurwetenschappelijke problemen te begrijpen in hun maatschappelijke en wetenschappelijke context;
- Kan concrete wetenschappelijke problemen binnen de natuurwetenschappen analyseren door middel van abstractie en op basis van natuurwetenschappelijke theorieën en modellen;
- Kan daartoe zelfstandig kennisbronnen in het relevante wetenschapsgebied opsporen, raadplegen en bewerken;
- Kan bestaand onderzoek naar vraagstukken van natuurwetenschappelijke aard begrijpen vanuit een basiskennis van de betreffende disciplines;
- Kan natuurwetenschappelijke vraagstellingen omzetten in een toetsbare hypothese volgens de criteria van empirisch onderzoek;
- Kan onder begeleiding deze hypotheses toetsen in de vorm van experimenten en daaraan gerelateerd theoretisch onderzoek;
- Is in staat zijn de maatschappelijke discussie over vraagstukken en problemen op multidisciplinair natuurwetenschappelijk gebied kritisch te volgen;
- Is in staat zijn een gemotiveerde keuze te maken voor ofwel het vervolg van de studie op masterniveau ofwel voor uitstroom naar een andere opleiding dan wel een functie in de samenleving.

Algemene vaardigheden
De Bachelor of Science in Natuurwetenschappen beheerst de algemene vaardigheden op het gebied van het presenteren en rapporteren, informatie zoeken en verwerken, computergebruik, projectmatig werken en het werken in projectgroepen. Voor een gedetailleerde beschrijving van cognitieve en communicatieve competenties wordt verwezen naar het opleidingsspecifieke deel.

Eindkwalificaties van de universitaire bacheloropleiding Farmaceutische Wetenschappen

Vakverbonden kennis en vaardigheden
De Bachelor of Science in Farmaceutische wetenschappen:

- Heeft voldoende inzicht in de diverse specialisaties van de farmaceutische wetenschappen die voortbouwen op de bachelorfase om een verantwoorde keuze te maken voor een vervolgopleiding;
- Heeft een gedegen theoretische en praktische basiskennis van de scheikunde (te weten analytische chemie, biochemie, organische chemie, theoretische chemie) en de farmaceutische wetenschappen, evenals de hulpvakken natuurkunde, wiskunde, informatica, biologie en medische fysiologie die toereikend is om met succes een masteropleiding op het terrein van de farmaceutische wetenschappen te volgen;
- Heeft kennis gemaakt met wetenschappelijke onderzoeksvaardigheden op het gebied van de farmaceutische wetenschappen en heeft daarvan een proeve van bekwaamheid afgelegd;

- Is zich bewust van de mogelijkheden op de arbeidsmarkt na eventuele afsluiting van de studie met een bachelordiploma;
- Heeft kennis van de veiligheids- en milieuaspecten van de farmaceutische wetenschappen;
- Is zich bewust van de rol van de farmaceutische wetenschappen in de maatschappij en van het internationale karakter van de farmaceutische wetenschappen.

Algemene vaardigheden
De Bachelor of Science in Farmaceutische wetenschappen beheerst de algemene vaardigheden op het gebied van het presenteren en rapporteren, informatie zoeken en verwerken, computergebruik, projectmatig werken en het werken in groepen. Voor een gedetailleerde beschrijving van cognitieve en communicatieve competenties wordt verwezen naar het opleidingsspecifieke deel.

Eindkwalificaties van de universitaire bacheloropleiding Bio-Farmaceutische Wetenschappen

Vakverbonden kennis en vaardigheden
De Bachelor of Science in Bio-Farmaceutische Wetenschappen:

- Heeft voldoende inzicht in de diverse specialisaties van de (bio-)farmaceutische wetenschappen en aanpalende opleidingen op het gebied van de chemie en de moleculaire levenswetenschappen die voortbouwen op de bachelorfase om een verantwoorde keuze te maken voor een vervolgopleiding;
- Heeft een gedegen theoretische en praktische basiskennis van de scheikunde (organische en analytische chemie, biochemie, moleculaire biologie) en de bio-farmaceutische wetenschappen (ontwikkeling en effecten van geneesmiddelen, actuele concepten en werkwijzen van het geneesmiddelenonderzoek), evenals hulpvakken (wiskunde, informatica, fysiologie, pathologie, anatomie, immunologie), die toereikend is om met succes een masteropleiding op het terrein van de bio-farmaceutische wetenschappen of een verwant vakgebied te volgen;
- Heeft overzicht gekregen van het vakgebied van het geneesmiddelenonderzoek en inzicht verkregen in de positie van verschillende deelgebieden binnen dit vakgebied en hun relatie tot aanpalende wetenschapsgebieden;
- Heeft inzicht verkregen in de wijze waarop bij geneesmiddelenonderzoek gangbare hypothesen via experimenten kunnen worden getoetst en hoe verworven kennis kan leiden tot theorievorming;
- Heeft kennis gemaakt met wetenschappelijke onderzoeksvaardigheden op het gebied van geneesmiddelenonderzoek en heeft daarvan een proeve van bekwaamheid afgelegd;
- Is zich bewust van de mogelijkheden op de arbeidsmarkt na eventuele afsluiting van de studie met een bachelordiploma;
- Heeft kennis van de veiligheids- en milieuaspecten van de bio-farmaceutische wetenschappen;
- Is zich bewust van de rol van de geneesmiddelenonderzoek in de maatschappij en van het internationale karakter van de (bio-)farmaceutische wetenschappen.

