MARINE TECHNOLOGY

MECHANICAL, MARITIME AND

MATERIALS ENGINEERING

DELFT UNIVERSITY OF TECHNOLOGY

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REPORT ON THE BACHELOR'S PROGRAMME AND THE MASTER'S PROGRAMME MARINE TECHNOLOGY OF DELFT UNIVERSITY OF TECHNOLOGY

This report takes the NVAO's Assessment Framework for Limited Programme Assessments as a starting point (September 2016).

ADMINISTRATIVE DATA REGARDING THE PROGRAMMES

Bachelor's programme Marine Technology

Name of the programme:	Maritieme Techniek
CROHO number:	56957
Level of the programme:	bachelor's
Orientation of the programme:	academic
Number of credits:	180 EC
Specializations or tracks:	-
Location:	Delft
Mode of study:	full time
Language of instruction:	Dutch
Expiration of accreditation:	31/12/2019

Master's's programme Marine Technology

Name of the programme:	Marine Technology
CROHO number:	66957
Level of the programme:	master's
Orientation of the programme:	academic
Number of credits:	120 EC
Specializations or tracks:	-
Location:	Delft
Mode of study:	full time
Language of instruction:	English
Expiration of accreditation:	31/12/2019

The visit of the assessment panel Mechanical Engineering to the Faculty of Mechanical, Maritime and Materials Engineering of Delft University of Technology took place on 13 and 14 December 2018.

ADMINISTRATIVE DATA REGARDING THE INSTITUTION

Name of the institution:	Delft University of Technology
Status of the institution:	publicly funded institution
Result institutional quality assurance assessment:	positive

COMPOSITION OF THE ASSESSMENT PANEL

The NVAO has approved the composition of the panel on 20 August 2018. The members of the assessment panel were selected based on their expertise, availability and independence. The panel that assessed the bachelor's programme and the master's programme Marine Technology consisted of:

- Prof. dr. K.G.S. (Sören) Östlund, professor of Packaging Technology at the Department of Solid Mechanics of the KTH Royal Institute of Technology (Sweden) [chair];
- Prof. dr. H.J. (Henry) Rice, professor, Mechanical Engineering and head of the School of Engineering of Trinity College, Dubin (Ireland);
- Dr. M. (Maddalena) Velonà, coordinator of studies at the Department of Mechanical and Process Engineering (D-MAVT) at Eidgenössische Technische Hochschule (ETH) Zürich (Switzerland);
- Drs. J.J. (Jan) Steen, consultant Quality of Education at Wageningen University & Research;
- Prof. dr. R.W. (Richard) Birmingham, professor in Small Craft Design at the Marine Technology Group of the School of Engineering, Newcastle University (United Kingdom);
- Ir. J. (Jan) Leideman, new business development manager at DEMCON Advanced Mechatronics;
- A.J. (Alicia) Knijnenburg, BSc, master's student Mechanical Engineering at the University of Twente [student member].

The panel was supported by dr. B.M. (Barbara) van Balen, who acted as secretary.

WORKING METHOD OF THE ASSESSMENT PANEL

The site visit to the bachelor's and master's programme Marine Technology at the Faculty of Mechanical, Maritime and Materials Engineering of Delft University of Technology was part of the cluster assessment Mechanical Engineering. In December 2018 the panel assessed eleven programmes at three universities. The following universities participated in this cluster assessment: Delft University of Technology, Eindhoven University of Technology and the University of Twente.

On behalf of the participating universities, quality assurance agency QANU was responsible for logistical support, panel guidance and the production of the reports. Dr. Alexandra Paffen was project coordinator for QANU. Dr. Barbara van Balen acted as secretary in the cluster assessment. She is a certified NVAO secretary.

Preparation
On 9 December 2018, the panel chair was briefed by QANU on his role, the assessment framework, the working method, and the planning of site visits and reports. A preparatory panel meeting was organised on 9 December 2018. During this meeting, the panel members received instruction on the use of the assessment frameworks. The panel also discussed their working method and the planning of the site visits and reports.

The project coordinator composed a schedule for the site visit in consultation with the Faculty. Prior to the site visit, the Faculty selected representative partners for the various interviews (see appendix 4).

Before the site visit to Delft University of Technology, QANU received the self-evaluation reports of the programmes and sent these to the panel. A thesis selection was made by the panel's chair and the project coordinator. The selection existed of fifteen theses and their assessment forms for each programme, based on a provided list of graduates 2016-2017. A variety of topics and tracks and a diversity of examiners were included in the selection. The project coordinator and panel chair assured that the distribution of grades in the selection matched the distribution of grades of all available theses.

After studying the self-evaluation report, theses and assessment forms, the panel members formulated their preliminary findings. The secretary collected all initial questions and remarks and distributed these amongst all panel members.

The evening before the site visit, the panel discussed its initial findings on the self-evaluation reports and the theses, as well as the division of tasks during the site visit.

Site visit
The site visit to Delft University of Technology took place from 13 to 14 December 2018. During the site visit, the panel studied the additional documents provided by the programmes. An overview of these materials can be found in Appendix 5. The panel conducted interviews with representatives of the programmes: students and staff members, the programme's management, alumni and representatives of the Board of Examiners.

The panel used the final part of the site visit to discuss its findings in an internal meeting. Afterwards, the panel chair publicly presented the panel's preliminary findings and general observations.

Consistency and calibration
In order to assure the consistency of assessment within the cluster, the following measures were taken:
1. The panel composition ensured regular attendance of (key) panel members, including the chair;
2. The secretary was present at the start of all site visits as well as the panel discussion leading to the preliminary findings at all site visits of Delft University of Technology, Eindhoven University of Technology and the University of Twente.

Report
After the site visit, the secretary wrote a draft report based on the panel's findings and submitted it to the project coordinator for peer assessment. Subsequently, the secretary sent the report to the panel. After processing the panel members' feedback, the project coordinator sent the draft reports to the Faculty in order to have these checked for factual irregularities. The project coordinator discussed the ensuing comments with the panel's chair and changes were implemented accordingly. The report was then finalised and sent to the Faculty and University Board.

Definition of judgements standards
In accordance with the NVAO's Assessment framework for limited programme assessments, the panel used the following definitions for the assessment of both the standards and the programme as a whole.

Generic quality
The quality that, in an international perspective, may reasonably be expected from a higher education Associate Degree, Bachelor's or Master's programme.

Unsatisfactory
The programme does not meet the generic quality standard and shows shortcomings with respect to multiple aspects of the standard.

Satisfactory
The programme meets the generic quality standard across its entire spectrum.

Good
The programme systematically surpasses the generic quality standard.

Excellent
The programme systematically well surpasses the generic quality standard and is regarded as an international example.

SUMMARY JUDGEMENT

The panel assesses the standards from the *Assessment framework for limited programme assessments* in the following way:

Bachelor's programme Marine Technology

Standard 1
The bachelor's programme Marine Technology (MT) is offered by the Faculty of Mechanical, Maritime and Materials Engineering (3mE) of Delft University of Technology. It strives to educate committed engineers who are able to develop, build and manage ships and other floating structures and their respective equipment in such a way that they are successful in today's highly competitive maritime markets and meet all modern sustainability requirements. The programme offers a broad knowledge of the engineering discipline Marine Technology and its sub-disciplines ship structures, ship hydromechanics, marine engineering, ship design, ship production and shipping management. It also aims to provide the students with a profound knowledge base in the fundamental engineering sciences and mathematics.

The programme translated these objectives into specific and measurable intended learning outcomes (ILOs). The panel established that the ILOs meet the Dutch qualifications framework and sufficiently reflect an academic bachelor's level. The ILOs tie in with the international perspective of the requirements set by the professional field and the discipline.

Standard 2
The bachelor's programme Marine Technology is built on the basis of fundamental engineering disciplines and mathematics. This basis is shared with the bachelor's programme Mechanical Engineering and concerns four mathematics modules (4x6 EC), four mechanics modules (4 x 6 EC) and a thermo-fluids module (6 EC). The rest of the curriculum contains 96 EC of MT-specific courses and a minor in the third year. The curriculum is developed along the lines of a design spiral, the generally accepted approach to ship design in which designers refine their designs in several iterations. In two integration projects, students learn how to integrate their knowledge into complete ship designs. In the bachelor end project (BEP), the students execute their first large research assignment. Smaller research assignments are present in several of the MT-specific courses. The first semester of the third year is scheduled for the 30 EC minor.

