Assessment Policy
Department of Chemical Engineering and Chemistry

Final version, May 2021

List of abbreviations and acronyms

AEB	(Chair committee Exams Bachelor) *Adviescommissie Examens Bacheloropleidingen*
AEM	(Chair committee Exams master) *Adviescommissie Examens Masteropleidingen*
BC	Bachelor College
BKO	Basic Teaching Qualification for Teachers (*Basiskwalificatie Onderwijs*)
CBL	Challenge Based Learning
CE&C	Chemical Engineering and Chemistry
CvB	College van Bestuur
DBL	Design Basesd Learning
EC	Examination committee
ESA	Education and Student Affairs
GS	Graduate School
IChemE	Association of Chemical Engineers
ITK	Institutional Education Audit (*Instellingstoets kwaliteitszorg*)
JPC	Joint Program Committee
NVAO	Dutch Flemish Accreditation Organization (*Nederlands-Vlaams AccreditatieOrgaan)*
PER	Program and Examination Regulations
STEP	Secure test environment protocol
TA	Teaching/Teacher assistant
TS	Teacher support officer, an educational technologist who helps teachers with education innovation
WHW	Dutch Higher Education and Scientific Research Act *(Wet op het Hoger Onderwijs en Wetenschappelijk onderzoek)*

Contents

This document is an updated version of the Assessment policy document of the department of Chemical Engineering and Chemistry (CE&C) 2015. The update of the institutional TU/e Exam framework as well as recent developments with respect to assessment at the department form the basis of the changes made in the departmental assessment policy.

Version 3.0

Advice:

Version 2.1	Chairmen of the education committee, Examination committee and program director.
Version 2.2	Chairmen of the education committee, Examination committee and program director.
Version 2.3	Education committee OCST 18 December 2019
Version 2.3	Examination committee ECST 27 November 2019
Version 3.0	Departmental Board 10 May 2021

Approved by:
Departmental Board d.d. 10 May 2021

Relevant documents and decisions:
TU/e Exam framework, 2019
TU/e Code of scientific conduct, 2014
Central Exam Regulations TU/e, 2019

Document administration:

The management, assurance and updating of this document is the responsibility of the program director of the CE&C department. The document "Assessment policy, Department of Chemical Engineering and Chemistry" is reviewed annually and updated when necessary.

Version management

1.0	FB-ST	March 2014
2.0	FB-ST	8 June 2015
3.0	FB-ST	10 May 2021

1 Introduction

This document is an updated version of the assessment policy document of the CE&C department drafted in 2015. In this document, the vision and policy of the department is described, with a focus on assuring and safeguarding the quality of assessment within the programs offered by the department, taking into account the guidelines as described in the document 'TU/e Exam framework 2019'.

Within the CE&C department, the education committee OCST and its subcommittee the quality assurance committee CKST are responsible for safeguarding the quality of education. The examination committee ECST is responsible for safeguarding the quality of assessments. The responsibility for safeguarding the quality of the organization of final exams is taken at institutional level. With reference to the document 'TU/e Exam framework 2019', Appendix 1 shows the responsibilities of different stakeholders with respect to exams.

The CE&C department offers two programs, both accredited by IChemE[1] and NVAO[2]: The BSc program in Chemical Engineering (CROHO-number 56960) within the Bachelor College comprising the major Chemical Engineering and Chemistry; And the MSc program in Chemical Engineering (CROHO-number 60437) which is part of the Graduate program Chemical Engineering and Chemistry.

In view of NVAO re-accreditation of the programs, an accreditation committee reviewed the programs in 2018. The committee has given both degree programs a final assessment of Good (standard 1 Intended learning outcomes and 4 Achieved learning outcomes were evaluated as Good; standard 2 teaching and learning environment and 3 assessment were evaluated as sufficient). In its assessment report, the committee specifically expressed that the objectives of both programs have been well-translated into the intended learning outcomes of the programs; that the course examinations are challenging; that students having completed the programs reached the intended learning outcomes; and that the committee regards the graduates of the programs to be very well prepared to continue their studies at master level (for the BSc graduates) and both PhD positions and jobs in industry (for MSc graduates). The department of CE&C views this as a substantiation that the departmental assessment policy and its implementation in the degree programs is sound and effective.

2 Vision on Education and Assessment

2.1 Vision on education

The CE&C department is fully committed to the mission and vision of Eindhoven University of Technology (TU/e). TU/e strives to be a research-driven and design-oriented university of international standing, where excellent research and excellent education go hand in hand. TU/e focusses on a balanced approach towards education, research and valorization of knowledge in the areas of engineering science and technology. The outlines of TU/e's vision on education are described in the booklet 'Engineers for the Future', published in 2013. Core elements of this vision include:

- The pursuit of excellence, in which the connection between education and research is the central pillar.
- Small-scale education and master-apprentice interaction as key components of academic education.
- Internationalization of the student population and a greater diversity of students.
- Teaching that is driven by student demand, with a stronger tutoring role for the teaching staff.
- An important role for ICT in teaching large groups of students and in lifelong learning.
- Professional development of the educators that transcends basic university teaching qualifications.
- Greater emphasis on multidisciplinarity.
- Greater emphasis on output qualifications in education and in educational quality assurance.
- In due course, a considerable expansion of TU/e education aimed at lifelong learning and a substantial involvement of the business world.

[1] IChemE: Institution of Chemical Engineers

[2] NVAO: Dutch Flemish Accreditation Organization

With these core elements in mind, TU/e has defined guidelines for the structure of bachelor programs (Guidelines Bachelor College) and graduate programs (guidelines graduate schools).