Algemene vaardigheden
De Bachelor of Science in Bio-Farmaceutische Wetenschappen beheerst de algemene vaardigheden op het gebied van het presenteren en rapporteren, informatie zoeken en verwerken, computergebruik, projectmatig werken en het werken in groepen. Voor een gedetailleerde beschrijving van cognitieve en communicatieve competenties wordt verwezen naar het opleidingsspecifieke deel.

Globale curriculumstructuur van een universitaire bacheloropleiding *chemie en verwante moleculaire opleidingen* in Nederland

De bacheloropleiding bestaat uit een basisprogramma van minimaal twee studiejaren. Het derde studiejaar van de bacheloropleiding omvat een substantieel deel aan chemie of verwante moleculaire vakken binnen het domein. Daarnaast kan maximaal een derde door de studenten worden ingevuld als keuzeruimte. Het is wenselijk om in het derde studiejaar ruimte in het programma te hebben voor oriëntatie op de praktijk. In het derde jaar wordt een individuele proeve van bekwaamheid afgelegd. Dat kan een onderzoeksscriptie zijn, een ontwerp of een stage.

Appendix 3: Intended learning outcomes

Bachelor’s programme Chemical Engineering

The learning outcomes of the bachelor’s programme contain the categories of domain-specific and general learning outcomes.

Domain-specific competencies are divided into three main groups:

- Chemistry: this includes the basic principles of analytical chemistry, inorganic chemistry, organic chemistry, polymer chemistry, thermodynamics, chemical bonding, catalysis, biochemistry, spectroscopy, physical chemistry, and reactor kinetics.
- Process engineering: this includes the basic principles of physical transport phenomena, applied thermodynamics, unit operations, chemical reactor engineering, process control and process design.
- Materials science: this includes the basic principles of organic, macromolecular, and inorganic synthesis, polymer technology, phase theory, interface chemistry, and materials science of metals, polymers and ceramics.

In brief, the domain-specific learning outcomes concern the command of the basic principles of mathematics, physics, computer science, process engineering, chemistry and materials science.

The general learning outcomes are divided into six categories:
a. Knowledge activation and knowledge acquisition abilities
b. Academic competencies
c. Contextual skills
d. Interactive skills
e. Design and research skills
f. Learning abilities with respect to the master’s degree program

a. Knowledge activation and acquisition abilities
Students demonstrate the ability to:
i. Re-activate relevant parts of previously acquired knowledge;
ii. Build on and apply knowledge or developments within the professional field;
iii. Quickly acquire new knowledge from disciplines closely related to one’s own discipline;
iv. Combine domain-specific knowledge and skills.

b. Academic competencies
Students demonstrate the ability to:
i. Analyze and solve simple problems in the domains of Process Engineering, Chemistry and Materials Science;
ii. Apply logical reasoning to subjects both from the own discipline and other disciplines;
iii. Independently develop and apply knowledge;
iv. Critically reflect upon own thoughts, decisions and actions.

c. Contextual skills
Students demonstrate the ability to:
i. Reflect on the relation between technology and society, through knowledge of the history of technology, philosophy of science, design methodology, and technology and ethics;
ii. Have insight into socio-economic preconditions of one’s own conduct and to analyze and discuss this subject;

iii. Have insight into the safety preconditions of one's own conduct and be able to analyze and discuss this subject;
iv. Have insight into the preconditions of environmental engineering of one's own conduct and be able to analyze and discuss this subject.

d. Interactive skills
Students demonstrate the ability to:
i. Independently operate over a long period of time in a (multidisciplinary) team, by using personal qualities, without predetermined guidelines and deadlines;
ii. To explain one's ideas and opinions univocally by clear usage, appropriate body language and correct stylistic language; both verbal and written language is used correctly, with the appropriate register for the target group (presentations, reports, discussions).

e. Design and research skills.
Students demonstrate the ability to:
i. Apply the acquired knowledge and skills in a design task or a research problem;
ii. Have insight into the design or research process by being able to take and substantiate decisions;
iii. Creatively approach and deal with a research or design problem.

f. Learning abilities with respect to the master's degree program.
Students have:
i. The professional study and work attitude necessary to successfully follow a master's degree program that is related to the bachelor's degree program;
ii. Mastered the relevant study skills to successfully follow a master's degree program that is related to the bachelor's degree program (time management, setting goals, studying books, the ability to concentrate and motivate).