The panel is positive about the projects and the learning lines that structure the curriculum. The Faculty has a clear vision on education. The programme sufficiently invests in mentoring and guiding the students to adapt their study style to the university environment. Students have ample possibility in the projects to apply acquired knowledge and skills in practice. The whole bachelor's programme has a clear structure. Students receive a solid basis in scientific knowledge and marine technology, combined with the development of soft skills and group work. The panel is also impressed with the position of the minor in the programme and the wide range of possible minor programmes students can choose from.

The graduation rates could be improved, however. The panel is of the opinion that the university should take responsibility for the slow study progress of the students; it noticed and appreciates that the Faculty management is starting to think about it. It encourages the Faculty management to investigate whether more incentives to encourage timely progress of the students are possible.

The quantity and the quality of the teaching staff are good.

Standard 3
The Faculty aims to achieve a high level of quality in its teaching and assessment. The assessment system and policy of the Faculty are well developed and implemented according to the panel. All teachers are aware of the policies and measures implemented to assure the validity and reliability of

the assessments. The Faculty has ensured that the teachers are supported in their tasks by the appointment of an educational advisor.

The courses use a variety of assessment methods, which are very well aligned, with the help of test matrices, with the learning outcomes and the curriculum. The procedures are transparent for teachers and students.

The panel approves the way the Board of Examiners is performing its tasks and concluded that the examinations, tests and the thesis assessment are transparent, valid and reliable.

Standard 4
The panel studied a selection of 15 bachelor final projects to assess whether the graduates had achieved the ILOs. It found the level of the BFP reports to be good. The graduates of the bachelor's programme are well prepared to continue their study in a master's programme. The panel concluded that graduates of the bachelor's programme Marine Technology have achieved the intended learning outcomes.

Standard 1: Intended learning outcomes	good
Standard 2: Teaching-learning environment	satisfactory
Standard 3: Assessment	good
Standard 4: Achieved learning outcomes	good
General conclusion	good

Master's programme Marine Technology

Standard 1
The master's programme Marine Technology (MT) is offered by the Faculty of Mechanical, Maritime and Materials Engineering (3mE) of Delft University of Technology. It strives to educate committed engineers who are able to develop, build and manage ships and other floating structures and their respective equipment in such a way that they are successful in today's highly competitive maritime markets and meet all modern sustainability requirements. The programme provides a broad knowledge of the engineering discipline Marine Technology and its sub-disciplines ship structures, ship hydromechanics, marine engineering, ship design, ship production and shipping management. It also aims to provide the students with a profound knowledge base in the fundamental engineering sciences and mathematics.

The programme translated these objectives into specific and measurable intended learning outcomes (ILOs). The panel established that the ILOs meet the Dutch qualifications framework and sufficiently reflect an academic master's level. The ILOs tie in with the international perspective of the requirements set by the professional field and the discipline.

Standard 2
The master's programme focuses on two connected goals:
- To teach students the theory of marine technology with six main focus points: 1) design, 2) marine engineering, 3) production, 4) shipping management, 5) structures and 6) hydromechanics of marine objects.
- To train students to perform research on marine technology at an academic level.

The aspects of Design, Marine Engineering, Production and Shipping Management are captured in one track (SDPO) and the other two are captured by the Science track (Sc). The first year of the programme consists of a set of obligatory courses worth a total of 35 EC and a number of electives worth at least 25 EC. For the graduation project, every student is linked to a supervisor who is a scientific staff member of the MT department. Graduation projects can be carried out within the

department, or within a company or research institute. The graduation project is divided into two parts: a literature survey and a thesis that is assessed independently.

The Faculty 3mE offers a solid master's curriculum MT. The structure of the curriculum is comparable to that of other engineering master's programmes. The curriculum enables the students to achieve the ILOs. The panel appreciates the close connection to industry.

The quantity and the quality of the teaching staff are good.

Standard 3
The Faculty aims to achieve a high level of quality in its teaching and assessment. The assessment system and policy of the Faculty are well developed and implemented according to the panel. All teachers are aware of the policies and measures implemented to assure the validity and reliability of the assessments. The Faculty has ensured that the teachers are supported in their tasks by the appointment of an educational advisor.

The courses use a variety of assessment methods, which are very well aligned, with the help of the matrices, with the learning outcomes and the curriculum. The procedures are transparent for teachers and students.

The panel approves the way the Board of Examiners is performing its tasks and concluded that the examinations, tests and thesis assessment are transparent, valid and reliable.

Standard 4
The panel studied a selection of 15 master's theses to assess whether the graduates had achieved the intended learning outcomes. It found the level of the theses to be very good. The graduates are well prepared to continue in a PhD programme or a career in industry.
The panel concludes that graduates of the master's programme Marine Technology have achieved the intended learning outcomes.

Standard 1: Intended learning outcomes	good
Standard 2: Teaching-learning environment	satisfactory
Standard 3: Assessment	good
Standard 4: Achieved learning outcomes	good
General conclusion	good

The chair, prof. dr. Sören Östlund, and the secretary of the panel, dr. Barbara van Balen, hereby declare that all panel members have studied this report and that they agree with the judgements laid down in it. They confirm that the assessment has been conducted in accordance with the demands relating to independence.

Date: 26 March 2019

DESCRIPTION OF THE STANDARDS FROM THE ASSESSMENT FRAMEWORK FOR LIMITED PROGRAMME ASSESSMENTS

General remarks cluster Mechanical Engineering

This report constitutes part of the limited programme assessment of the NVAO Assessment cluster Mechanical Engineering representing 11 bachelor and masters programmes in Mechanical Engineering, Automotive Technology, Marine Technology, Offshore and Dredging and Materials Science and Engineering at University of Twente, Eindhoven University of Technology and Delft University of Technology. The findings for each programme are based on the self-evaluations performed by each programme and site visits taking place on December 10-14, 2018.

In the self-evaluation reports and during the site visits, the evaluation panel has encountered many knowledgeable and dedicated programme managers, skilled and engaged teachers, well-educated and enthusiastic students and successful alumni. It is therefore with great pleasure that we can conclude that the overall outcome of the evaluation panel ends on a positive note.

All programmes are based on intended learning outcomes well set in national or international perspective of the requirements currently set by the professional field and the discipline, programme managers, teachers and students work hard to create a motivating and dynamic teaching and learning environment, all programmes have elaborated assessment plans and the achieved learning outcomes are good. Many of the theses read by the evaluation panel are indeed of very high quality, and graduates from the eleven programmes in general have very good career opportunities.

There is of course always room for improvements, and, particularly, the processes around internships, the overall study times and the high dropout rates are areas that should be given continued high attention. The increased internationalisation of the programmes, the growth in number of students and the level of the students are other challenges that needs consideration in the coming years. However, it is the opinion of the assessment panel that the programmes in the Assessment cluster Mechanical Engineering are well prepared to meet these.

On behalf of the Mechanical Engineering assessment panel,
Sören Östlund (Chair)

Governance structure of the Faculty

The bachelor and master's degree programmes Marine Technology are provided by the Faculty of Mechanical, Maritime and Materials Engineering (3mE). This Faculty additionally offers the master's programme Offshore and Dredging Engineering, the bachelor's and master's programmes Mechanical Engineering, and the master's programme Materials Science and Engineering, which are also being assessed in this cluster assessment. The Faculty also offers the bachelor and master's programmes Technical Medicine and the master's programmes Biomedical Engineering and System and Control.

Standard 1: Intended learning outcomes

The intended learning outcomes tie in with the level and orientation of the programme; they are geared to the expectations of the professional field, the discipline, and international requirements.

Findings

The bachelor's and master's programmes Marine Technology (MT) strive to educate committed engineers who are able to develop, build and manage ships and other floating structures and their respective equipment in such a way that they are successful in today's highly competitive maritime markets and meet all modern sustainability requirements. They provide a broad knowledge of the engineering discipline Marine Technology and its sub-disciplines ship structures, ship hydromechanics, marine engineering, ship design, ship production and shipping management. They

also aim to provide the students with a profound knowledge base in the fundamental engineering sciences and mathematics.