The structure of the programs offered by the CE&C department comply with the regulations set by the Bachelor College and Graduate School. At the basis, research and education are intertwined, especially in the master's program. In the bachelor's degree program, a common basis is laid for both master's tracks (Chemical Process Technology and Molecular Systems & Materials Chemistry), supported by courses in mathematics, physics and physical chemistry. Students conclude the program with a bachelor final project conducted in the research groups within the department or at partner institutions. In the master's program, the master tracks offered by the department are directly linked to the research focus areas of the department and the graduation project forms a substantial part of the program.

Both programs are an elaboration of clearly formulated learning outcomes defining the competences of graduates. These Learning Outcomes not only describe the scientific knowledge and skills, but also competences with respect to conducting research and design, communication and societal awareness (see Appendix 2a, b). The learning outcomes of the programs comply with BSc/MSc requirements as formulated by the Dublin descriptors, as shown in Appendix 3a, b.

2.2 Vision on assessment

The department has drawn up its assessment policy based on the guidelines defined at institutional level. At TU/e, assessments are used to test the level at which the student has mastered the material (a tool of learning) as well as to help students to learn (a tool for learning). A set of agreed rules enable a careful balance between the judgment (summative) and assistance (formative) function of tests. Summative assessments are delivered at the end of the course, whereas formative assessments occur throughout the course (in most cases during guided self-study sessions), to encourage students to study regularly and provide insight into their progress.

All curriculum components are assessed using an assessment method appropriate to the curriculum component (see Table 2.1 and the course descriptions published in the OSIRIS catalogue). By using a variety of study methods and corresponding assessment methods, the department aims to sufficiently assess knowledge, understanding, applied knowledge and skills. In practicals and design based learning (DBL)/challenge based learning (CBL) projects where students work in teams, group assessment as well as individual assessment takes place. The assessment of skills occurs throughout the curriculum in the different modules and projects. Except for experimental work, all final exams are offered twice a year.

The examiners who are responsible for assessments are all academic staff members and are experienced in setting up, grading and evaluating assessments. The examiner is the senior lecturer of the curriculum component concerned. Students, PhD's and post-doctoral researchers, if they have the right expertise, can offer valuable assistance in testing and assessment under the supervision of an examiner. However, the deployment of assistants demands a number of requirements and measures to guarantee reliability and validity and to restrict the chances of fraud.

Hence, the following restrictions apply with regard to the use of students:

- Students cannot be used as proctors for final testing.
- Students cannot be used to process grades.
- Students have no access to final tests and the associated response models before the tests have been administered.

Students must also approach the responsibilities delegated to them upon appointment with professionalism and integrity. To this end, contracts must be signed specifying the rights and obligations of the student and the university. Signing for non-disclosure concerning confidential information (e.g. student and assessment details) constitute an important part of these contracts. The examination committee ensures that these contracts are signed.

Table 2.1: Assessment methods used for different study methods

Study methods	Assessment methods used
Lectures	A combination of written exam (open book or closed book), (group) assignments, and /or oral exam. Use of intermediate and final (e-) assessments.
Practicals	Oral/written test of theory and experiments (before, after), execution of experiments (implies obligatory attendance), written report (measurement report, fixed/open format), presentation, skills assessment.
Design-based learning projects (DBL)/ Challenge-based learning projects (CBL)	A combination of various methods to be determined by lecturers: individual testing of theory by means of written exam (optional), skills assessment, registration of attendance, peer review, individual input in final discussion, individual contribution to group process, final discussion with the group, written reports, oral presentations and/or posters, skills assessments.
Bachelor final project	Oral test of theory and experiments (before, during and after execution), execution of project/experiments, written report, reflection report, presentation, poster.
Industrial internship	Final report, presentation, student's communication during (the preparation for) the internship, reflection report.
Graduation project	Oral test of theory and experiments (before, during and after execution), execution of project/experiments, written report, presentation.

E-assessment

A recent development within TU/e is the implementation of e-assessment for formative and summative assessments. The department uses these methods for different purposes:

1. As formative interim assessments to enhance students learning by providing them with timely feedback on their learning;
2. As a tool to engage students during lectures and provide teachers with insight on students understanding by delivering short e-assessments during these lectures;
3. As summative assessment in a modular setting to foster active learning during the whole education period;
4. As a means to make more time available for students supervision by reducing the time needed for grading exams.

To secure a safe assessment environment TU/e has developed, in conjunction with a partner from the software industry, the Secure Test Environment Protocol (STEP) which is currently used for summative e-assessment.

Lecturers at the department of CE&C are assisted in setting up and implementing e-assessment by a teacher support officer (TS). At institutional level, instruction materials are being developed which will be published on the intranet in due time.

2.3 Vision on fraud

A TU/e diploma is highly valuable. Students, society and the labor market need to be able to trust the value of this diploma. At TU/e, it is made clear to students that committing fraud[3] is incompatible with the conduct that is expected of them as future scientists and engineers. The Code of Scientific Conduct (2014), developed by TU/e, is a point of reference for TU/e fraud policy. This code was based on the national VSNU Code of Conduct, which

[3] Any action or failure to act on the part of a student that makes it partially or completely impossible for the examiner to form an accurate opinion of his or her knowledge, understanding and skills, and/or deliberate attempts on the part of a student to influence any part of the examination process for the purpose of influencing the results of the examination is considered as fraud. Plagiarism is a specific type of fraud. This equally applies to any facilitating or complicit actions of student assistants in committing fraud by students.

states that: “(employees of) institutes that fulfill a societal role are held to a proper exercise of their duties”. TU/e has an integral policy on fraud consisting of four elements for the purpose of maintaining a culture of academic integrity:

