academion

M Materials Science and Engineering

TU Delft

www.academion.nl
info@academion.nl

Project code P2321

Contents

Summary 4
Score table 6
Introduction 7
Procedure 7
Panel 8
Information on the programme 9
Description of the assessment 10
Organization 10
Recommendations previous accreditation panel 10
Standard 1. Intended learning outcomes 10
Standard 2. Teaching-learning environment 12
Standard 3. Student assessment 19
Standard 4. Achieved learning outcomes 21
General conclusion 22
Recommendations 22
Appendix 1. Intended learning outcomes 23
Appendix 2. Programme curriculum 24
Appendix 3. Programme of the site visit 25
Appendix 4. Materials 26

Summary

Standard 1. Intended learning outcomes

Based on the reviewed documents and discussions during the site visit, the panel concludes that the master's programme Materials Science and Engineering has a well-defined, unique profile. It offers students broad expertise as well as professional and personal skills focused on the sustainable design, production, and application of materials, while combining fundamental and engineering knowledge, design expertise and societal relevance. The panel appreciates the interdisciplinarity of the programme, which covers a broad range of disciplines (physics, chemistry, characterization and computational methods), as well as the strong embedding of environmental and sustainability considerations in the programme, and the preferred shift from a focus on knowledge and data to excellence in application and recombination. Furthermore, the programme is very attentive to contemporary academic and societal questions, due to its strong connections with the professional and societal field. The panel considers the ILOs to be appropriate to an academic master's level and in alignment with expectations in the academic and professional field.

Standard 2. Teaching-learning environment

The panel considers the curriculum to be well-structured and coherent. The curriculum covers all ILOs and provides students with a broad foundation in materials science and engineering, thus offering a unique programme for the international industry. The panel appreciates the comprehensive set of core courses, which also cover relevant ethical and societal-oriented aspects. According to the panel, the curriculum integrates an attractive mix of experimental techniques and fundamentals. The four specializations provide a wide variety of options, offering much flexibility for students and a broad (interdisciplinary) focus. In addition, the panel is positive about the attention to personal skills development. Concerning the scheduling of courses, the panel encourages the programme to seek a structural solution to resolve any course overlaps in the scheduling of electives and core courses.

The panel appreciates how the curriculum is continuously updated in response to developments in the professional and academic fields. In general, there is a need for improved monitoring through the PDCA (Plan-Do-Check-Act) cycle, particularly in relation to the connection with the ILOs. To facilitate this process, the panel believes that the role of programme directors could be strengthened. While it values the formal and informal evaluation of courses, the panel is of the opinion that more attention could be paid to data driven evaluation and providing feedback on students' feedback.

The panel is positive about the small-scale, student-centred learning environment, providing opportunities for the development of an academic community, and the active role of the study association. The courses offer varied teaching methods, including blended learning and project-based education, and an appropriate balance between theoretical knowledge and practical skills. The panel highlights the importance of keeping a focus on AI in the programme. Student awareness could be increased by (further) integrating AI into teaching. The panel appreciates the interdisciplinary focus of the programme, including the Joint Interdisciplinary Project (JIP), as well as the increased emphasis on student integration and personal development. The strong ties of the programme with the industry provide students with enriching learning opportunities. According to the panel, students are well-supported throughout the programme, with staff actively engaged in this effort. The panel concludes that all students receive adequate guidance and support. Furthermore, the admission criteria, the information provided to students, and the facilities available for students with disabilities are all satisfactory.

The panel considers the curriculum of the programme to be feasible, although it encourages the programme to pay further attention to the study duration, building upon the progress made in recent years. In this

context, the panel appreciates the introduction of a progress monitoring system. Additionally, the panel recommends reassessing the allocation of EC for specific courses and closely monitoring the workload for each course.

The panel is impressed with the quality and enthusiasm of the teaching staff of the programme, who come from a variety of (international) backgrounds. They are all pedagogically qualified and are experts in their diverse fields, covering the broad academic scope of the programme. All staff members engage in research and have strong connections with the professional and societal field through their research activities, thus providing a research-intensive environment. In addition, the panel appreciates that lecturers value personal contacts with students; they are easily accessible and are dedicated and responsive towards students. Furthermore, the cooperative principal investigator (CPI) governance model is valued for fostering teamwork and encouraging active participation in education.

The English-taught programme is internationally oriented, which is reflected in the international community of students and staff. According to the panel, the choice of an English name and language of instruction is well substantiated and aligns well with the international nature of the professional and academic field.