The panel appreciates the clear benchmark the programmes provided in the self-evaluation report. This benchmark functions as a domain-specific frame of reference. The Marine Technology programmes are the only ones of this kind in the Netherlands, but within Europe, there are several bachelor's and master's MT programmes with specific choices and focus points. The benchmark illustrates that the amount of attention paid to engineering fundamentals and mathematics by the Delft programmes occupies the middle of the field. The programme has a very good international reputation. The Delft programmes are the only ones paying attention to shipping management. The benchmark confirms that the programme is up-to-date and covers the relevant topics. There is regular interaction with an industrial advisory board.

Bachelor's programme
The intended learning outcomes (ILOs) for the bachelor's programme Marine Technology (MT) are defined within the framework of the 4TU criteria for Academic Bachelor's and Master's Curricula, known as the Meijers criteria (Appendix 2). The panel established that the ILOs are formulated in line with the mission and that they sufficiently indicate what could be expected from programmes at a bachelor's level. It also ascertained that the ILOs meet the internationally accepted description for academic bachelor's programmes, the Dublin descriptors, which are elaborated for the engineering programmes in the 4TU (Meijers) criteria[1]. The panel finds the ILOs to be well defined, specific and measurable. They indicate the content, level and orientation of the bachelor's programme MT and fit the professional field. The distinction between the ILOs of the bachelor's and the master's programme is clear.

Master's programme
The critical reflection stated that the ILOs of the master's programme MT were revised in 2017 in order to make them more specific and measurable in reaction to the recommendations of the former assessment committee. The result of this revision is included in Appendix 2. The Industrial Board was closely involved in the process of developing the new ILOs. The panel appreciates the careful and thorough way the programme has taken up the recommendations and worked on improvement. The ILOs are well defined, measurable and specific according to the panel. The panel established that the ILOs are formulated in line with the objectives of the programme's mission and sufficiently indicate what could be expected from programmes at a master's level. It also ascertained that the ILOs meet the internationally accepted description for academic master's programmes, the Dublin descriptors, which are elaborated for the engineering programmes in the 4TU (Meijers) criteria. It particularly appreciates the process of redefining the ILOs and the involvement of the Industrial Board in this process.

Considerations
The panel concluded that the ILOs of the bachelor's and master's programmes Marine Technology are well defined, specific and measurable. The MT programmes are the only ones of this kind offered in the Netherlands. The panel appreciates the benchmark with other universities offering Marine and Maritime academic programmes in Europe and elsewhere.

The ILOs of both programmes meet the Dutch qualifications framework and sufficiently indicate the academic bachelor's or master's level, respectively. The ILOs tie in with the international perspective of the requirements set by the professional field and the discipline.

Conclusion
Bachelor's programme Marine Technology: the panel assesses Standard 1 as good.

Master's programme Marine Technology: the panel assesses Standard 1 as good.

[1] https://www.ram.ewi.utwente.nl/embedded2017/doc/Meijers_summarised.pdf

Standard 2: Teaching-learning environment
The curriculum, the teaching-learning environment and the quality of the teaching staff enables the incoming students to achieve the intended learning outcomes.

Findings

Bachelor's programme

The bachelor's programme MT is built on a basis of fundamental engineering disciplines and mathematics. This basis is shared with the bachelor's programme Mechanical Engineering and concerns four mathematics modules (4 x 6 EC), four mechanics modules (4 x 6 EC) and a thermo-fluids module (6 EC). The rest of the curriculum contains 96 EC of MT-specific courses and a minor in the third year. The curriculum is developed along the lines of a design spiral, the generally accepted approach to ship design in which designers refine their designs in several iterations. In the spiral, a designer starts out with rough calculations to develop first insights into the design, and then uses progressively complex and detailed methods to refine the design. This principle is implemented in the education programme by increasing the difficulty in each discipline and finishing the first and the second year with an integration project. These projects aim to teach students how to integrate their knowledge into complete ship designs. In the courses on constructing (1st year), maritime markets & operations (2nd year), and organisation of ship production (3rd year), students acquire additional knowledge related to business economics and maritime logistics that enables them to design and assess maritime operations. In the bachelor end project (BEP), the students execute their first large research assignment and are taught the basic principles of initialising, executing and reporting academic research. Smaller research assignments are present in several of the MT-specific courses. The minor is scheduled for the first semester of the third year; this is a cohesive unit of modules worth 30 EC. Students can choose from a wide variety of thematic minors offered by TU Delft and the partner universities Erasmus University and Leiden University or at a university abroad. The panel finds the curriculum to be well structured and coherent.

According to the self-evaluation report, the curriculum is designed to maximise study success. Whenever possible, students apply their knowledge from the theoretical courses immediately in the projects. Study success is stimulated by identically sized, relatively large modules, which provide structure to the curriculum and limit the number of exams during any given exam period, and by strict admission standards for the bachelor end project (finished 1st year and at least 54 credits from the 2nd year). The panel finds the curriculum well-structured and appreciates the efforts to stimulate students to apply the theory immediately in projects.

The BEP is a 12 EC research assignment executed by teams of four students. All assignments for the BEP are submitted by assistant, associate and full professors and are reviewed by the BEP coordinator. The assignment of the project is different for each group, but in all cases relates to a multidisciplinary assignment (design) featuring a clear research component. It may involve a complete ship, part of a ship or a process that is related to shipbuilding or shipping. It contains both a multidisciplinary design and/or analysis component and an in-depth research component, but the balance between these components may differ within reasonable boundaries. The nature of the assignment is always such that it requires the students to combine at least two disciplines within MT.

Courses are a mix of lectures that are followed by an exam, and project assignments. The teaching styles applied are:

- Formal lectures by scientific staff members, usually combined with individual and/or group assignments;
- Project assignments in which individual students or groups solve larger problems;
- Practical assignments in labs;
- Working classes in which students can consult a teacher while carrying out exercises individually.
- Peer reviews, in which the students learn by assessing the approach and/or solutions to a problem elaborated by other students
- Online teaching modules that are used to teach students how to use specific software.
- Self-study: unsupervised learning.

Before the start of the programme, students are invited to an introductory weekend organised by the study association Scheepsbouwkundig Gezelschap William Froude, to create social cohesion in the cohort. During the first year, students are subdivided by the programme management into groups of 6-7 for the MT-specific courses, which feature a significant amount of project work. Each group is mentored by an older student, who pays special attention to group dynamics and helps new students to develop a good study flow. The student coaches are supervised by the teacher of the ongoing project and a Faculty student counsellor. The programme has recently intensified the mentoring in the first semester, including mentoring by staff mentors. The mentors motivate and stimulate the students. To support students in the transition from high school to university, they are stimulated through regular study assignments, tutorial classes, attendance monitoring and frequent feedback. This guidance is gradually scaled down in the first semester.

The panel was impressed by the structure and organisation of the curriculum. In particular, the organisation of the tutoring and the mentoring of the first-year students, the spiral design structure and the integration projects build an attractive curriculum. The students appreciate the relatively small scale of the programme and the project approach. Both aspects are reasons for students to choose this programme. The space reserved for the minor and the wide range of possible minor programmes the students can choose from is very positive according to the panel.

Master's programme
The master's programme focuses on two connected goals:
- To teach students the theory of marine technology with six main focus points: 1) design, 2) marine engineering, 3) production, 4) shipping management, 5) structures and 6) hydromechanics of marine objects.
- To coach students to perform research on marine technology at an academic level.

The aspects of Design, Marine Engineering, Production and Shipping Management are captured in one track (SDPO) and the other two are captured by the Science track (Sc). The first year consists of a set of obligatory courses worth a total of 35 EC and a number of electives worth at least 25 EC. Six obligatory courses form a solid basis in marine technology from each of the six focus points. Each track has two additional obligatory courses that the student requires for their track-specific specialization, supported by a star elective. Star electives are a set of highly recommended electives from which students must choose at least one.

Both tracks offer 40 EC worth of electives, taken partly in the first year and partly in the first quarter of the second year. Besides the star electives, a list of recommended electives has been put together by the Programme Management. This list consists of courses from Aerospace Engineering, Mechanical Engineering and Applied Mathematics. Students are allowed to choose courses that are not on the list to satisfy their individual ambition. Furthermore, a maximum of 6 EC are available for personal development, such as language courses or academic writing skills. About 10-15% of the students take the opportunity to follow courses (electives and sometimes obligatory courses) abroad. The complete list of electives of an individual study trajectory must be approved by the Master's Coordinator and the Board of Examiners.