1. Informing: The boundaries of what is permissible is communicated to the student in a clear manner by the university starting from the first year of enrolment: banners and flyers during exam weeks, email prior to the start of the exam period, information provision during mentor sessions to all first year students. During each written exam, students are informed which tools they may use, and which documents they may consult in case of open ended exams. This information is included in the cover page of the written exam. In case of mid-term assessments, projects and assignments, students are informed that plagiarism is unacceptable.
2. Prevention: Any situations conducive to fraud will be avoided by the university and its students. For example, during final exams sufficient invigilators are set in; for summative e-assessments the Secure Test Environment Protocol (STEP) is use; to prevent students committing plagiarism, it is mandatory for BSc students to take a workshop (offered by the Information and Expertise Center) about how to use correct referencing and paraphrasing.
3. Detection: The University will ensure that in case cheating occurs during examinations this is detected by invigilators and reported to the Examinations committee involved. Reports and assignments are checked for plagiarism with the use of appropriate software packages (currently Urkund).
4. Imposing sanctions: In the event of fraud, sanctions will be imposed on the offending students that, in light of the breach of trust, are appropriate to the type of fraud committed. During AEB/AEM meetings, Chairmen of examination committees exchange cases about fraud and corresponding sanctions.

In the case of suspicion of fraud, the examination committee of the department in question is responsible for dealing with the student. Due to the share of elective courses and the supra- departmental basic courses, where there is collaboration in multidisciplinary teams, an action protocol has been designed for supra-departmental courses, to ensure equal treatment of students from different study programs and to prevent setting precedents.

In the case of the suspicion of fraud by student assistants both the examination committee and the supervisor of the student assistant are responsible for dealing with them. A protocol has been developed to guide this process.

3 Assuring and safeguarding the quality of assessment

3.1 Quality assurance cycle

In order to safeguard the quality of the programs, the CE&C department has a quality assurance system in place which consists of the following steps:

1. Drafting an education plan and corresponding assessment plan for the whole program. These plans are described in the Program and Education Regulations with corresponding evaluation plan, the Examination Regulations, the education guide, OSIRIS Catalogue and in Canvas.
2. Executing the education plan: delivering courses, projects and practicals that constitute the curriculum and facilitating the necessary means for teachers and students.
3. Executing the evaluation plan: discussing the outcomes of the evaluations with stakeholders and defining which actions need to be taken in order to address points of concern that raise from these evaluations;
4. Checking whether the actions mentioned under 3 are executed before the next delivery of the specific part of the curriculum.

Appendix 4 shows how the different responsibilities with respect to quality of **assessments** are divided between examination committee and management.

3.2 Assuring the quality of assessments

The primary responsibility for the quality of assessments is with examiners whereas the examination committee is responsible for safeguarding the quality of assessments. As starting point examiners are expected to use the competence "testing and assessment" which is part of the BKO[4]. Each assessment should meet the following criteria: transparency, validity and reliability:

Transparency: prior to the start of the course, students are clearly informed about how and on what they are assessed. A brief description is published in OSIRIS catalogue; a detailed description is published on canvas, either through the syllabus of the course or an assessment plan[5].

Validity: the assessment covers the learning objectives. In validity, content (congruent with the learning objectives), level (the level of difficulty) and representativeness play a role;

Reliability: the assessment makes a meaningful distinction between the students who have a good or less good command of the learning objectives. The quality of the assessment plays a role here (distinctive character, minimal chance of gambling, clarity), the circumstances under which the test is administered (standardization and objectivity) and the way in which the results are assessed (objective, accurate, realistic).

Efficiency: There are two sides to efficiency: the amount of assessment moments, the spreading of deadlines etc. must be in proportion to the learning process. Efficiency also relates to the effort of the lecturer in relation to assessing the achievement of the learning outcomes by students.

Tables 3.2 show the measures taken to assure the quality of assessments.

Table 3.2: Measures taken by the department to assure the validity, transparency and reliability of assessments

	Measures taken before the exam
Transparency	In OSIRIS catalogue the assessment format is described. Prior to the start of the course, it is clearly mentioned in OSIRIS and CANVAS how the course will be assessed and how the final grade is calculated.
	In each written assessment, the total score for the assessment as well as per question is clearly stated.
	Each written assessment contains a cover page with instructions for students and invigilators.
	Students are offered the opportunity to take practice exams which are representative of the actual exam.
Validity	In the assessment plan of the course, Examiners describe how the different learning objectives are assessed.
	The lecturer defines beforehand how the subjects covered in the course are assessed and the level of learning objectives to be tested (e.g. knowledge, comprehension, application, analysis, synthesis, evaluation).
	The assessments are reviewed by at least one peer. Examiners can ask PhD students who supervised the guided self-study sessions to make the assessment prior to assessment delivery to check its validity.
	A copy of the exam which is reviewed by two examiners is handed in to the examination committee one week before the exam takes place.
Reliability	For each assessment examiners should have a model answer with a marking scheme.
	There are at least two examiners involved in composing and grading assessments. In most cases, each examiner will grade a specific part of the assessment. PhD students may be involved in checking exams under supervision of the responsible examiner. Final grading is always done by an Examiner who is nominated by the Examination committee.

[4] Basic Teaching Qualification for higher education

[5] Assessment Plan Template-CE&C

	Measures taken before the exam
Efficiency	Each quarter, the department makes an inventory of dates of interim tests and deadlines for reports and presentations and communicates this to the lecturers involved in the quarter for a certain year. Furthermore, in the final exam planning exams are spread as much as possible over the exam weeks. TU/e has made a number of tools available (ANSDelft, Cirrus, Canvas quizzes) to make the assessment process less time consuming for lecturers.

3.3 Safeguarding the quality of assessments

The examination committee

The examination committee is an independent body within the department. The most important task with regard to assessment is safeguarding of the quality of assessments and exams and the achievement of the intended learning outcomes by graduating students.