Standard 3. Student assessment

The panel concludes that the assessment system is transparent and well designed. Adequate procedures, such as the four-eyes principle, are in place to ensure and enhance the quality of assessment. The assessment methods used are diverse and appropriate, and include assessment of skills. Amongst others, the panel appreciates the attention for constructive alignment, the standard rubrics for the literature research and MSc thesis, and the support offered by ESA. In addition, the panel appreciates the introduction of an assessment matrix for the project-based courses, as well as the efforts of the programme to inform (new) lecturers about assessment materials and policies more consistently.

The graduation project covers all ILOs of the programme at an individual level. The panel appreciates the set-up of the thesis project and the way it is evaluated according to uniform assessment criteria, set out in a clear rubric. The panel considers the assessment procedure to be well thought out and the grades awarded to be sufficiently substantiated. As for the duration of the graduation project, the panel encourages the programme to streamline processes and ensure consistency across supervisors, while pursuing stricter adherence to the thesis rubrics and guidelines. According to the panel, establishing a clear timeline and providing more intensive guidance would help students successfully finish their thesis within 7 months.

According to the panel, the Board of Examiners proactively contributes to the quality of assessment in the programme. It has a clear task and safeguards the quality of the assessment in the programme in various ways, including the continuous evaluation of the quality of examinations.

Standard 4. Achieved learning outcomes

Based on the examination of a selection of 15 theses from the programme, the panel concludes that the level of the theses is appropriate for an academic master's programme. The theses cover various topics, reflecting the broad scope of the programme, and demonstrate the achievement of the ILOs. The documentation and interviews show that alumni are generally content with the programme and are well prepared to perform successfully in the professional field in the Netherlands and abroad.

Score table

The panel assesses the programmes as follows:

Master's programme Materials Science and Engineering

Standard 1: Intended learning outcomes	meets the standard
Standard 2: Teaching-learning environment	meets the standard
Standard 3: Student assessment	meets the standard
Standard 4: Achieved learning outcomes	meets the standard
General conclusion	positive

Prof. dr. ir. Tine Baelmans, chair

Carlijn Braam MA, panel secretary

Date: 13 March 2025

Introduction

Procedure

Assessment

On 5, 6 and 7 November 2024, the bachelor's programmes Mechanical Engineering and Marine Technology of the TU Delft, and the master's programmes Mechanical Engineering, Marine Technology, Offshore and Dredging Engineering, and Materials Science and Engineering were assessed by an independent peer review panel as part of the cluster assessment Mechanical Engineering. The assessment cluster consisted of 12 programmes, offered by the University of Twente, the University of Groningen, the TU Delft and the TU Eindhoven. The assessment followed the procedure and standards of the NVAO Assessment Framework for the Higher Education Accreditation System of the Netherlands (April 2024).

Quality assurance agency Academion coordinated the assessment upon request of the cluster Mechanical Engineering. Peter Hildering acted as coordinator and panel secretary. Yannick Slagter and Carlijn Braam also acted as secretaries in the cluster assessment. They have been certified and registered by the NVAO. Carlijn Braam acted as panel secretary in the site visit of the TU Delft.

Preparation

Academion composed the peer review panel in cooperation with the institutions and taking into account the expertise and independence of the members as well as consistency within the cluster. On 27 June 2024, the NVAO approved the composition of the panel. The coordinator instructed the panel chair on her role in the site visit according to the Panel chair profile (NVAO 2016).

The programmes composed a site visit schedule in consultation with the coordinator (see appendix 3). The programmes selected representative partners for the various interviews. They also determined that the development dialogue would be made part of the site visit. A separate development report was made based on this dialogue.

The master's programme Materials Science and Engineering provided the coordinator with a list of graduates over the period between September 2021 and August 2024. In consultation with the coordinator, the panel chair selected 15 theses of the programme. They took the diversity of final grades and examiners into account. Prior to the site visit, the programme provided the panel with the theses and the accompanying assessment forms. It also provided the panel with the self-evaluation report and additional materials (see appendix 4).

The panel members studied the information and sent their findings to the secretary. The secretary collected the panel's questions and remarks in a document and shared this with the panel members. In a preliminary meeting, the panel discussed the initial findings on the self-evaluation reports and the theses, as well as the division of tasks during the site visit. The panel was also informed of the assessment framework, the working method and the planning of the site visits and reports.