Master's programme Chemical Engineering

At the end of the program the graduate demonstrates:

a. The command of specialist expertise in the field of molecular engineering, process engineering, or polymers and composites;
b. The ability to reactivate previously acquired knowledge, acquire and expand knowledge in disciplines closely related to one's own discipline, and integrate disciplinary knowledge in a multidisciplinary problem;
c. The possession of academic competences by showing the ability to think analytically and logically, to independently generate and apply knowledge, to reflect on one's own action and on the relationship between technology and society;
d. The ability to combine elements of specialist expertise and knowledge for the purpose of analyzing complex problems in the field of chemical engineering;
e. The ability and will to consider societal, socio-economic, safety and environmental preconditions of one's own conduct;
f. Demonstrates the command of interactive skills as the ability to work in a multidisciplinary and or multicultural team of experts, to present results both orally and in written form; and show leadership skills;
g. The ability to work with the basic operational skills regarding research, development and design.

Appendix 4: Overview of the curricula

Bachelor's programme Chemical Engineering

B1-1 Quarter	B1-2 Quarter	B1-3 Quarter	B1-4 Quarter
Calculus 1 5 EC	Linear Algebra 5 EC	Calculus 2 5 EC	Modelling & Simulation 5 EC Hemmes, Meinsma, Sun
Energy & Entropy 5 EC Ter Brake	Structure & Reactivity 5 EC Jonkheijm, Winnubst	Intro. Materials Science 5 EC Ten Elshof	Process Technology 5 EC Mul
Orientation Science & Technology 5 EC, Koster		Experimental Lab 2 5 EC Veugelers	Project Sustainable Energy 5 EC, Rossum
Experimental Lab 1 5 EC, Veugelers			

B2-1 Quarter	B2-2 Quarter	B2-3 Quarter	B2-4 Quarter
Inorganic Chemistry 3 EC, Winnubst	Organic Chemistry 4 EC, Cornelissen	Synthesis & Analysis Lab & Project 6 EC, Verboom	
Equilibria 1 5 EC Nijmeijer	Equilibria II 3 EC, Bouwmeester, Gardeniers	Transport Phenomena (incl.. lab) 6 EC, Brilman	
Physics of Atoms & Molecules 4 EC, Van der Hoef	Intro Transport Phenomena 4 EC, Van der Hoef	Project Chemical Technology 7 EC, Van der Ham	
	Analytical Lab 2 EC, Gardeniers	Applied Industrial Chemistry 3 EC, Verboom	Kinetics & Catalysis 5 EC, Lefferts, Seshan
Applied Molecular Spectroscopy 3 EC, Velders	Numerical Algorithm & Modelling 5 EC, Zwier		

B3-1 Quarter	B3-2 Quarter	B3-3 Quarter	B4-4 Quarter
Minor 20 EC		Chemistry & Technology Organic Materials 5 EC Grijpma, Hempenius	Bachelor Assignment 15 EC
		Sustainable Process Technology 5 EC, Brilman	
Separation Technology (incl. lab) 5 EC, Benes	Advanced Materials Science 5 EC, Ten Elshof, Koster	Optional 5 EC; PT: Process Equipment Design M&M: Chem. & Techn. Inorganic Materials	

Master's programme Chemical Engineering

Process Technoloy			
PT M1 Quarter	**PT M2 Quarter**	**PT M3 Quarter**	**PT M4 Quarter**
Chemical reaction engineering, 5 EC Brilman		Multiphase reaction technology, 5 EC Kersten	
	Thermodynamics & flowsheeting, 5 EC vd Ham	Process plant design, 10 EC, vd Ham / vd Berg	
		Process equipment design, EC co-ordinator vd Ham	

Molecules & Materials			
M&M M1 Quarter	**M&M M2 Quarter**	**M&M M3 Quarter**	**M&M M4 Quarter**
AMM Molecular and biomolecular CT, 5 EC Huskens	AMM Structure & properties of organic materials, 5 EC Vancso	AMM Structure & properties of inorganic materials, 5 EC Rijnders	AMM Applications, 5 EC Lammertink
AMM Characterization 5 EC Schön		AMM Project organic materials, 5 EC Hempenius	AMM Project inorganic materials & molecular s&t, 5 EC Koster