Examination committee members possess the expertise needed for fulfilling their roles to the desired level. The dean gives the members a hearing and appoints them, and has final responsibility for their performance, and for that of the committee. There are schooling, advice, and support options available to the examination committees. The safeguarding of the quality of testing and assessing is covered in the TU/e examination committee examination regulations; there is also an additional focus on the composition, appointments, work methods, and duties of the examination committee. For the details of the departmental approach to testing and assessment policy, reference is made in the examination regulations to the departmental assessment policy document. Each year, the examination committee ensures that the department sufficiently assesses knowledge, understanding, applied knowledge and skills by giving advice on the program and education regulations (PER) in which the program components including corresponding study methods and assessment methods are described.

Furthermore, the examination committee is proactively involved in the quality assurance processes and procedures at the department. The proactive role of an examination committee is shaped by, among other things:

- Consultation once a year between the chair of the examination Commitee and the Departmental Board;
- Consultation twice a year between the chair of the examination Commitee, program committee and the program director;
- Actively monitoring the assessment process within the department.

Through the joint chair meeting AEB/AEM, advice is regularly provided to the Deans BC and GS. The examination committee, whose members are appointed by the dean, operates according to the role, responsibilities and duties set out in the WHW, and in a visibly independent and expert manner.

The examination committee acts in accordance with its legal tasks, for which purpose the committee holds monthly meetings. Recurrent tasks are:

- establishing the results of (final) examinations;
- deciding on requests for deviations from the program;
- deciding on requests for exemptions with respect to certain examinations;
- deciding on other requests for deviation from the stipulations in the Education and (final)
- Education Regulations;
- dealing with instances of fraud;
- dealing with requests for a second assessment;
- safeguarding the quality of exams.

The examination committee issues an annual report that is discussed together with the department board. Possible actions taken for improvement are described in the annual report for education. The annual report includes also the resolutions of the Examination Committee to shape or improve the safeguarding of quality of exams for the next report period.

The program committee

The (joint) program committee has an advising role regarding the quality of education, including assessment. Through students representatives, input about feasibility of the assessment plan and assessment methods can be gathered and discussed. The result of this discussion is shared with the program director and examination committee.

Measures for safeguarding the quality of assessments

The examination committee takes specific measures for safeguarding the quality of an assessment, see table 3.3. In this process, the quality assurance committee assists the examination committee by providing students' opinion as to whether the assessments were representative of the learning objectives of the curriculum component, whether the students had enough time to sit the examinations, and whether the questions were clearly formulated. Furthermore, the quality assurance committee provides the examination committee periodically with an analysis of the results of examinations.

Table 3.3: Measures taken by the examination committee to check the validity, transparency and reliability of assessments

	Measures taken after the exam
Transparency	Through course surveys, students can report any irregularities that occurred during the exams. Every quarter, the examination committee receives a report of these irregularities and takes necessary actions when needed.
	The invigilators make a short report of each exam session. An overall report of all exams taken during the exam period is sent by ESA to examination committees. In case of irregularities, the examination committee takes further actions needed based on these reports.
Validity	Through course surveys, students give their views on the representativeness of the assessment. The examination committee receives an overview of these findings each quarter and takes necessary actions when needed.
	In case of irregularities (complaints, success rates are too high (>90%) or too low (<60%), the examination committee may start an investigation.
	Every three years, the department organizes a session with external experts to review exams and corresponding marking schemes, and a random selection of students' detailed exams and project reports.
Reliability	Examiners analyze the assessment results and in case of ambiguous or poor performing questions adjust the marking scheme after informing the examination committee. Examiners assure that no student is disadvantaged after adjustment of the marking scheme.
	The department organizes approximately 3 years after the NVAO accreditation an external review of exams of CE&C courses. A first pilot will be performed in 2022 during which randomly selected courses will be screened by external experts.
Efficiency	Through course surveys, students give feedback about the study load within the course and quartile and whether the assessment methods used are appropriate.

Safeguarding the quality of Examiners

The quality of examiners is safeguarded through monitoring and through the provision of feedback on the quality of exams and assessments. Since the academic year 2010-2011, the examination committee has issued an annual report of its activities, including reports on the activities relating to the expertise of the examiners.

Safeguarding a safe process for exam construction, taking, grading and archiving

In recent years TU/e has implemented specific software that facilitate exam construction and grading (Cirrus, Oncourse, AnsDelft). Teachers are assisted by Teacher Support officers and in some cases Teaching/teacher assistants (PhD students and postdocs for summative assessment and Student assistants for building large question banks for formative assessments). Another development is a new process for printing and archiving exam papers which is currently being implemented. In view of these new processes, TU/e has updated the document Central Exam Regulations @TU/e and drafted instruction manuals for teachers. Responsibilities and

actors in safeguarding the validity, reliability, and transparency of assessment are described in the assessment policy document and the TU/e Central Examination Regulations.

	Regulations where Safety measure are described
Exam construction	Assessment policy, department of Chemical Engineering and Chemistry 2019 Module 'Assessment' in BKO program plan.
Exam taking	Assessment policy, department of Chemical Engineering and Chemistry 2019 Central Exam Regulations TU/e, 2019
Exam grading	Module 'Assessment' in BKO program plan.
Exam archiving	Program and Exam Regulations

5 Safeguarding the attainment of the learning outcomes of the program

To safeguard the quality of the assessment of the bachelor's final project, the industrial internship and the master's graduation project, the CE&C department has drawn up protocols for the assessment procedures that are included in the Examination Regulations. The protocols are accompanied by lists of criteria for the assessors, and the model of the assessment form to be used. The protocols clearly establish by whom, when and how the assessment should be made (including which aspects should be considered to what extent and which sub-parts of the assessment may or may not be compensated by other sub-parts of the assessment). The procedure in the event of an insufficient grade is described as well. Following the recommendations of the NVAO accreditation committee the assessment forms for the bachelor's final project and the master's graduation project now include more space for examiners to add extensive written comments about students' performance. Furthermore, the various criteria for the different levels for professional skills have been specified in a rubric as described in the document 'Professional skills @ CE&C'.