Site visit

During the site visit, the panel interviewed various programme representatives (see appendix 3). The panel also offered students and staff members an opportunity for confidential discussion during a consultation hour. No consultation was requested. 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 preliminary findings.

Report

The secretary wrote the draft reports based on the panel's findings and submitted them to the coordinator for peer assessment. Subsequently, the secretary sent the reports to the panel for feedback. After processing this feedback, the secretary sent the draft reports to the programmes in order to have them checked for factual irregularities. The secretary discussed the ensuing comments with the panel chair and changes were implemented accordingly. The panel then finalized the reports, and the coordinator sent them to the Faculty of Mechanical Engineering and the TU Delft.

Panel

The following panel members were involved in the cluster assessment:

- Prof. dr. ir. M. (Tine) Baelmans, full professor at the Department of Mechanical Engineering of the KU Leuven (Belgium) [chair];
- Prof. dr. S. (Sören) Östlund, professor of Packaging Technology at the KTH Royal Institute of Technology (Sweden);
- Drs. J.J. (Jan) Steen, independent educational consultant;
- Prof. dr. A. (Atul) Bhaskar, professor in Applied Mechanics at the Department of Mechanical Engineering of the University of Sheffield (United Kingdom);
- Prof. dr. E. (Eilif) Pedersen, professor in Marine Technology at the Department of Marine Technology of the Norwegian University of Science and Technology (Norway);
- Prof. dr. D.J. (Daniel) Rixen, professor in Applied Mechanics at the Technische Universität München (Germany);
- Prof. dr. A.S.J. (Akke) Suiker, professor in Applied Mechanics at the Department of the Built Environment of the TU Eindhoven;
- Prof. dr. K. (Kari) Tammi D.Sc., Lic.Sc., M.Sc., professor in Design of Mechatronic Machines at Aalto University (Finland);
- T.W.C. (Thijs) Haartmans BSc., master's student Mechanical Engineering at the TU Eindhoven [student member];
- M.A. (Maartje) Janszen BSc., master's student Mechanical Engineering at the TU Delft [student member].

The panel assessing the bachelor's programmes Mechanical Engineering and Marine Technology and the master's programmes Mechanical Engineering, Marine Technology, Offshore and Dredging Engineering, and Materials Science and Engineering at the TU Delft consisted of the following members:

- Prof. dr. ir. M. (Tine) Baelmans, full professor at the Department of Mechanical Engineering of the KU Leuven (Belgium) [chair];
- Prof. dr. S. (Sören) Östlund, professor of Packaging Technology at the KTH Royal Institute of Technology (Sweden);
- Drs. J.J. (Jan) Steen, independent educational consultant;
- Prof. dr. E. (Eilif) Pedersen, professor in Marine Technology at the Department of Marine Technology of the Norwegian University of Science and Technology (Norway);
- Prof. dr. D.J. (Daniel) Rixen, professor in Applied Mechanics at the Technische Universität München (Germany);
- Prof. dr. A.S.J. (Akke) Suiker, professor in Applied Mechanics at the Department of the Built Environment of the TU Eindhoven;
- T.W.C. (Thijs) Haartmans BSc., master's student Mechanical Engineering at the TU Eindhoven [student member].

All panel members, the secretary and the institution have signed a statement on impartiality and can confirm that the assessment was carried out in complete independence.

Information on the programme

Name of the institution:	TU Delft
BRIN-number:	21PF
Address:	Postbus 5, 2600 AA Delft
Status of the institution:	Publicly funded institution
Result institutional quality assurance assessment:	Positive
Programme name:	M Materials Science and Engineering
ISAT number:	66958
Level:	Master
Orientation:	Academic
Number of credits:	120 EC
Location:	Delft
Mode(s) of study:	Fulltime
Language of instruction:	English
Awarded degree:	MSc.
Submission date NVAO:	1 May 2025

Description of the assessment

Organization

The master's programme Materials Science and Engineering (MSE) is provided by the Faculty of Mechanical Engineering (ME) of Delft University of Technology (TUD). This faculty also offers the bachelor's and master's programmes Mechanical Engineering, the bachelor's and master's programmes Marine Technology and the master's programme Offshore and Dredging Engineering (ODE), which are all being assessed in this cluster assessment. The ME faculty also offers the bachelor's and master's programmes Technical Medicine and the master's programmes Biomedical Engineering, Robotics and Systems and Control Engineering. Until January 2024, the faculty was known as the Faculty of Mechanical, Maritime, and Materials Engineering (3mE). The new faculty name encompasses the scope and content of all research, application and education disciplines, thus strengthening cohesion in the faculty.