The programme uses a variety of teaching strategies:
- Lectures by scientific staff members, usually combined with homework assignments;
- Practical work: a lot of training equipment is available, both physical tools in the labs and digital computer programs.
- Projects: students work in teams on relevant problems.
- Self-study: unsupervised learning activities.
- Literature survey: students undertake an extensive search of the available literature on a certain topic and write a coherent and critical report of their findings.
- Thesis project: students explore a challenging problem in depth, typically related to a scientific or societal need, and develop a new theoretical approach or a new design method to solve it.

For the graduation project every student is assigned a supervisor who is a scientific staff member of the MT department. The supervisor monitors the quality of the graduation project, which is always connected to his/her research area. The self-evaluation report explains that the supervisor benefits from the high quality achieved by the student, and the student benefits from the stimulating environment and personal guidance. The graduation project can be carried out within the department (approx. 20% of the students) or within a company or research institute (approx. 80%). The graduation project is divided into two parts: a literature survey and a thesis that is assessed independently. This process is described in the graduation guide.

The master's students would like to see more evidence of the connection to research in the courses. Although research papers are part of the course material, they think that cutting edge research in the programme is lacking. The panel advises the teaching staff to incorporate their research more explicitly into the lectures. In general, the students are happy with the programme, and there is a good atmosphere in the department.

The panel learnt during the site visit that a decision was taken to transform the obligatory industry internship into an individual research elective since 90% of the students do their thesis project in a company. The panel endorses this development. The connection to industry is very strong, and students have enough possibilities in the programme to learn what industry is about.

Students and study yield
From September 2017 on, students with a negative BSA in ME are not allowed to enter the MT bachelor's programme. That measurement had a positive effect on the success rates in the first year of the bachelor's programme, because the switching students were often unsuccessful, given the fact that the most difficult courses are the same in ME and MT. The student intake in the bachelor's programme is on average 100. The intake of master students has increased since 2014, it is on average 60, and 25% of them are foreign.

Programme management recently took some measures to limit the high drop-out rates of first-year bachelor students, including intensifying the mentoring in the first semester and the stop on ME switchers with a negative BSA. Successful ME students are still permitted to switch to MT. Recent evaluations showed that this intensified mentoring resulted in better study results. In the last academic year, 35% of the student intake dropped out during the first quarter; this year (2018-2019) the percentage is 10%. The percentage of female students in MT is relatively high, it recently increased to 25%. Programme management thinks that women choose MT because of the small scale and the close mentoring. The success rates of the MT bachelor's programme can be improved: on average 75% of the students who reregister in the second year graduate, and only 16% finishes the bachelor's programme within three years.

Both students and teachers report that the causes for study delay are usually time spent on other activities such as participating in study associations, contributing to successful university student teams or working part-time. Students starting in the master's programme believe they will manage to graduate in two years, but most do not succeed in achieving that target. They find it hard to plan their courses and experience a high workload.

Neither students nor staff experience the average study duration as an urgent problem. They call this the Delft culture. Students choose Delft University because of the atmosphere, the city and the fame. They like to be part of the Delft community, participate in the study associations, the successful student teams, and the spin-off activities and companies. There is also an increasing number of master students doing a double master's degree, which obviously takes more time.

The panel is of the opinion that the university should take responsibility for the slow study progress of the students; it noticed and appreciates that the Faculty management is starting to think about it. There is still a 'laissez faire' attitude, however. The panel encourages the Faculty management to investigate whether more incentives to encourage the timely progress of the students are possible.

Teaching staff
The self-evaluation report provided overviews of the staff involved in teaching the bachelor's and the master's programmes. The Faculty is strongly committed to developing and maintaining the quality of the teaching staff. To promote involvement and improve mutual communication, an Education Day is organized each year in August for all teaching staff in the Faculty. At this event, the staff receive information on the latest developments in education and professional practice from experts in the field of education. Educational policy and new developments in education are discussed, and attendees participate in workshops organised around various educational themes. Lecturers are academic staff members with a PhD degree.

The students are satisfied with the teaching quality. Teachers put a lot of effort into making the best of their courses; they include interaction in the classes and develop blended teaching methods. The panel appreciates the efforts the teaching staff is making. They take the students seriously. A high percentage (91%) of the teaching staff holds a UTQ (University Teaching Qualification). Overall the panel thinks that the quality of the teaching staff is good.

Facilities
Marine Technology has a number of facilities for experimentation at its disposal for research and education: model basins, hydro-mechanic workshops, cavitation tunnel, flume tank, diesel engine and hexapod. The panel received a video of the lab facilities and was given a short tour during the site visit. The facilities in general add to the attractiveness of the bachelor's and master's programme Marine Technology. The panel appreciates that research funding is used to keep the facilities up-to-date and that students can also make use of them. This is a laudable implementation of research-led teaching.

Considerations
The curriculum of the bachelor's programme Marine Technology enables the students to achieve the intended learning outcomes. The panel found the curriculum to be well developed, managed and implemented; there is a good alignment between the intended learning outcomes and the curriculum.

The panel is positive about the projects and the learning lines that structure the curriculum. The vision of the Faculty on education in which engineering fundamentals and mathematics are immediately applied in projects in order to stimulate students to study consistently is appreciated. The programme invests sufficiently in mentoring and guiding the students to adapt their study style to the university environment. Students have ample possibility in the projects to apply their acquired knowledge and skills in practice. The panel appreciates the design spiral of the curriculum. Students receive a solid basis in scientific knowledge and marine technology, combined with the development of soft skills and group work. The panel is also very positive about the position of the minor in the programme and the wide range of possible minor programmes students can choose from.

The Faculty 3mE offers a solid master's curriculum MT in the panel's opinion. The structure of the curriculum of the master's programme is comparable to that of other engineering master's programmes. The curriculum enables the students to achieve the intended learning outcomes. The Faculty provides excellent facilities for experimentation in education, which makes the programme very attractive. Furthermore, students profit from a close connection to industry. This connection enables them to perform their thesis research projects in companies, which is very much appreciated by them. The panel endorses this appreciation.

The study yields could be improved, however. The panel is of the opinion that the university should take responsibility for the slow study progress of the students; it noticed and appreciates that the Faculty management is starting to think about it. It encourages the faculty management to investigate whether more incentives to encourage timely progress of the students are possible.

The quantity and the quality of the teaching staff are good.

Conclusion
Bachelor's programme Marine Technology: the panel assesses Standard 2 as satisfactory.

Master's programme Marine Technology: the panel assesses Standard 2 as satisfactory.

Standard 3: Student assessment
The programme has an adequate system of student assessment in place.

Findings
Assessment policy
The Faculty aims to achieve the highest possible quality standards in relation to validity, reliability and transparency for assessments, within the limits of feasibility. The Faculty's full vision and policy on assessment are described in the document 'Toetsing bij 3mE'. In order to determine adequately whether a student has achieved the final qualifications, every form of assessment is tailored to the learning objectives and teaching formats (constructive alignment). An examiner should have the UTQ certificate or be in the process of obtaining one. All examiners in the bachelor's and master's programmes are employed by TU Delft.

In the process of constructing tests, examiners have to apply the 'four-eyes' principle with a colleague in the interests of safeguarding the quality of assessment. This can vary from the provision of feedback to doing trial tests, discussing the answer model and jointly determining the pass mark. Examiners have to prepare a test matrix in advance as a blueprint for their exams to guarantee the constructive alignment.

Once every three years, the educational advisor provides the examiners with feedback on test issues such as reliability, validity, construction and safeguarding of the learning objectives. Examiners who are not in the procedure are expected to keep working on improving quality and using the relevant instruments. The educational advisor is always available for support at the examiner's request. At the end of every semester, the educational advisor submits an evaluation with findings and recommendations to the Board of Examiners and the Director of Education.

For written exams, students receive their grades within 15 working days after the exam date. Students have the right to feedback on their exam work within 20 working days after the grade publication date. Most lecturers organise office hours or something similar for students to check their exams and ask questions. Students increasingly receive digital scans of the exams they have taken, and the feedback procedure is often handled online as well.