Appendix 5: Quantitative data regarding the programmes

Data on intake, transfers and graduates

Bachelor's programme Chemical Engineering

Bachelor intake	2005	2006	2007	2008	2009	2010	2011	Mean
Total intake per september 1	25	34	50	45	38	39	41	39
Female	3	5	12	8	3	8	10	7
	12%	15%	24%	18%	8%	21%	24%	18%
German	1	1	2	4	3	1	4	2
From other WO	1	2	4	2	0	3	0	2
From HBO			2					
Two studies(1)		1				1		
Criterion group(2)	43%	59%	69%	63%	49%	63%	56%	57%

BSc students	2005	2006	2007	2008	2009	2010	2011
Male	71	91	112	122	121	119	113
Female	16	20	27	29	26	30	31
	18%	18%	19%	19%	18%	20%	22%
Total Sept. 1	87	111	139	151	147	149	144

Bachelor dropouts per cohort

Cohort		Cumulative drop-out			
Year	number of students	after 1 year	after 2 years	until now	with P diploma
2001	27	24%	28%	40%	8%
2002	26	20%	24%	32%	0%
2003	27	50%	50%	59%	5%
2004	28	25%	32%	43%	7%
2005	25	13%	17%	38%	0%
2006	34	23%	29%	32%	0%
2007	50	16%	23%	25%	0%
2008	45	28%	35%	37%	0%
2009	38	47%	55%		0%
2010	39	14%			
Average 2001-2004		**30%**	**34%**	**43%**	**5%**
Average 2005-2010		**23%**	**32%**	**33%**	**0%**

Performances	regular students[5] mean 2001-2010	criterion group mean 2001-2010
P diploma ≤ 1 year	30%	47%
P diploma ≤ 2 years	46%	66%
P diploma final	64%	81%
BSc diploma ≤ 3 years of re-registrants	4%	6%
BSc diploma ≤ 4 years of re-registrants	25%	32%
BSc diploma ≤ 5 years of re-registrants	52%	58%
BSc diploma final of re-registrants	77%	87%

Master's programme Chemical Engineering

Master intake	2005	2006	2007	2008	2009	2010
Total intake	17	15	24	36	37	42
Female	5	3	8	11	10	10
	29%	20%	33%	31%	27%	26%
From BSc ChE	4	10	17	16	16	25
From other national BSc	-	-	-	1	2	6
From HBO	9	3	5	7	8	3
International	4	2	2	12	11	8
	24%	13%	8%	33%	30%	23%
Double Degree	-	-	-	3	3	3
Water process technology	-	-	-	5	5	4

MSc students	2005	2006	2007	2008	2009	2010	2011
Male	8	15	21	34	51	54	59
Female	8	7	8	12	22	22	21
	50%	32%	28%	26%	30%	29%	26%
Total Sept. 1	16	22	29	46	73	76	80

[5] Regular means all students who start before 1 December of an academic year and are in possession of a VWO-diploma that meets the admission requirements, this includes German students with a comparable secondary school diploma.

Performances	mean over cohorts 2002-2008
MSc diploma ≤ 2 year	61%
MSc diploma ≤ 3 years	90%
MSc diploma final	96%

Teacher-student ratio achieved

Year	Number of teaching FTEs	Number of registered BSc + MSc students	Number of BSc + MSc graduates in 2011	Number of students per teaching FTE	Number of graduates per teaching FTE
December 2011	15.1	224	68	14.8	4.5

Average amount of face-to-face instruction per stage of the study programme

Year	Scheduled hours							Non-scheduled hours				Total number of hours
	Lectures	Tutorials	Combined Lect. & Tutor.	Lab courses	Projects	Supervised self-study	Exams(2)	Projects	Self study	Bachelor assignment	Minor	
B1	118 7%	86 5%	206 12%	230 14%	112 7%	78 5%	42 3%	126 8%	682 40%	-	-	1680
	lectures-tutorials 24%											
B2	212 13%	132 8%	176 10%	256 15%	18 1%	-	50 3%	224 14%	612 36%	-	-	1680
	lectures-tutorials 31%											
B3	90 13%	30 4%	62 9%	40 6%	-	-	30 4%	140 20%	308 44%	420	560	1680
	lectures-tutorials 26%											

Year	Scheduled hours					Non-scheduled hours		Optional courses	Total number of hours for courses
	Lectures	Combination Lect. & Tutor.	Lab Projects	Design Projects	Exams(2)	Projects	Self study		
M1 M&M	48 5%	112 11%	280 29%	-	16 2%		524 53%	560	1540
M1 PT	40 5%	126 15%	-	104 12%	12 14%	205 24%	353 42%	700	1540