Recommendations previous accreditation panel

The last formal external assessment of the master's programme Materials Science and Engineering of the TUD took place in December 2018. In the self-evaluation report of the current assessment, the programme described the actions undertaken in response to the recommendations. Also, several improvements were discussed in the interviews during the site visit. The improvements include a clearer presentation of the programme's focus to future students; the introduction of new courses, broadening the focus of the MSE specialization topics; a revision and update of the descriptions of the courses; and the hiring of new teaching staff, strengthening and broadening the content of the programme. The panel concludes that the recommendations have been seriously acted upon by the programme and is generally satisfied with the improvement measures taken.

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

Profile

The master's programme Materials Science and Engineering (MSE) provides a broad education dedicated to the field of Materials Science, focusing on fundamental and engineering aspects. It aims to cultivate engineers and scientists who not only excel in technical proficiency but also possess a deep understanding of societal needs and environmental responsibility. The programme prepares students to contribute to the sustainable design, production, and application of materials. It is centred on the relationship between micro(structures) and the behaviour of materials (fundamental aspect), and the design of these microstructures to produce predefined properties for specific applications (engineering aspect). The panel appreciates the interdisciplinarity of the programme, applying physics, chemistry, characterization and computational methods. It notes that design is an integral part of the MSE curriculum and has a broader interpretation compared to other programmes within ME, since it applies here to the specific tuning of material properties and not necessarily to the development of a final product. In addition, the panel values that environmental and sustainability considerations are embedded in the programme, focusing on processes that are environmentally friendly and sustainable. This is in line with the vision and mission of the Materials Science and Engineering department, which addresses materials' lifecycle to enable a circular economy. The fact that the programme is run by a single department seems to give it a distinct position

within the faculty. The panel notes a strong sense of ownership within the MSE department, where the scientific staff collectively shares the responsibility for financial and strategic decision-making within the department. The programme's mission is to offer students high-quality, interdisciplinary education, by providing students with a thorough understanding of the underlying scientific and engineering principles involved in Materials Science and Engineering, and promoting a culture of innovation and collaboration, amongst others. It is the only programme in the Netherlands with a specialized degree in Materials Science and Engineering. Students are exposed to state-of-the-art materials science research and to a multi-disciplinary and multi-cultural environment. This will enhance interpersonal skills, facilitating collaboration and knowledge dissemination when addressing complex challenges. Students will also gain skills in computational modelling and simulation, as well as time management skills.

The panel recognizes that the programme covers a broad range of disciplines, distinguishing it from other similar programmes. It aims to combine scientific engineering knowledge, design expertise and societal relevance. In addition to the existing specialization, the emphasis on sustainability continues to expand and will increasingly be incorporated into the curriculum. The panel reinforces the observation of the programme that a transition from focusing on knowledge to excellence in application and recombination is essential, along with the development of professional and interpersonal skills.

The intake of students in the medium-sized programme seemed to have stabilized around 55 per year. However, a decline in applications has been observed in the last two years (42 in 2023, 25 in 2024), both from Dutch and non-European applicants. The panel was informed that efforts are underway to increase the programme's visibility and attract prospective students, including exploring collaborative partnerships with other faculties. The programme aims for an inflow of around 60 students per year. In 2023-2024, international students account for around 60% and female students for 33% of the overall enrolment. The panel considers these figures to reflect a satisfactory representation of female and international students.

The programme clearly stimulates students to become well-trained professionals and to be adequately prepared to conduct research at PhD level. The panel values the level of self-reflection of the programme. According to the panel, the programme is highly responsive to developments in the dynamic field and contemporary academic and societal debates. The programme is well-connected to the professional field, facilitated by numerous interactions in the context of guest lectures, internships, graduation projects, case studies, and career-related events. Further alignment with the field is pursued through the Industrial Advisory Board. The panel was pleased to learn that the Advisory Board is actively involved in the development of the programme and advises them on developments within the domain as well as the needs of society and the professional field that are relevant to the content of the programme. The professional field representatives that the panel interviewed generally feel that their input is taken into account and indicated that they value the mutual exposure. In addition, the MSE department has established an Industrial Platform: a consortium of companies collaborating to advance materials science and engineering. This initiative aligns closely with the department's research and educational efforts. Annual meetings with platform members provide valuable feedback for programme development. Notably, many board members of the platform are alumni of the MSE programme. The active role of the faculty's Industrial Advisory Board and of the department's Industrial Platform is appreciated by the panel.