The assessment of the Bachelor's final project is done by two examiners being a(n) (assistant/associate) professor at the CE&C department, one of which being the supervisor of the project. The assessment of the industrial internship in the Master's is done by the responsible lecturer in consultation with the external supervisor for the industrial internship. For the graduation project in the master, the assessment is done by a committee in which at least three examiners sit in addition to the graduation supervisor being a(n) (associate) professor. At least one of these members may not belong to a research group where the project has taken place.

The use of the assessment forms according to the prescribed model is mandatory. The examination committee has access to all assessment forms and supervises compliance with the protocols. Each graduate has to sign the TU/e code of scientific conduct and include this form in the report of the final bachelor project/MSc thesis.

Each year, the department issues an annual report on education in which an overview of grades of graduation projects and final bachelor projects over the preceding three years is reported and analyzed to see if there is any misbalance in the awarded grades in the different research groups over the years to avoid mark inflation and systematic bias. The Bachelor final project and graduation project are evaluated through curriculum surveys. In these evaluations, students can give their opinion on various aspects of the BSc and MSc graduation, the supervision and the evaluation of the thesis. For the industrial internship, separate surveys are held at least once in three years. One in two years, a survey is sent to recently graduated alumni. In this survey, alumni are asked amongst others about how well the program has prepared them for their career.

6 Innovation towards 2030

Moving towards 2030, TU/e is making room for a completely new education setting (including assessment), such as for example digitization and Challenge Based Learning. TU/e works towards giving future students more room to define their own learning path and will learn more and more in an interdisciplinary setting. In view of these developments TU/e has made a number of funds available to teachers to start experiments in their teaching. This bottom up approach is supported by an early involvement of the program director and the Examination committees to ensure that in such experimental settings the degree certificate quality is guaranteed, but also to gain insight on the effect of the experiments on students' learning on the one side and education support processes on the other side. Starting 2020-2021, a description of the experiments conducted at the department

and corresponding regulations and quality assurance measures are included in the Program and Examination Regulations.

The experiments that are being conducted at the department of Chemical Engineering and Chemistry are described in appendix 5.

Appendix 1: Roles and powers

Pre-conditions	CvB (via Dean)	Department Dean	Director of Education	Examination Committee	Program Committee	Department council	University Council/JPC	Examiner	Manager ESA department	CM Exam planning- and	CM Study progress	Student	invigilator	Exam planner	Exam coordinator	
Composition of and appointment to examination committee		a / r	c	c	i	i		i	i		i	i				WHW, Section 7.12, 7.12a and 7.12b, and OER, Article 2.10B and 2.11B
Examination committee annual report		a	c	r				i	i							WHW, Section 7.12c paragraph 1
Examination committee annual report		a	i	r	i	i		i	i			i				WHW, Section 7.12b paragraph 5, and model departmental regulations[7], Article 2.13B
Model OER	a / r	c	c		c[8]	c[9]	c		c[10]							TU/e Guideline BC + GS
Program and Examination Regulations program		a	r	c	c	c		i	r			i				WHW, Section 7.13 and Section 7.14
University-wide assessment policy	a / r	c	c	c	c	c	c	i	c[11]	i	i					TU/e Exam framework
Program assessment policy (content)	i	a	r	c	c	i		i	c			i				TU/e Exam framework
Examination regulations	i		i	a / r	i	i		i	i			i	i	i	i	OER + WHW Article 7.12b paragraph 1b
a=accountable, r= responsible c= to be consulted, i= to be informed																

6 CM ESA Chain Manager Exam planning and fraud

7 As guideline for the departmental regulations

8 Via JPC

9 Via UR

10 Also central ESA manager

11 Idem

Pre-conditions	CvB (via Dean)	Department Dean	Director of Education	Examination Committee	Program Committee	Department council	University Council/JPC	Examiner	Manager ESA department	CM Exam planning- and fraud[12]	CM Study progress	Student	invigilator	Exam planner	Exam coordinator	
Quality of examiners		a	r	c	i	i		r								TU/e Exam framework
Safeguarding the quality of testing	i	i	c / i	a / r	c / i			c / i	i							Examination Regulations (WHW, Article 7.12b)
a=accountable, r= responsible c= to be consulted, i= to be informed																

Teaching and Examination processes	CvB (via Dean)	Department Dean		Examination Committee	Program Committee	Department council		Manager ESA department	CM Exam planning- and fraud	CM Study progress	Student	invigilator	Exam planner	Exam coordinator	
Program goals/ descriptors	i	a	r	c	c		i				i				WHW, Section 5a.8, 5a.10a, 5a.13f and 5a.13g WHW, Section 7.13 par 2c, OER
Program exam plan	i	c	a/r	c	c		i				i				TU/e Exam Framework
Course exam plan			c	i	i		a/r	i			i				BC regulations/ PER
Learning objectives for each course	i		a	c	c		r	i			i				Curriculum
a=accountable, r= responsible c= to be consulted, i= to be informed															

12 CM ESA Chain Manager Exam planning and fraud

Teaching and Examination processes	CvB (via Dean)	Department Dean		Examination Committee	Program Committee	Department council		Manager ESA department	CM Exam planning- and fraud	CM Study progress	Student	invigilator	Exam planner	Exam coordinator	
Making sample exams available				i			a/r				i				BC regulations/ PER
Exam matrix/ exam schedule				i			a/r				i				Assessment policy and program exam plan
Exam + exam quality			i	i			a/r				i				Examination regulations
Assessment procedures and model				i			a/r				i				OER, and Examination
Determining the pass mark/ guess correction				i			a/r				i				OERs, and Examination[13]
Assessment				i			a/r				i				Examination regulations
Exam analysis and evaluation			i	a	i		r	r							Examination regulations
a=accountable, r= responsible c= to be consulted, i= to be informed															