Appendix 6: Programme of the site visit

Management team	*Vrijdag 15 juni 08.30-09.30 uur* *Vrijdag 15 juni 14.30-15.30 uur*

Naam	*Functies*
Prof. dr. G. (Gerard) van der Steenhoven	Decaan Faculteit Technische Natuurwetenschappen
Dr. ir. B.H.L. (Ben) Betlem	Opleidingsdirecteur Scheikundige Technologie (BSc/MSc) Lid UCO Auteur zelfevaluatierapport
Dr. ir. A.G.J. (Louis) van der Ham	Voormalig Opleidingscoördinator Scheikundige Technologie (BSc/MSc) Docent Leerstoel TCCB Coördinator master track Process Technology Lid curriculumcommissie ST Mentor BSc studenten
Prof. dr. ir. J. (Jurriaan) Huskens	Plaatsvervangend Disciplinevoorzitter Scheikundige Technologie Leerstoelhouder MnF Voorzitter examencommissie Lid curriculumcommissie ST

Studenten BSc + MSc	*Vrijdag 15 juni 09.30-10.30 uur*

Naam	*Functies*	*Track*	*Jaar + bijzonderheden*
E. (Esther) Slouwerhof	Panelvertegenwoordiger eerstejaars	-	1e jaars BSc
R.T. (Rick) Driessen	2010-2011 Panel eerstejaars 2011-2012 Panelvertegenwoordiger tweedejaars Lid Onderwijskwaliteitcommissie ST 2011-2012 voorzitter Tostis	-	2e jaars BSc
C.N. (Carmen) Edelijn	2009-2010 Panel eerstejaars 2010-2011 Panel tweedejaars 2011-2012 Onderwijscommissaris studievereniging Alembic Lid curriculumcommissie ST	-	3e jaars BSc
H.C. (Hylke) Donker	2010-2011 secretaris studievereniging Alembic	-	4e jaars BSc

I.M. (Iris) Smal	Lid Onderwijskwaliteitcommissie ST Student-assistent voor Quaestio vakevaluaties 2009-2011 Lid opleidingscommissie	PT	5e jaars MSc sinds nov. 2011
K. (Khalid) El Tayeb El Obied		PT	1e jaars MSc
J. (Janneke) Veerbeek	Lid Onderwijskwaliteitcommissie ST Student-assistent voor Quaestio vakevaluaties	M&M	5e jaars (incl. BSc) MSc sinds sept. 2010 Stage: Ytkemiska Institutet, Stockholm Afstudeergroep: MnF
W.D. (Wouter) Post	2009-2011 Lid opleidingscommissie	M&M	6e jaars (incl. BSc) MSc sinds dec. 2010 Stage: Teijin Aramid BV Afstudeergroep: IM
W.H. (Hendra) Saputera		M&M	1e jaars MSc Double Degree Bandung

Docenten	*Vrijdag 15 juni 10.30-11.15 uur*

Naam	*Functies*
Dr.ir. A.G.J. (Louis) van der Ham	Voormalig Opleidingscoördinator Scheikundige Technologie (BSc/MSc) Docent Leerstoel TCCB Coördinator master track Process Technology Lid curriculumcommissie ST Mentor BSc studenten
Dr. A. (Arie) van Houselt	UD Leerstoel CPM Mentor BSc studenten
Dr. ir. P. (Pascal) Jonkheijm	UHD Leerstoel MnF Mentor BSc studenten
Prof. dr. G. (Guido) Mul	Leerstoelhouder PCS
Dr. ir. D.C. (Kitty) Nijmeijer	UHD Leerstoel MST
Prof. dr. ing. A.H.J.M. (Guus) Rijnders	Leerstoelhouder NEM Mentor BSc studenten

Opleidingscommissie	*Vrijdag 15 juni 11.30-12.00 uur*

Studenten	*Functies*
F.T. (Frank) de Groot	2010-2011 Lid Faculteitsraad TNW
M. (Maaike) Sikkink	Panel eerstejaars Panelvertegenwoordiger tweedejaars

F.M. D. (Floris) Weijland	2009-2010 Panel eerstejaars 2010-2011 Panel tweedejaars 2011-2012 bestuur studievereniging Alembic
Docenten	***Functies***
Prof. dr. ir. J.E. (André) ten Elshof	UHD leerstoel IMS Lid curriculumcommissie ST Mentor BSc studenten
Prof. dr. ir. R.G.H. (Rob) Lammertink	Leerstoelhouder SFI Coördinator master track Molecules and Materials Lid curriculumcommissie ST Mentor BSc studenten
Dr. W. (Wim) Verboom (voorzitter)	UHD leerstoel MnF Lid examencommissie