Intended learning outcomes
The final qualifications of the programme are based on the Meijer's Criteria for 4TU programmes, which cover the Dublin descriptors. These criteria are defined in terms of seven broad competence areas, namely: 1) Competence in one or more scientific disciplines, 2) Competence in conducting research, 3) Competence

in designing, 4) Scientific approach, 5) Basic intellectual skills, 6) Competence in cooperating and communicating, and 7) Consideration of the temporal and social context.

The panel considers the ILOs to be explicit and well-defined and appropriate for the academic master's level. They are formulated in accordance with the Dublin Descriptors and the domain-specific framework, and cover all relevant aspects of the master's programme. The panel also appreciates that the ILOs are aligned with addressing societal challenges, ensuring that students are prepared to tackle these issues constructively. Additionally, the panel is pleased with the level of detail of the ILOs, which contributes to the educational design.

Considerations

Based on the reviewed documents and discussions during the site visit, the panel concludes that the master's programme Materials Science and Engineering has a well-defined, unique profile. It offers students broad expertise as well as professional and personal skills focused on the sustainable design, production, and application of materials, while combining fundamental and engineering knowledge, design expertise and societal relevance. The panel appreciates the interdisciplinarity of the programme, which covers a broad range of disciplines (physics, chemistry, characterization and computational methods), as well as the strong embedding of environmental and sustainability considerations in the programme, and the preferred shift from a focus on knowledge and data to excellence in application and recombination. Furthermore, the programme is very attentive to contemporary academic and societal questions, due to its strong connections with the professional and societal field. The panel considers the ILOs to be appropriate to an academic master's level, and in alignment with expectations in the academic and professional field.

Conclusion

The panel concludes that the master's programme Materials Science and Engineering meets standard 1.

Standard 2. Teaching-learning environment

The curriculum, the teaching-learning environment and the quality of the teaching staff enable the incoming students to achieve the intended learning outcomes.

Findings

Curriculum

The MSE programme consists of 120 EC and is offered as a fulltime two-year English language programme, structured into eight quarters of 15 EC. The curriculum consists of three main components: core courses (41 EC), specialization courses (34 EC) and the master thesis (45 EC). The core programme is a set of eleven obligatory courses that provide a solid understanding of the fundamental principles of materials science and engineering. They equip the students with the essential knowledge and skills required to tackle complex materials challenges. The panel appreciates the strong set of core courses, including the courses Society's Needs, and Ethics and Engineering, which cover relevant ethical and societal-oriented aspects. According to the panel, the core courses cover the basics, enabling all students from diverse backgrounds such as industrial design, mechanics, aerospace, physics and materials science, to quickly reach a shared level of understanding in the fundamentals. The panel notes that whenever feasible, greater emphasis is placed on a wider range of cases and examples (related to metals and non-metals). Furthermore, the panel is positive about the implementation of the personal development course into the curriculum, which can support skills development.

Following the core courses, during Q2 students select a specialization that suits their interests and career aspirations. The MSE programme offers four specializations, of which three are predefined specializations: Materials in Engineering Applications (MEA), Metals Science and Technology (MST), Materials for Sustainable Development (MSD). Students can also compose a self-defined specialization (SDS). This option is subject to approval. It allows them to select courses from a wide range of electives, and to focus on other (interdisciplinary) areas. To broaden the focus of the MSE specialization topics, the programme has introduced new courses. The panel appreciates that also within the pre-defined specializations, personalization is possible: while the core of the specializations (at least 14 EC) includes two obligatory courses and a selection of 2-3 courses from the available options, the remaining credits can be fulfilled by selecting electives from a recommended course list, provided by MSE or other programmes. Additionally, other courses may be taken after consulting with the coordinator. Students like that they have ample freedom in the selection of courses. The panel values the flexibility provided within the programme, including the opportunity to undertake project-based courses as part of the electives. This includes the TUD-wide Joint Interdisciplinary Project (JIP) course, where students from different faculties cooperate to solve an assignment from an industrial partner of the TUD.