[13] at the least: make clear in advance how pass mark is determined ; opportunities for modifications later are clear; how to deal with borderline cases

Organization of testing		CvB (via Dean)	Department Dean	Director of Education	Examination Committee	Program Committee	Department council	Examiner	Manager ESA department	Manager ESA central	CM Exam planning- and fraud	CM Study progress	Student	invigilator	Exam planner	Exam coordinator	Requirements
Registering for scheduled exams								**i**	**i**			**a**	**r**	**i**	**i**		OER
Holding an exam	Deliver exam for holding			**a**				**r**	**i**							**i**	OER, TU/e central examination
	The actual holding itself				**i**			**r**		**a**			**r**	**r**		**r**	OER, TU/e central examination
	Organiza-tion/ mange-ment in order to hold the exams			**c/i**	**c/i**			**i**		**a**	**c/i**			**i**		**r**	TU/e Exam Framework/ TU/e policy concerning studying with a functional impairment
Scheduling of exams				**c**	**c**			**c**	**r**	**a**	**c/i**	**i**	**i**	**i**	**r**	**c/i**	Examination regulations

a=accountable, r= responsible c= to be consulted, i= to be informed

Exemptions and degree certificates	**CvB (via Dean)**	**Department Dean**	**Director of Education**	**Examination Committee**	**Program Committee**	**Department council**	**Examiner**	**Manager ESA department**	**CM Exam planning- and fraud**	**CM Study progress**	**Student**	**invigilator**	**Exam planner**	**Exam coordinator**	**CBE[14]**	**Requirements**
Exemptions			**i**	**a/r/**			**c**	**i**			**r[15]/ i**					WHW Section 7.12b lid 1d
Degree certificate			**i**	**a/r/**				**r**			**r[16]/ i**					WHW Section 7.11
Double degree				**a/r/ i**				**i**			**R/ i**					Directive Executive Board TU/e with regard to internal double diplomas

Fraud and complaints	**CvB (via Dean)**	**Department Dean**	**Director of Education**	**Examination Committee**	**Program Committee**	**Department council**	**Examiner**	**Manager ESA department**	**CM Exam planning- and fraud**	**CM Study progress**	**Student**	**invigilator**	**Exam planner**	**Exam coordinator**	**CBE**	**Requirements**
Prevention of and information about fraud			**a/ r**	**r**			**r**	**r**			**r**	**i**		**r**	**i**	Assessment policy CE&C, and TU/e wide agreements regarding fraud prevention
a=accountable, r= responsible c= to be consulted, i= to be informed																

[14] CBE: Examinations Appeals Board

[15] At the request of the student

[16] Idem

Fraud and complaints	**CvB (via Dean)**	**Department Dean**	**Director of Education**	**Examination Committee**	**Program Committee**	**Department council**	**Examiner**	**Manager ESA department**	**CM Exam planning- and fraud**	**CM Study progress**	**Student**	**invigilator**	**Exam planner**	**Exam coordinator**	**CBE**	**Requirements**
detection of cases of suspicion of fraud				**i**			**a/ r**		**i**		**c/i**	**r**				OER, Student statute and Examination Regulations
Dealing with cases of suspicion of fraud		**i**	**i**	**a/r**			**c/ i**				**c/i**	**c / i**				WHW, Section 7.12b paragraph 2, procedure for cases of fraud that affect more than one department
Dealing with complaint s in relation to exams				**r**[17] **/ c**					**i**		**c/i**				**a / r**	WHW, Section 7.12b paragraph 3 and 4 Program and Examination Regulations

[17] Amicable settlement

Appendix 2a: Elaboration of the learning outcomes of the BSc program in Chemical Engineering and Chemistry

Learning outcomes of the BSc program	Study components where the learning outcome is elaborated
BSc graduates are academically qualified to degree level within the domain of engineering science and technology.	All study components.
BSc graduates are competent in the relevant domain-specific disciplines, namely Chemical and Process Technology and Molecular Systems and Materials Chemistry, at the level of a Bachelor of Science.	All study components except Calculus, Linear Algebra, USE Basic, Data Analytics, Engineering Design, USE.
BSc graduates are able to conduct research and design under supervision.	Engineering Design, all DBL's, Bachelor Final Project.
BSc graduates are aware of the significance of other disciplines.	Calculus, Applied Physics, Linear Algebra, USE basic, Data Analytics, Engineering Design, USE, Elective program.
BSc graduates take a scientific approach to non-complex problems and ideas, based on current knowledge.	Data Analytics, All practicals, all DBL's, USE, Bachelor final project.
BSc graduates possess intellectual skills and are able to reflect critically, reason and form opinions under supervision.	All study components.
BSc graduates have the ability to communicate the results of their learning, thinking, acts and decision-making processes.	USE Basic, all practicals, all DBL's, Separation Technology, USE, Bachelor Final Project.
BSc graduates can plan and execute their activities.	Engineering Design, all practicals, all DBL's, USE, Bachelor Final project.
BSc graduates are aware of the temporal and societal contexts of science and technology (understanding and analysis),	USE, Energy.
In addition to a recognizable domain-specific profile, BSc graduates possess a sufficiently broad basis to be able to work or collaborate in an interdisciplinary and multidisciplinary context. Here, multidisciplinary means focusing on other relevant disciplines needed to solve the design or research problem in question	Engineering Design, Energy, DBL Energy, USE, Elective program.