During the site visit the panel learned about the test matrix that is used to align the programme with the intended learning outcomes, the learning outcomes of the course, the course exam and the assessment. It found this matrix to be very helpful and a good instrument to improve the validity and quality of assessment. It is also very positive about the assessment policy in general. It appreciates the role of the educational advisor in quality assurance and, in particular, the support the educational advisor gives to the teaching staff to improve the assessment quality. It was assured during the site visit that all teachers are aware of the policies and that measurements to assure the validity and reliability of the assessments are implemented.

Assessment methods
In the bachelor's programme every course or project unit contains at least one summative test at the end of the module period. For the theory courses, testing is rather uniformly conducted by 'written exams'; the majority on paper containing open questions, multiple-choice questions and 'short answer' questions (mixtures of them), but some tests are taken on computer screens in prepared digital examination halls. In the projects, assessment is mainly done by written research reports and oral presentations that are all commonly graded via a rubric.

Regarding the BEP, students are graded for individual performance as well as group performance. To ensure that the students get an objective assessment, each group has two supervisors: the primary supervisor, who proposed the assignment, and a secondary supervisor, who acts as a neutral observer and advises the primary supervisor on the grades. The secondary supervisor is always the primary supervisor of another group, which he supervises with the same co-supervisor.

Within the master's programme, several ways of formative and summative testing are used: written exams, oral exams, individual project work, group project work and homework assignments. The graduation project is divided into two parts: a literature survey and a thesis that is assessed independently. The literature survey is assessed by the supervisor. For the thesis, students must write a well-structured scientific report, present their findings at a public colloquium, and defend their work before a graduation committee. This committee should consist of at least two scientific staff members and one postdoc or PhD candidate. One staff member should be from another section or preferably another department. The chair should be a full or associate professor who is authorized by the Board of Examiners to sign the master's certificate. The supervisor is a member of the committee. Industrial partners can take part in the committee as guests. To ensure that the thesis is assessed in a uniform manner, a set of uniform assessment criteria for the thesis has been introduced, which are set out in the Master's Thesis Grading Rubric.

The panel established that in both the bachelor's and the master's programme, a variety of assessment methods are used, which is very positive. The main assessment form used in the bachelor's programme is still the written test, which is appropriate. During the site visit it was mentioned that multiple-choice questions are being used steadily less, due to unfortunate experiences. The panel wants to emphasize that it is possible to construct high-quality, multiple-choice exams, testing higher level learning outcomes and competences.

Board of Examiners
The Board of Examiners (BoE) of 3mE consists of a chairman, a secretary, one member of each research department and an external member from another Faculty. The BoE performs its duties independently. The chairman and the secretary of the BoE hold regular meetings with the Dean, the Director of Education, and other TU Delft Boards of Examiners to discuss common concerns and improve assessment.

The BoE monitors the quality of assessment and the correct application of the Teaching and Examination Regulations. Additionally, it deals with students with special personal circumstances and with appeal cases. It has regular meetings in which it decides on cases brought in by students and staff members. The outcomes of its decisions are communicated in writing. In order to promote the equal treatment of students and to preserve the ability to act decisively, wherever possible, decisions are transformed into policy and recorded in internal policy documents.

According to the panel, the BoE has put adequate procedures in place to check the quality of assessment in the programme. The panel is very positive about the way the BoE is performing its tasks. The BoE has set strict rules for the composition of graduation committees and for graduating with distinction. It has a fraud and a complaints committee, each consisting of three members. These committees advise the BoE, which comes to a joint decision. There is a protocol for the procedure to be followed in cases of fraud. The BoE maintains close contact with the educational advisor about the quality of the exams. The semester evaluation by the educational advisor is regularly discussed in a meeting of the BoE. In specific cases, the BoE can request the educational advisor to provide feedback or an analysis of an exam that was not assessed that year.
Every year, the BoE writes an annual report on the performance of its statutory duties. It also inspects the thesis work and accompanying assessment forms twice a year for a number of randomly chosen master students and assesses whether the graduation committees made fair judgements leading to the final grades.

Considerations
The Faculty's assessment system and policy are well developed and implemented. All teachers are aware of the policies and measures implemented to assure the validity and reliability of the assessments. The Faculty has ensured that the teachers are supported in their tasks by the appointment of an educational advisor.

The courses in the bachelor's as well as in the master's programme use a variety of assessment methods, which are very well aligned, with the help of the matrices, with the learning outcomes and the curriculum. The assessment procedures for the BEP and the master's thesis are well developed and documented. The procedures are transparent for teachers and students.

The panel is very positive about the way the Board of Examiners is performing its tasks and concluded that the examinations, tests and thesis assessment are transparent, valid and reliable.

Conclusion
Bachelor's programme Marine Technology: the panel assesses Standard 3 as good.

Master's programme Marine Technology: the panel assesses Standard 3 as good.

Standard 4: Achieved learning outcomes
The programme demonstrates that the intended learning outcomes are achieved.

Findings
The panel studied a selection of 15 bachelor end projects and 15 master's theses to assess whether the graduates had achieved the intended learning outcomes. It concluded that the bachelor graduates did indeed achieve the level that can be expected. It found that both the BEP reports and the master's theses were of a high level overall. The BEP reports showed that the bachelor students are competent in the scientific discipline Marine Technology and are able to conduct research and design under supervision. They demonstrated a scientific approach to problems and ideas, based on current knowledge. The bachelor's programme prepares the students for continuing their studies in a master's programme. The alumni of the bachelor's programme felt well prepared for the master's programme.

The panel also concluded that the master's graduates did indeed achieve the level that can be expected of them. It studied a selection of theses with a mix of high grades and low grades and found them to be of a high level overall. It would have graded most theses higher than the graduation committee. The theses showed that the graduates are able to conduct research and design independently, have a scientific approach to complex problems and ideas, and have the ability to seek new potential applications, taking the social context into consideration. The theses showed an advanced level of knowledge in a specialised field, systematic understanding of the key aspects and concepts in mechanical engineering, and the ability to integrate theory and practice.

The self-evaluation states that the MT programme involves hydromechanics, structural engineering, marine engineering, production, shipping management and design. This combination of competences is highly sought after by industry. Graduates easily find jobs. The faculty has an active Industrial Advisory Board which meets twice a year and is involved in curriculum changes, research reviews and the profile of the graduates. A recent survey of employers showed that the professional field perceives the graduates as competent.

Considerations
The panel concludes that graduates of the bachelor's programme Marine Technology have achieved the intended learning outcomes. It found the level of the BEP reports to be good. The graduates of the bachelor's programme are well prepared for continuing their study in a master's programme.

The panel concludes that graduates of the master's programme Marine Technology have achieved the intended learning outcomes. It found the level of the master's theses to be very good and would have graded most theses higher than the graduation committee. The graduates are well prepared for continuing in a PhD programme or a career in industry.

Conclusion
Bachelor's programme Marine Technology: the panel assesses Standard 4 as good.

Master's programme Marine Technology: the panel assesses Standard 4 as good.

GENERAL CONCLUSION

The panel assesses standards 1, 3 and 4 of the bachelor's programme as good and standard 2 as satisfactory. It was positive about the detailed formulation of the intended learning outcomes, the assessment system and the level achieved by the bachelor graduates. Following the NVAO decision rules, the panel's general conclusion is that the programme is assessed as good.

The panel assesses standards 1, 3 and 4 of the master's programme as good and standard 2 as satisfactory. It was positive about the detailed formulation of the intended learning outcomes, the assessment system and the level achieved by the master graduates. Following the NVAO decision rules, the panel's general conclusion is that the programme is assessed as good.

Conclusion
The panel assesses the *bachelor's programme Marine Technology* as good.

The panel assesses the *master's programme Marine Technology* as good.

APPENDICES

APPENDIX 1: DOMAIN-SPECIFIC FRAMEWORK OF REFERENCE

Introduction

Today's society strongly depends on the use of the world's oceans and waterways to sustain and further increase our welfare. Over 50.000 merchant ships sail across the seas to transport 90% of all our goods, while thousands of other ships and floating structures are used to fish, extract oil and gas from below the seabed, install and support offshore windfarms, provide safety and security and perform a host of other tasks. The Netherlands has a thriving maritime cluster that designs, builds, operates and supports significant numbers of these ships. The cluster consists of over 17.000 companies that employ over 270.000 employees and annually add over 23 billion Euros of value (Nederland Maritiem Land, 2018). To support the Dutch and global maritime cluster, the bachelor's programme Marine Technology and the master's programme Marine Technology strive to educate committed BSc and MSc engineers that are able to develop, build and manage ships and are able to develop, build and manage ships and other floating structures and their respective equipment in such a way that they are successful in today's highly competitive maritime markets and meet all modern sustainability requirements.