The final three quarters are dedicated to a literature research (10 EC) and a thesis (35 EC), which may build on the literature survey. In the thesis project, each student is paired with a supervisor from the scientific staff of the MSE department, or a scientific staff member from another department, in consultation with the master coordinator. The daily supervisor monitors the progress and quality of the graduation project. The panel is positive that workshops for writing skills are integrated into the curriculum before the start of the thesis and that students are provided with a list of possible thesis topics, including clearly defined research questions. Projects are always related to the supervisor's research discipline. Graduation projects are conducted either within the MSE facilities, with another department at TUD, in an industrial setting (in the context of an internship), or at other research institutions in the Netherlands and abroad. Students have regular meetings with their supervisor and should demonstrate responsibility in their work, writing, and time and project management.

According to the programme management, the new curriculum structure implemented in recent years has provided a more balanced distribution of the content. Nevertheless, the workload of the programme is still demanding for the students, reflecting the need for a further revision of the MSE programme, as concluded by the programme. This is especially the case in the third quarter of the first year, where students still have compulsory courses but their specialization also needs focus. Although the curriculum is structured in a clear and straightforward way, the panel noted some overlap in the scheduling of electives and core courses (i.e. courses that are scheduled simultaneously), which poses challenges for the students. It supports the programme's objectives to update the learning goals and balance the workload between the obligatory and the specialization programme, to better match the flexibility provided in the programme, and help reduce the risk of study delays.

The panel considers the curriculum to be well-structured and coherent, with strong links between the courses. The curriculum covers all ILOs, as is demonstrated in the tables included in the self-evaluation reports. The design of the curriculum makes sure that courses build upon each other in terms of knowledge and skills. The panel appreciates how the programme continually reflects on the content of the curriculum in light of the professional and academic field. This responsive attitude is also reflected in the ongoing incremental changes implemented in the courses. The panel supports the idea of establishing a bachelor's minor in MSE, as this could enhance visibility and draw more students to the programme. Other future opportunities, supported by the panel, include revising the core programme and specializations to ensure

alignment, as well as collaboration with other faculties and programmes, which can expand specialization areas and foster synergy.

The panel observes that in general, every course is evaluated once every three years. This evaluation, as well as individual feedback from students, serves as a signal for lecturers. At the end of each quarter the study load, amongst others, is assessed through a survey. In addition, midterm panel discussions are arranged with the study associations to collect feedback during each quarter. On the basis of these evaluations, actions are planned and taken. The results and follow-up of evaluations are reported to the study associations, which relay this information to the students. The panel values the formal and informal evaluation of courses. Yet, based on signals from students during the interviews, it recommends that the programme places greater emphasis on responding to student feedback. For instance, at the beginning of each course, last year's feedback and follow-up steps could be shared with students.

The Education and Student Affairs (ESA) department is currently enhancing its use of various evaluation data for monitoring purposes, supported by a recently implemented dashboard. The panel supports this development, as it thinks that the current PDCA (Plan-Do-Check-Act) cycle, the check and act phases in particular, could benefit from a more structural approach. This includes for instance formulating explicit goals, determining the necessary steps to achieve these and monitoring the impact of measures. According to the panel, the ILOs should be the basis of this approach: all improvements should ultimately contribute towards equipping students better to achieve the learning outcomes. It recommends the programmes to continue onto the path of structural use of evaluation data. To aid programme directors in the continuous improvement of the programme, the panel suggests that their attendance at Board of Studies meetings be established as a standard practice.

Learning environment
Following the faculty's vision on education, the programme strives to offer students a student-centred learning environment, where they take responsibility for their own learning and development as engineers (self-leadership). This occurs in dialogue with developments in society. Design-based learning is therefore integrated into the educational concept of the reflective engineer. In the (multi- and interdisciplinary) project-based education, students learn to apply knowledge, design, collaborate in international teams, and find solutions to societal challenges.

The panel notes that the programme offers a variety of teaching strategies in the courses, such as lectures, practical work involving labs classes in the MSE laboratories, projects or case studies (individually or in teams), presentations, guest lectures and organized visits to laboratories and companies. For example, in the obligatory course Society's Needs students work in groups to study a grand challenge in materials sustainability's of their choice. The course includes mini symposiums to present and discuss their findings, as well as a workshop session about feedback and communication. Some courses use blended learning, combining online learning material and discussions in the classroom; other courses use actual cases from Dutch high-tech industries. The department has good industrial contacts and provides exposure and introduction of the students to the Dutch industry. Furthermore, students actively engage in research through graduation projects and other curricular projects. The panel observes that students highlight the multidisciplinary nature of the programme. According to the students, the diversity in backgrounds of the student body promotes collaboration and enhances the learning environment. Additionally, the programme's small size provides good opportunities for internships and thesis work.