Examencommissie + studieadviseur	***Vrijdag 15 juni 12.45-13.30 uur***

Naam	***Functies***
Prof. dr. ir. J. (Jurriaan) Huskens (voorzitter)	Plaatsvervangend Disciplinevoorzitter Scheikundige Technologie Leerstoelhouder MnF Lid curriculumcommissie ST
Dr. H.J.M. (Henny) Bouwmeester	UHD Leerstoel IM Subcommissie Evaluatie toetsing
Dr. ir. D.W.F. (Wim) Brilman	UHD Leerstoel TCCB Mentor BSc studenten Subcommissie Evaluatie toetsing
Dr. W. (Wim) Verboom	UHD leerstoel MnF Voorzitter opleidingscommissie
Dr. A.J.A. (Louis) Winnubst (secretaris)	UD Leerstoel IM Mentor BSc studenten
M.A. (Marijke) Stehouwer, MA	Studieadviseur Scheikundige Technologie Studieadviseur Advanced Technology Mentor BSc studenten Lid Harde Knip commissie UT

Alumni	***Vrijdag 15 juni 13.30-14.00 uur***

Naam	***Werkt bij***	***Afgestudeerd***
Ir. S. (Suzanne) Bos	Pentair (X-flow)	November 2006
Ir. S. (Stijn) Cornelissen	ZininZin	Maart 2008
Ir. B.D. (Bindikt) Fraters	Aio leerstoel PCS	November 2010
Ir. M. (Marion) van Lotringen	Exxon	Februari 2011
Ir. M. (Maarten) Nijland	Aio leerstoel IMS	Mei 2010
Ir. P.W. (Wessel) Spek	NEM steam generating equipment	Juni 2007

Appendix 7: Theses and documents studied by the committee

Prior to the site visit, the committee studied the theses of the students with the following student numbers:

Bachelor theses

0121665	0169269	0152420
0146021	0150169	0093068
0148636	0039985	0171794
0150150	0139777	0198404
0174769	0165646	0182702

Master theses

0150606	0123188	1065076
0042285	0214906	1029355
0088358	0067040	1023977
0184446	1000829	1022482
0214736	0051675	0217530

During the site visit, the committee studied, among other things, the following documents (partly as hard copies, partly via the institute's electronic learning environment).

- Course manuals bachelor's and master's programme
- Standard / basic books
- Tests, assessment criteria, assessment forms and answers
- Minutes of the Board of Examiners 2009- 2011
- Minutes of het Programme committee 2009 – 2011
- Assessment report on bachelor's and master's programme chemical engineering, QANU, 2007
- Assessment report on chemical engineering research, QANU, 2010.

Appendix 8: Declarations of independence

nvao
nederlands - vlaamse accreditatieorganisatie

ONAFHANKELIJKHEIDS- EN GEHEIMHOUDINGSVERKLARING

INDIENEN VOORAFGAAND AAN DE OPLEIDINGSBEOORDELING

ONDERGETEKENDE

NAAM: Dhr. Peter Janssens

PRIVÉ ADRES: Finlandstraat 21
6137 KV Sittard

IS ALS DESKUNDIGE / SECRETARIS GEVRAAGD VOOR HET BEOORDELEN VAN DE OPLEIDING:

QANU visitatie scheikunde
Twente + Groningen

AANGEVRAAGD DOOR DE INSTELLING:

VERKLAART HIERBIJ GEEN (FAMILIE)RELATIES OF BANDEN MET BOVENGENOEMDE INSTELLING TE ONDERHOUDEN, ALS PRIVÉPERSOON, ONDERZOEKER / DOCENT, BEROEPSBEOEFENAAR OF ALS ADVISEUR, DIE EEN VOLSTREKT ONAFHANKELIJKE OORDEELSVORMING OVER DE KWALITEIT VAN DE OPLEIDING TEN POSITIEVE OF TEN NEGATIEVE ZOUDEN KUNNEN BEÏNVLOEDEN;

1

nvao
nederlands - vlaamse accreditatieorganisatie

VERKLAART HIERBIJ ZODANIGE RELATIES OF BANDEN MET DE INSTELLING DE AFGELOPEN VIJF JAAR NIET GEHAD TE HEBBEN;

VERKLAART STRIKTE GEHEIMHOUDING TE BETRACHTEN VAN AL HETGEEN IN VERBAND MET DE BEOORDELING AAN HEM/HAAR BEKEND IS GEWORDEN EN WORDT, VOOR ZOVER DE OPLEIDING, DE INSTELLING OF DE NVAO HIER REDELIJKERWIJS AANSPRAAK OP KUNNEN MAKEN.

VERKLAART HIERBIJ OP DE HOOGTE TE ZIJN VAN DE NVAO GEDRAGSCODE.