To achieve this aim, we educate engineers with a broad knowledge of the engineering discipline Marine Technology and its sub-disciplines ship structures, ship hydromechanics, marine engineering, ship design, ship production and shipping management. Furthermore, the programme aims to provide the students with a profound knowledge base in the fundamental engineering sciences and mathematics. It is the only programme of its kind in the Netherlands and among the largest in Europe.

The bachelor's programme's core aim is shared by all major similar bachelor's programmes in Europe: NTNU (Alesund, Norway), TUHH (Hamburg, Germany), Universita degli studi di Genova (Genoa, Italy), Instituto Superior Tecnico (Lisbon) and the BEng programme of the University of Newcastle (UK). Although on a detailed level, the various programmes all have different focus points. However, all major disciplines that are addressed at TU Delft are also addressed at the other universities, with the exception of shipping management, which is only clearly identifiable in Delft and Newcastle. In terms of attention paid to engineering fundamentals and mathematics, TU Delft is in the middle of the field. The BEng at Newcastle University pays less attention to the fundamentals and spends more time on practical applications. On the other side of the spectrum, Lisbon currently only has a limited number of Marine Technology courses, while spending more effort on mathematics and basic engineering knowledge. They intend to change this in favour of the MT courses in the future. NTNU also pays a significant amount of attention to offshore engineering, which in Delft is covered extensively in the master's Offshore Engineering.

The MSc in Marine Technology is a subject-oriented master's. It combines a variety of scientific disciplines to focus on a single subject: ships. There are six disciplines involved in the MSc MT programme at TU Delft:

- Ship Hydromechanics
- Ship Structures
- Ship Design
- Shipping Management
- Ship Production
- Marine Engineering

The programme is the only one of its kind in the Netherlands. In the 2017 Shanghai rankings, the TU Delft MSc MT ranked 5th in the discipline of Marine/Ocean Engineering, after Shanghai Jiaotong, NTNU, Dalian and (IST) Lisbon. The Times Higher Education Ranking places TU Delft above these universities, however, it is not field specific. Within Europe, there are numerous maritime programmes. Basically, every country with access to the sea and a shipping or shipbuilding industry of any importance has at least one university which offers a degree in Marine Technology, Marine

Engineering or Naval Architecture. However, specific choices and focus points within each discipline are made in each country depending on the nature of the industry.

Hydromechanics is a part of maritime education almost without exception. This discipline distinguishes Marine Technology from other engineering degrees, such as Mechanical Engineering and Civil Engineering. This was confirmed by a benchmark study on the availability of the various disciplines in other European maritime education programmes.

Recently, several leading organizations within the maritime sector presented their vision for the industry over the next 10-30 years. Invariably, we will experience an increase in automation, both in the production of ships and shipping itself. Human-computer interaction and digital data will also play a much greater role, as well as new forms of energy and propulsion. Finally, but perhaps most importantly, the oceans are increasingly considered the place to go to increase our food supply (e.g. seaweed), raw materials (deep sea mining), energy creation and for life itself.

These new demands will only increase the importance of maritime technology in the future and will also further increase the number of disciplines involved in this field. Major changes to the programme, as well as the relevance of the current programme are discussed in regular meetings with industrial representatives. This close cooperation has ensured our students remain in high demand, both by research institutes and companies.

To ensure that the programme is up-to-date and covers the relevant topics, there is regular interaction with an Industrial Advisory Board, consisting of representatives from various Dutch companies and institutes that frequently hire our graduates. There are meetings at least twice a year, at which recent developments within the programme are discussed and the Industrial Advisory Board provides advice.

APPENDIX 2: INTENDED LEARNING OUTCOMES

Bachelor's programme Marine Technology

1. Competent in the scientific discipline marine technology

A graduate in Marine Technology is able to...

1A. ...solve intermediate problems in the fundamental engineering sciences that form the basis of marine technology: solid and fluid mechanics and mathematics.

1B. ...solve elementary problems in related fields: thermodynamics, materials science, control engineering, electricity and information technology.

1C. ...solve intermediate problems in the most important marine technology disciplines: ship hydromechanics, ship structures, ship design, marine engineering, shipping and ship production.

2. Competent in doing research

A graduate in Marine Technology is able to...

2A. ...apply knowledge and skills in the scientific discipline marine technology to research marine systems.

2B. ...apply common methods and tools that are used to model, simulate and research marine systems.

2C. ...apply commonly used problem solving models to do applied research under supervision.

2D. ...document research approach and outcomes in a scientific report or paper.

3. Competent in designing

A graduate in Marine Technology is able to...

3A. ...apply knowledge and skills in the scientific discipline marine technology to design marine systems.

3B. ...apply commonly used methods and tools to design coherent marine systems.

4.A scientific approach

A graduate in Marine Technology is able to... :

4A. ...define and analyse problems, in the range from academic-fundamental to industrial-applied.

4B ...develop innovative solutions to problems and evaluate the feasibility and limitations of these solutions.

5. Basic intellectual skills

A graduate in Marine Technology is able to...

5A. ...systematically gather the relevant information to solve problems in a systematic way.

5B. ...maintain and extend his/her knowledge and skills through self-study

5C. ...critically reflect on own knowledge, skills and attitude.

5D. ...take a rational standpoint with regard to a scientific or technical argument within the area of research and/or design.

6. Competent in co-operating and communicating

A graduate in Marine Technology is able to...

6A. ...work individually with a high level of autonomy.

6B. ...work in teams and divide subtasks within a team.

6C. ...explain and defend outcomes from the research area to specialists and peers from university and industry.

6D. ...present and report his/her work in Dutch according to the common standards for style and structure and neatness

7. Considering the temporal and social context

A graduate in Marine Technology is able to...

7A. ...evaluate and assess the technological, ethical and societal impact of own work.

7B. ...act responsibly with regard to sustainability, economy and social welfare.

Master's programme Marine Technology

1. Competent in the scientific discipline Marine Technology

A graduate in Marine Technology is able to…

1A. …apply applied physics and mathematics in maritime systems.
1B. …design, carry out and evaluate experiments.
1C. …discuss and evaluate recent advances in a discipline of Marine Technology.

2. Competent in doing research

A graduate in Marine Technology is able to…

2A. …study a topic by critically selecting relevant scientific literature.
2B. …write a scientific report about his/her own research.
2C. …analyse maritime systems at various levels of abstraction, including a reflective understanding of their structure and relations to other fields.
2D. …generate knowledge within the discipline of Marine Technology.

3. Competent in designing

A graduate in Marine Technology is able to…

3A. …generate innovative contributions to a discipline of Marine Technology.
3B. …systematically design complex (parts of a) ship and its systems.
3C. …take into account the impact on other disciplines of Marine Technology.

4. A scientific approach

A graduate in Marine Technology is able to…

4A. …apply paradigms, methods and tools to design/improve a (part of a) ship.
4B. …analyse problems and use modelling, simulation, design and integration to solutions.
4C. …manage his/her own scientific research independently.

5. Basic intellectual skills

A graduate in Marine Technology is able to…

5A. …analyse and solve technological problems in a systematic way.
5B. …identify and acquire lacking expertise.
5C. …critically reflect on own knowledge, skills and attitude.
5D. …plan and execute research in changing circumstances.
5E. …integrate new knowledge in an R&D project, considering ambiguity, incompleteness and limitations.
5F. …remain professionally competent.
5G. …take a standpoint with regard to a scientific argument within the research area.

6. Competent in operating and communicating

A graduate in Marine Technology is able to…

6A. …work both independently and in multidisciplinary teams.
6B. …explain and defend outcomes from the research area to academia and industry, to specialists and the public.
6C. …present and report in good English.