Appendix 2a: Elaboration of the learning outcomes of the MSc program in Chemical Engineering

Learning outcomes of the BSc program	Program components[18] where the learning outcome is elaborated
MSc graduates are academically qualified to degree level within the domain of 'science engineering & technology'.	All program components.
MSc graduates are competent in the relevant domain-specific discipline, namely Chemical and Process Technology or Molecular Systems and Materials Chemistry, at the scientific Master's degree level.	All program components
MSc graduates are able to conduct research and design independently.	Industrial Internship, graduation project.
MSc graduates have the ability and attitude to include other disciplines in their research, where necessary.	Industrial Internship, graduation project.
MSc graduates have a scientific approach to complex problems and ideas.	All program components
MSc graduates possess intellectual skills that enable them to reflect critically, reason and form opinions.	All program components
MSc graduates have the ability to communicate the results of their learning, thinking and decision-making processes at an international level.	All program components
MSc graduates are aware of the temporal and social context of science and technology (comprehension and analysis) and can integrate this context in their scientific work.	Industrial Internship, graduation project.
In addition to a recognizable domain-specific profile, MSc graduates possess a sufficiently broad basis to be able to work or collaborate in an interdisciplinary and multidisciplinary context. In this context, multidisciplinary means being focused on other relevant disciplines needed to solve the design or research problem in question.	Industrial Internship, specialization elective program, free elective program.
MSc graduates have the ability and attitude to seek new potential applications, taking the social context into consideration.	Industrial Internship, graduation project.

[18] i.e. Core program, elective program, specialization elective, free elective, industrial internship, graduation project

Appendix 3a: Learning outcomes BSc related to Dublin descriptors

	Dublin descriptors for BSc programs
1	The BSc graduates have demonstrated knowledge and understanding in a field of study that builds upon and their general secondary education, and is typically at a level that, whilst supported by advanced textbooks, includes some aspects that will be informed by knowledge of the forefront of their field of study.
2	The BSc graduates can apply their knowledge and understanding in a manner that indicates a professional approach to their work or vocation, and have competences typically demonstrated through devising and sustaining arguments and solving problems within their field of study.
3	The BSc graduates have the ability to gather and interpret relevant data (usually within their field of study) to inform judgements that include reflection on relevant social, scientific or ethical issues.
4	The BSc graduates can communicate information, ideas, problems and solutions to both specialist and non-specialist audiences.
5	The BSc graduates have developed those learning skills that are necessary for them to continue to undertake further study with a high degree of autonomy

	Learning Outcomes of the BSc program Chemical Engineering and Chemistry
A	BSc graduates are academically qualified to degree level within the domain of engineering science and technology.
B	BSc graduates are competent in the relevant domain-specific disciplines, namely Chemical and Process Technology and Molecular Systems and Materials Chemistry, at the level of a Bachelor of Science.
C	BSc graduates are able to conduct research and design under supervision.
D	BSc graduates are aware of the significance of other disciplines.
E	BSc graduates take a scientific approach to non-complex problems and ideas, based on current knowledge.
F	BSc graduates possess intellectual skills and are able to reflect critically, reason and form opinions under supervision.
G	BSc graduates Have the ability to communicate the results of their learning, thinking, acts and decision-making processes.
H	BSc graduates can plan and execute their activities.
I	BSc graduates are aware of the temporal and societal contexts of science and technology (understanding and analysis),
J	In addition to a recognizable domain-specific profile, BSc graduates possess a sufficiently broad basis to be able to work or collaborate in an interdisciplinary and multidisciplinary context. Here, multidisciplinary means focusing on other relevant disciplines needed to solve the design or research problem in question

In the matrix below, the relationship between the learning outcomes of the BSc program in Chemical Engineering offered by TU/e and the Dublin descriptors are shown:

Dublin descriptor for BSC programs	Dublin descriptor xx is covered in learning Outcome xx of the BSc program in Chemical Engineering and Chemistry
1	A, B, D, J.
2	C, E, F, J.
3	C, E, F, I.
4	G.
5	E, F, H.

Appendix 3b: Learning outcomes MSc related to Dublin descriptors

Nr.	Dublin descriptors for MSc program
1	The master has demonstrated knowledge and understanding that is founded upon and extends and/or enhances that typically associated with the bachelor's level, and that provides a basis or opportunity for originality in developing and applying ideas, often within a research context.
2	The master can apply their knowledge and understanding and problem solving abilities in new or unfamiliar environments within broader (or multidisciplinary) contexts related to their field of study.
3	The master has the ability to integrate knowledge and handle complexity and formulate judgments with incomplete or limited information, but that include reflecting on social and ethical responsibilities linked to the application of their knowledge and judgments.
4	The master can communicate conclusions, and the knowledge and rationale underpinning these, to specialist and non-specialist audiences, clearly and unambiguously.
5	The master has the learning skills to allow them to continue to study in a manner that may be largely self-directed or autonomous.