PLAATS: Geleen DATUM: 16-04-2012

HANDTEKENING:

2

nvao
nederlands - vlaamse accreditatieorganisatie

ONAFHANKELIJKHEIDS- EN GEHEIMHOUDINGSVERKLARING

INDIENEN VOORAFGAAND AAN DE OPLEIDINGSBEOORDELING

ONDERGETEKENDE

NAAM: Etienne SCHACHT

ADRES: Rysseveldstraat, 99
B-8840 STADEN, België

IS ALS DESKUNDIGE / SECRETARIS GEVRAAGD VOOR HET BEOORDELEN VAN DE OPLEIDING:

ZIE BIJLAGE

AANGEVRAAGD DOOR DE INSTELLING:

ZIE BIJLAGE

VERKLAART HIERBIJ GEEN (FAMILIE)RELATIES OF BANDEN MET BOVENGENOEMDE INSTELLING TE ONDERHOUDEN, ALS PRIVÉPERSOON, ONDERZOEKER / DOCENT, BEROEPSBEOEFENAAR OF ALS ADVISEUR, DIE EEN VOLSTREKT ONAFHANKELIJKE OORDEELSVORMING OVER DE KWALITEIT VAN DE OPLEIDING TEN POSITIEVE OF TEN NEGATIEVE ZOUDEN KUNNEN BEÏNVLOEDEN;

1

nvao
nederlands - vlaamse accreditatieorganisatie

VERKLAART HIERBIJ ZODANIGE RELATIES OF BANDEN MET DE INSTELLING DE AFGELOPEN VIJF JAAR NIET GEHAD TE HEBBEN;

VERKLAART STRIKTE GEHEIMHOUDING TE BETRACHTEN VAN AL HETGEEN IN VERBAND MET DE BEOORDELING AAN HEM/HAAR BEKEND IS GEWORDEN EN WORDT, VOOR ZOVER DE OPLEIDING, DE INSTELLING OF DE NVAO HIER REDELIJKERWIJS AANSPRAAK OP KUNNEN MAKEN.

VERKLAART HIERBIJ OP DE HOOGTE TE ZIJN VAN DE NVAO GEDRAGSCODE.

PLAATS: Rotterdam DATUM: 22/03/2012

HANDTEKENING:

2

nvao nederlands - vlaamse accreditatieorganisatie

ONAFHANKELIJKHEIDS- EN GEHEIMHOUDINGSVERKLARING

INDIENEN VOORAFGAAND AAN DE OPLEIDINGSBEOORDELING

ONDERGETEKENDE

NAAM: Maja Medić

PRIVÉ ADRES: Rijnsburgerweg 124 G31
2333 AG Leiden

IS ALS DESKUNDIGE / SECRETARIS GEVRAAGD VOOR HET BEOORDELEN VAN DE OPLEIDING:

AANGEVRAAGD DOOR DE INSTELLING:

VERKLAART HIERBIJ GEEN (FAMILIE)RELATIES OF BANDEN MET BOVENGENOEMDE INSTELLING TE ONDERHOUDEN, ALS PRIVÉPERSOON, ONDERZOEKER / DOCENT, BEROEPSBEOEFENAAR OF ALS ADVISEUR, DIE EEN VOLSTREKT ONAFHANKELIJKE OORDEELSVORMING OVER DE KWALITEIT VAN DE OPLEIDING TEN POSITIEVE OF TEN NEGATIEVE ZOUDEN KUNNEN BEÏNVLOEDEN;

1

VERKLAART HIERBIJ ZODANIGE RELATIES OF BANDEN MET DE INSTELLING DE AFGELOPEN VIJF JAAR NIET GEHAD TE HEBBEN;

VERKLAART STRIKTE GEHEIMHOUDING TE BETRACHTEN VAN AL HETGEEN IN VERBAND MET DE BEOORDELING AAN HEM/HAAR BEKEND IS GEWORDEN EN WORDT, VOOR ZOVER DE OPLEIDING, DE INSTELLING OF DE NVAO HIER REDELIJKERWIJS AANSPRAAK OP KUNNEN MAKEN.

VERKLAART HIERBIJ OP DE HOOGTE TE ZIJN VAN DE NVAO GEDRAGSCODE.