7. Considering the temporal and social context

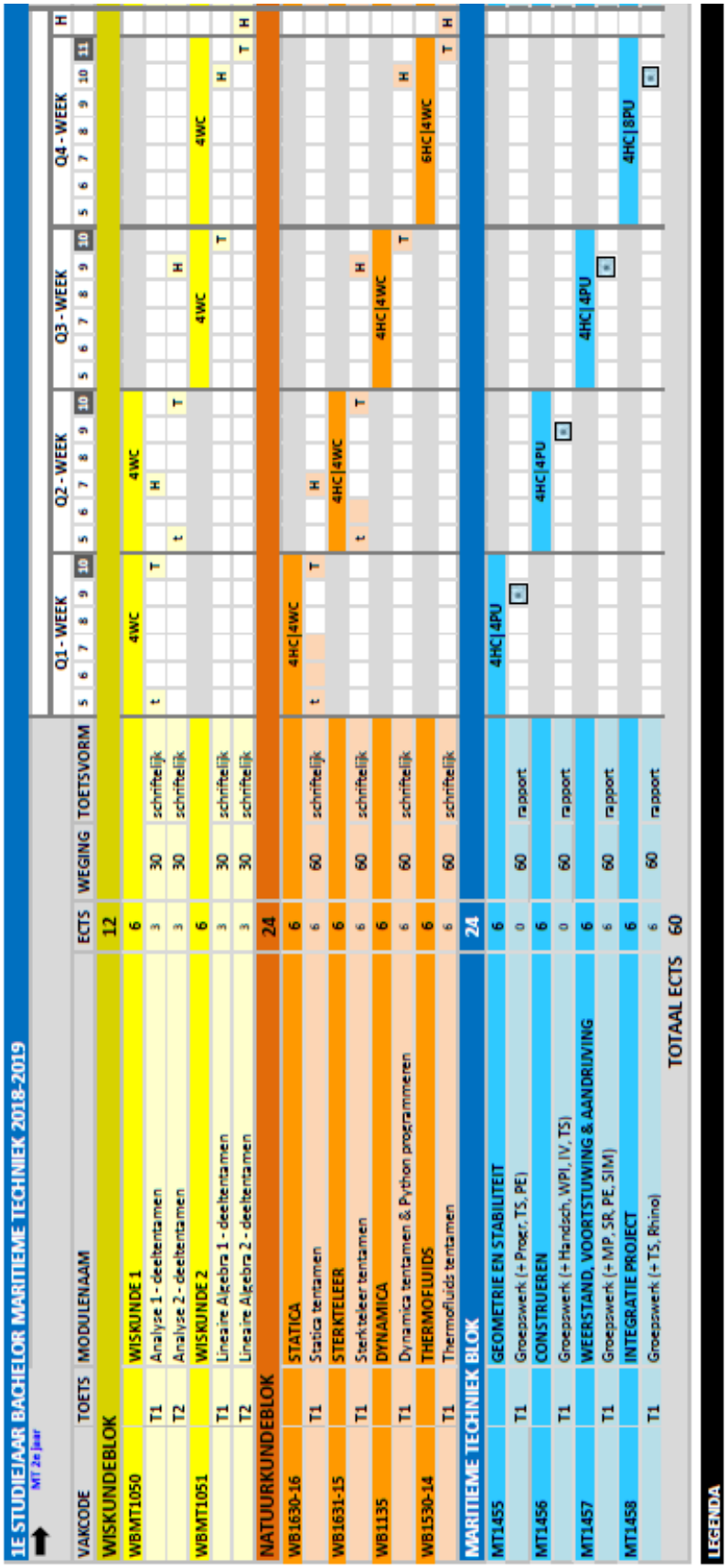
A graduate in Marine Technology is able to…

7A. …evaluate and assess the technological, ethical and societal impact of his/her own work.
7B. …act responsibly with regard to sustainability, economy and social welfare.

APPENDIX 3: OVERVIEW OF THE CURRICULUM

Bachelor's programme Marine Technology

Year 1



2E STUDIEJAAR BACHELOR MARITIEME TECHNIEK 2018-2019

MT 1e jaar

VAKCODE	TOETS	MODULENAAM	ECTS	WEGING	TOETSVORM	Q1 - WEEK 5	6	7	8	9	10	Q2 - WEEK 5	6	7	8	9	10	Q3 - WEEK 5	6	7	8	9	10	Q4 - WEEK 5	6	7	8	9	10	11	H
WISKUNDEBLOK			**12**																												
WBMT2048		WISKUNDE 3	6			4HC | 2WC						4HC |																			
	T1	Analyse - deeltentamen	3	30	schriftelijk						T					H															
	T2	Differentiaalvergelijkingen - deeltentamen	3	30	schriftelijk												T					H									
WBMT2049		WISKUNDE 4	6															4HC |						4HC |						
	T1	Kansrekening en Statistiek - deeltentamen	3	30	schriftelijk																	T							H		
	T2	Numerieke Wiskunde - deeltentamen	3	30	schriftelijk																									T	H
	T3	Numerieke Wiskunde - practicum	0	0	practicum																			3 dagd.							
MARITIEME THEORIE BLOK			**24**																												
WB2630		MECHANICA	6			8HC																									
	T1	Advanced Dynamics	3	30	schriftelijk						T					H															
	T2	Continuum Mechanics	3	30	schriftelijk						T					H															
MT2430-16		WEERSTAND, VOORTSTUWING EN AANDRIJVING 2	6									6HC																			
	T1	WVA2 Tussentoets	1	30	schriftelijk							T				H															
	T2	Voortstuwings Practicum	0,5	0	Deelname																										
	T3	Cavitatie Practicum	0,5	0	Deelname																										
	T4	Dieselmotor Practicum	0,5	0	Deelname																										
	T5	WVA2 tentamen	3,5	70	schriftelijk												T					H									
MT2432		STERKTELEER VAN SCHEPEN	6															6HC |2WC												
	T1	SvS tentamen	5	80	schriftelijk																	T							H		
	T2	Materiaal Practicum	0,5	10	Rapport																										
	T3	Constructie Practicum	0,5	10	Rapport																										
MT2433		SCHEEPSBEWEGINGEN	6																					4HC | 4WC						
	T1	Scheepsbewegingen tentamen	6	100	schriftelijk																								T	H	
MARITIEME PRAKTIJK BLOK			**12**																												
MT2429		MARITIEME MARKTEN EN OPERATIES	6			4HC |																									
	T1	Project Opdracht	4	65	rapp./pres.																										
	T2	MMO tentamen	2	35	schriftelijk											H															
MT2431		GEOMETRIE EN STABILITEIT 2	6									6HC |																		
	T1	Project Opdracht	3	50	rapp./pres.																										
	T2	G&S2 tentamen	3	50	schriftelijk												T					H									
MARITIEME PROJECT BLOK			**12**																												
MT2434		2E INTEGRATIEPROJECT	12															4HC |						4HC |						
	T1	Project Opdracht(en)	10	85	rapport																										
	T2	Ethiek en Veiligheid tentamen	2	15	schriftelijk																	T									H
		TOTAAL ECTS	60																												

3E STUDIEJAAR BACHELOR MARITIEME TECHNIEK 2018-2019

MT 2e jaar

CONTACTUREN PER WEEK EN TOETSING IN:

VAKCODE	TOETS	MODULENAAM	ECTS	WEGING	TOETSVORM	Q1 - WEEK 1-5 6 7 8 9 10	Q2 - WEEK 1-5 6 7 8 9 10	Q3 - WEEK 1-5 6 7 8 9 10	Q4 - WEEK 1-5 6 7 8 9 10 11	A
MINORBLOK			**30**							
		Minor Biomedical Engineering								
		Minor Robotica								
		Minor Zeiljachten								
		Alle TUD-minors of vrije minor								
MARITIEME TECHNIEK BLOK			**18**							
MT3431		COMPLEXE BELASTINGEN EN TRILLINGEN	6					8HC		
	T1	CBT tentamen	5	100	diversen			T	H	
	T2	Practicum Trillingen	1	0	practicum			p		
MT3432		ORGANISATIE VAN SCHEEPSPRODUCTIE	6					8HC		
	T1	OVS tentamen	2,5	25	schriftelijk			T	H	
	T2	Rapport	3,5	35	rapport			#		
MT3420		ELEKTRISCHE SYSTEMEN & REGELTECHNIEK	6						8HC	
	T1	ESR tentamen	6	60	schriftelijk				T	H
EINDPROJECT BLOK			**12**							
MT3BEP		BACHELOR EINDPROJECT	12			herkansing	herkansing	regulier	regulier	
	T1	Bachelor Eindproject	12	120	rapp.pres.	3 ECTS	9 ECTS R	3 ECTS	9 ECTS R	
		TOTAAL ECTS	**60**							