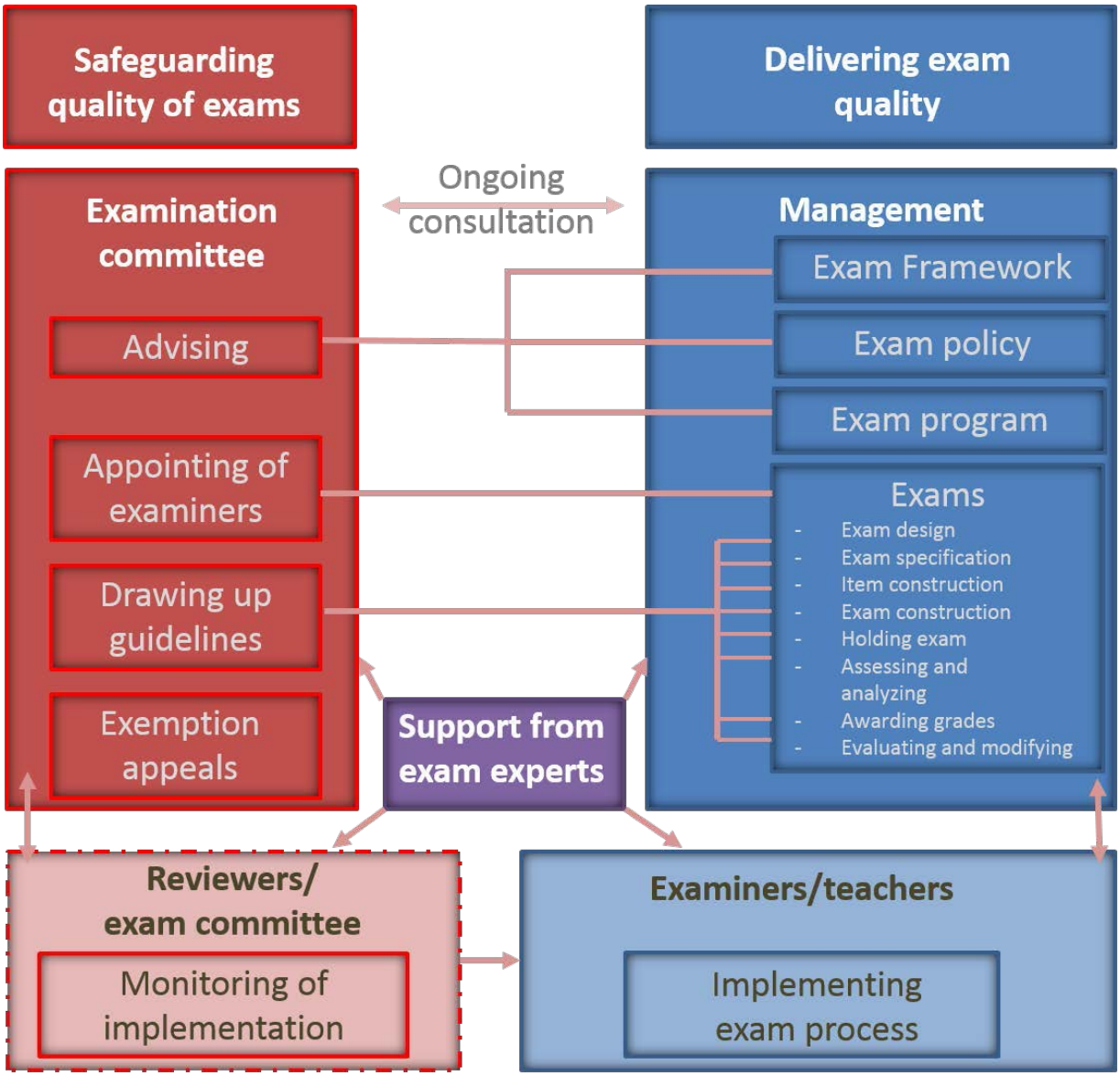
Nr.	Learning Outcomes of the MSc program in Chemical Engineering
A	MSc graduates are academically qualified to degree level within the domain of 'science engineering & technology'.
B	MSc graduates are competent in the relevant domain-specific discipline, namely Chemical and Process Technology or Molecular Systems and Materials Chemistry, at the scientific Master's degree level.
C	MSc graduates are able to conduct research and design independently.
D	MSc graduates have the ability and attitude to include other disciplines in their research, where necessary.
E	MSc graduates have a scientific approach to complex problems and ideas.
F	MSc graduates possess intellectual skills that enable them to reflect critically, reason and form opinions.
G	MSc graduates have the ability to communicate the results of their learning, thinking and decision-making processes at an international level.
H	MSc graduates are aware of the temporal and social context of science and technology (comprehension and analysis) and can integrate this context in their scientific work.
I	In addition to a recognizable domain-specific profile, MSc graduates possess a sufficiently broad basis to be able to work or collaborate in an interdisciplinary and multidisciplinary context. In this context, multidisciplinary means being focused on other relevant disciplines needed to solve the design or research problem in question.
J	MSc graduates have the ability and attitude to seek new potential applications, taking the social context into consideration.

In the matrix below, the relationship between the learning outcomes of the BSc program in Chemical Engineering offered by TU/e and the Dublin descriptors are shown:

Dublin descriptor for BSC programs	Dublin descriptor is covered in learning Outcome xx of the BSc program in Chemical Engineering and Chemistry
1	A-J
2	A-E
3	D, F, H, I, J.
4	G
5	C, E, F.

Appendix 4: Ensuring versus safeguarding

The division of the responsibilities of the examination committee and management at TU/e



Based on Van Zijl & Jaspers (2012), Joosten-ten Brinke & Van der Linen-Straatman (2012). Reviewers can assess the quality of an exam before it is held; a test committee may be appointed by the examination committee, whether or not with specific points of attention concerning the safeguarding of the quality of exams.

Appendix 5: overview innovative experiments at the department of CE&C

	Description/System	Implemented in courses…
Formative Assessments in Canvas	Canvas quizzes: large databank with question Goal is activating students during the course Randomly generated questions and answer possibilities to make the exam taking safer. Canvas Assignments	6EMA51, 6M3X0 (Safety test), 6I2X0 6E4X0, 6E5X0
Formative Assessments with feedback	In Canvas/Oncourse	6P1X0
Continuous and directed assessment through modules	In Oncourse with STEP	6P3X0
Peer assessment	Assignment with supervised peer review. Final assessment done by examiner	6E5X0