PLAATS: Rotterdam DATUM: 22-03-2012

HANDTEKENING: maja medić

2

Q339

nvao
nederlands - vlaamse accreditatieorganisatie

ONAFHANKELIJKHEIDS- EN GEHEIMHOUDINGSVERKLARING

INDIENEN VOORAFGAAND AAN DE OPLEIDINGSBEOORDELING

ONDERGETEKENDE

Prof. Dr. Jeroen A. van Bokhoven
Institute for Chemical and Bioengineering
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NAAM:

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PRIVÉ ADRES: Toblerstrasse 90
8044 ZH Zürich
Switzerland

IS ALS DESKUNDIGE / SECRETARIS GEVRAAGD VOOR HET BEOORDELEN VAN DE OPLEIDING:

Scheikunde Q339

AANGEVRAAGD DOOR DE INSTELLING:

VERKLAART HIERBIJ GEEN (FAMILIE)RELATIES OF BANDEN MET BOVENGENOEMDE INSTELLING TE ONDERHOUDEN, ALS PRIVÉPERSOON, ONDERZOEKER / DOCENT, BEROEPSBEOEFENAAR OF ALS ADVISEUR, DIE EEN VOLSTREKT ONAFHANKELIJKE OORDEELSVORMING OVER DE KWALITEIT VAN DE OPLEIDING TEN POSITIEVE OF TEN NEGATIEVE ZOUDEN KUNNEN BEÏNVLOEDEN;

1

VERKLAART HIERBIJ ZODANIGE RELATIES OF BANDEN MET DE INSTELLING DE AFGELOPEN VIJF JAAR NIET GEHAD TE HEBBEN;

VERKLAART STRIKTE GEHEIMHOUDING TE BETRACHTEN VAN AL HETGEEN IN VERBAND MET DE BEOORDELING AAN HEM/HAAR BEKEND IS GEWORDEN EN WORDT, VOOR ZOVER DE OPLEIDING, DE INSTELLING OF DE NVAO HIER REDELIJKERWIJS AANSPRAAK OP KUNNEN MAKEN.

VERKLAART HIERBIJ OP DE HOOGTE TE ZIJN VAN DE NVAO GEDRAGSCODE.

PLAATS: Zürich DATUM: 09 07 2012

HANDTEKENING:

2

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ONAFHANKELIJKHEIDS- EN GEHEIMHOUDINGSVERKLARING

INDIENEN VOORAFGAAND AAN DE OPLEIDINGSBEOORDELING

ONDERGETEKENDE

NAAM: Prof. Dr. Jürgen Heck

PRIVÉ ADRES: Süderoogstieg 17
D - 22926 Ahrensburg

IS ALS DESKUNDIGE / SECRETARIS GEVRAAGD VOOR HET BEOORDELEN VAN DE OPLEIDING:

Scheikunde

AANGEVRAAGD DOOR DE INSTELLING:

QANU

VERKLAART HIERBIJ GEEN (FAMILIE)RELATIES OF BANDEN MET BOVENGENOEMDE INSTELLING TE ONDERHOUDEN, ALS PRIVÉPERSOON, ONDERZOEKER / DOCENT, BEROEPSBEOEFENAAR OF ALS ADVISEUR, DIE EEN VOLSTREKT ONAFHANKELIJKE OORDEELSVORMING OVER DE KWALITEIT VAN DE OPLEIDING TEN POSITIEVE OF TEN NEGATIEVE ZOUDEN KUNNEN BEÏNVLOEDEN;

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VERKLAART HIERBIJ OP DE HOOGTE TE ZIJN VAN DE NVAO GEDRAGSCODE.

PLAATS: Hamburg DATUM: 9.7.2012

HANDTEKENING: [signature]

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ONAFHANKELIJKHEIDS- EN GEHEIMHOUDINGSVERKLARING

INDIENEN VOORAFGAAND AAN DE OPLEIDINGSBEOORDELING

ONDERGETEKENDE

NAAM: José van Zwieten

PRIVÉ ADRES: Croesestraat 17
3522 AA Utrecht

IS ALS ~~DESKUNDIGE~~ / SECRETARIS GEVRAAGD VOOR HET BEOORDELEN VAN DE OPLEIDING:

Scheikunde en Scheikundige technologie

AANGEVRAAGD DOOR DE INSTELLING:

Rijksuniversiteit Groningen en Universiteit Twente

VERKLAART HIERBIJ GEEN (FAMILIE)RELATIES OF BANDEN MET BOVENGENOEMDE INSTELLING TE ONDERHOUDEN, ALS PRIVÉPERSOON, ONDERZOEKER / DOCENT, BEROEPSBEOEFENAAR OF ALS ADVISEUR, DIE EEN VOLSTREKT ONAFHANKELIJKE OORDEELSVORMING OVER DE KWALITEIT VAN DE OPLEIDING TEN POSITIEVE OF TEN NEGATIEVE ZOUDEN KUNNEN BEÏNVLOEDEN;

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VERKLAART HIERBIJ OP DE HOOGTE TE ZIJN VAN DE NVAO GEDRAGSCODE.

PLAATS:
Rotterdam

DATUM:
22-9-2012

HANDTEKENING:

2