Master's programme Marine Technology

Master MT 2018-2019

Code	Course	Docent	ME	SP	SM	SD	SH	SOS	EC	Period		Test
MT44015	Student Colloquia	Secretariaat	C	C	C	C	C	C	0			-
MT44020	Motions & Loading of Structures in Waves	Wellens	C	C	C	C	C	C	5	Q2	Q3	T
MT44030	Torsion and shear in Marine Structures	Kaminski/Pahlavan	C	C	C	C	C	C	5	Q1		R + O
MT44035	Design of Complex Specials	Hopman/Kana	C	C	C	C	C	C	5	Q4		R
MT44000	Mechatronics in MT	Godjevac	C	C	C	C	C	C	5	Q1 & Q3		R
MT44040	Maritime Finance, Business & Law	Pruyn	C	C	C	C	C	C	5	Q2		R + P
MT44045	Introduction to Ship and Offshore Hydromechanics	Wellens	H	H	H	H	H	H	3	Q1		T
WM0320TU	Ethics and Engineering	TBM	*	*	*	*	*	*	3	Q1 & Q3		T
WM1301TU	Ethics of Transportation	TBM	*	*	*	*	*	*	3	Q3		T
WM0375TU	Risk Ethics	TBM	*	*	*	*	*	*	3	Q3		T
WM0353TU	Climate Ethics	TBM	*	*	*	*	*	*	3	Q2		T
MT44065	Risk in Maritime Asset & Project Management	Coenen/Godjevac	C	C	C	C			5	Q1		R + T
ME44205	Quantitative Methods for Logistics	Duinkerken	C	C	C	C			5	Q1	Q2	T
MT44050	Fundamentals of Marine Engineering	de Vos	*			R			5	Q3		T
ME44310	Advanced Operations and Production Management	Beelaerts		*					6	Q3	Q4	R + T
MT44070	Shipping Management	van de Voorde			*				5	Q3		R + P
MT44095	Design of Advanced Marine Vehicles	Frouws			R	*			5	Q1		R + P
ET4117	Electrical Machines and Drives	Polinder	R						4	Q2		T
ME44305	Delft Systems and Simulation Approach	Veeke/Coenen		R	R				5	Q3	Q4	R
ME45100	Fuel Cell Systems	Purushothaman Vellayani	R		R	R			3	Q4		T
MOT1421	Economic Foundations	Storm			R				5	Q2		T
MT44005	Marine Propulsion System	Godjevac/Grevink	R		R	R			3	Q4		T
MT44100	Diesel Engines A	Visser	R		R				5	Q3		T
MT44105	Diesel Engines B	Visser	R						5	Q4		R + T
MT54005	Individual Research Assignment for MT-DPO	Pruyn	R	R	R	R			15	-		R
SC42020	Modern Robotics	Delgado Lopes		R					5	Q4		T
SC42060	Modelling and Nonlinear Systems Theorie	Jeltsema	R	R	R	R			4	Q2		T
MT44025	Numerical Ship Hydrodynamics	Akkermans			R	R	C	C	5	Q3		R
MT44090	Fluid - Structure Interaction in Marine Structures	Den Besten					C	C	5	Q1		R
ME45040	Advanced Fluid Dynamics	Tam					*		5	Q1	Q2	T
OE44085	Fatigue strength of marine structures	Den Besten						*	5	Q3		R + O
AE4136	CFD 2: Discretization Techniques	Gerritsma					R		2	Q2		R + O
CIE4325	Ocean Waves	Reniers					R	R	6	Q1		T
ME45155	Modelling of thermo- and hydrodynamic systems											R + T
ME46050	Advanced finite element methods	Aragon					R		4	Q3	Q4	R
MT44010	Non-metallic materials in Marine Structures	Kaminski		R		R		R	5	Q2		R + T
MT44060	Advanced Course in Resistance and Propulsion	Terwisga				R	R		4	Q3	Q4	R + P
MT44080	Hydromechanics of Special Shiptypes	Keuning/Thill					R		4	Q4		R
MT44085	Buckling & Ultimate Strength in Marine Structures	Kaminski				R		R	5	Q2		R + O
MT54005	Individual Research Assignment for MT-Sc	Wellens	R	R	R	R			15	-		R + O
Total EC Obligatory Courses			35	35	35	35	35	35				
Total EC Star-Electives			8	9	8	8	8	8				
MT54015-A	Thesis Project, Analysis and Literature Research		10	10	10	10	10	10				
MT54015-B	Thesis Project, Solution generation and validation + defense		35	35	35	35	35	35				
Total EC available for free-electives			32	31	32	32	32	32				
Total EC Master			120	120	120	120	120	120				

The courses with a "C" are obligatory for a certain track. To graduate with a certain research group (direction within Maritime Technology), a Star-elective ("*") must be followed. Also, for a course on Ethics we decided to apply the principle of Star-Electives, allowing students to pick a course from a pre-selected list.

Also, for the Test Column;
- T is a written exam
- R is a report
- O is an oral exam
- P is a presentation

APPENDIX 4: PROGRAMME OF THE SITE VISIT

Thursday 13 December 2018

Time	Activity	Function
08.30–08.45 h	Welcome	Director of Education 3mE
08.45–09.45 h	Programme Management	Dean 3mE Director of Education 3mE Director of Studies Master's coordinator Master's coordinator Head Education & Student Affairs
09.45 – 10.00 h	*Break*	
10.00–10.45 h	Bachelor Students Mechanical Engineering	
10.45–11.00 h	*Break*	
11.00–11.45 h	Master's Students Mechanical Engineering & Materials Science & Engineering	
11.45–12.15 h	*Lunch*	
12.15–12.45 h	Roundtour	
12.45–13.30 h	Staff Mechanical Engineering	
13.30-13.45 h	*Break*	
13.45–14.30 h	Staff Materials Science & Engineering	
14.30–14.45 h	*Break*	
14.45–15.15 h	Board of Examiners	Chair Member Member Secretary Educational Advisor
15.15–15.30 h	*Break*	
15.30–16.30 h	Professional Field Alumni	Boskalis (ME) Huisman Equipment (MSE) De Voogt Nav.Arch. (ODE) Alumnus ME Alumnus ME Alumnus MT
16.30–18.00 h	*Drafting preliminary conclusions*	

Friday 14 December 2018

Time	Activity	Function
08.30 – 08.45 h	Arrival	
08.45–09.45 h	Programme Management Marine Technology & Offshore and Dredging	Dean 3mE Director of Education Director of Studies Director of Studies Master's coordinator Head Education & Student Affairs
09.45–10.00 h	*Break*	
10.00–10.45 h	Students Marine Technology	
10.45–11.00 h	*Break*	
11.00–11.45 h	Staff Marine Technology & Offshore and Dredging Engineering	
11.45–12.30 h	*Lunch*	
12.30–13.00 h	Students Offshore & Dredging Engineering	
13.00–13.45 h	Programme Management Representatives	Dean 3mE Director of Education Director of Studies Director of Studies Head Education & Student Affairs
13.45–16.00 h	*Drafting preliminary conclusions*	
16.00–17.15 h	Feedback meeting & drinks	

APPENDIX 5: THESES AND DOCUMENTS STUDIED BY THE PANEL

Prior to the site visit, the panel studied 15 theses of the bachelor's programme Marine Technology and 15 theses of the master's's programme Marine Technology. Information on the selected theses is available from QANU upon request.

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

- 3mE Vision on Education
- Criteria for Academic Bachelor's and Master's Curricula
- Film Lab Facilities
- Toetsing bij 3mE
- Teaching and Examination Regulations Mechanical Engineering 2018-2019
- Master 3mE Graduation Procedure
- Results of Employers Survey
- Jaarrapportage Bacheloropleiding Maritieme Techniek 2016-2017
- Year report Master's degree programme Marine Technology 2016-2017
- 3mE Annual Report, MSc Mechanical Engineering 2016-2017
- Minutes Board of Examiners 2017-2018
- Minutes Board of Studies 2017-2018