The panel values the student centredness of the programme and is positive about the small-scale learning environment, providing ample opportunities for the development of an academic community. The panel is of

the opinion that the programme offers varied teaching methods which are aligned with the learning objectives, and an adequate balance between theoretical knowledge and practical skills. The curriculum integrates an attractive mix of experimental techniques and fundamentals. The strong ties of the programme with the industry provide students with unique learning opportunities through guest lectures and real case studies; the panel appreciates the contributions from the industry, as well as the blended classrooms. The panel notes that while the existing AI policy is clear, there is an opportunity to enhance student awareness of it, for example by (further) integrating AI into teaching, to educate students on the use of AI as a tool.

The panel observes that the facilities of the Department of Materials Science & Engineering are of a high standard, encompassing state-of-the-art equipment, labs and computational resources for teaching and research. These facilities are available for students during the courses and master projects. MSE students also have access to the education facilities in the ME faculty and other locations on campus.

Feasibility
The MSE programme aims to attract Dutch students with an academic BSc degree, Dutch students with a BEng degree from a university of applied sciences, and international students from inside or outside the EU. For some Dutch bachelor's degrees, there are fixed admission requirements. International bachelors must have an academic BSc degree in the same or a closely related discipline, and adequate English proficiency. Several bachelor's degrees might give admission; in these cases, the student's background in mathematics, physics, chemistry and thermodynamics is taken into account. The panel notes that the success rates for MSE (approximately 55%) are average compared to other MSc programmes at the ME faculty, with around 40 students graduating each year of the cohorts 2018 to 2020.

The panel observes that the average study duration until graduation is 2.7 years, which is average when compared to other ME programmes, and seems to be decreasing in recent years, combined with an increase of the success rate from 53% to 57% between cohorts 2019 and 2020. The drop-out rate of MSE varies between 4-11% over the last six years, with a decreasing trend in the last period. Students evaluate the programme as demanding, especially in the first year. In addition, they may be confronted with overlap in the scheduling of electives and core courses. Moreover, the tight scheduling of exams occasionally seems to cause problems, for example when two exams of mandatory core courses are scheduled on the same day. The programme's efforts to find a solution when this happens, are appreciated. The programme informed the panel that it is also considering course optimization, such as merging specific courses for smaller student groups. However, since the issues directly affect students, the panel recommends that the programme seek a structural solution at the faculty level (within the scheduling department) to tackle scheduling challenges and avoid course overlaps and concentrated exam demands.

Regarding the length of the graduation project, the panel learnt that the literature survey and thesis, which together amount to 45 EC, typically require about 9 months to complete, although some students may take longer. The panel notes that in principle, 45 EC should not exceed approximately 7 months, and exceptions should not be supervisor-dependent, which is now sometimes the case. As the panel notes that most of the study delay in the programme can be contributed to a prolonged thesis process, it encourages the programme to further support students in completing their work in time, given the extensive scope of their theses, and to monitor this. In this regard, it is positive that a progress monitoring system (MyCase) is currently being implemented to track student progress during their thesis work and offer targeted support. The programme intends to facilitate this through close monitoring and guidance from programme management. Moreover, the programme will consider reducing the literature review requirement from 10 to 5 EC. The panel considers the curriculum of the programme to be feasible, although actual study duration could benefit from further attention, building upon the progress that has been made in recent years. The panel

suggests a more thorough follow-up on the duration of studies, particularly concerning MSc theses, by establishing clear and uniform guidelines for thesis completion. The panel acknowledges that there is a system in place (Evasys) for monitoring, amongst other things, the perceived workload for each course. However, as the programme is aware of, some courses' workload needs revising. Thus, the panel recommends improving the monitoring of workload across courses and academic quarters, as well as reassessing the allocation of ECs for certain courses with respect to their workload. Since any changes to the workload of courses must be submitted by March for implementation in the subsequent academic programme, it is essential to promptly follow up on student feedback.

Guidance

The panel views the guidance provided to students during the programme and the accessibility of programme-specific services and facilities positively. These include transparent and timely information for prospective students, a buddy system in which second-year students mentor the new students (with similar cultural backgrounds), and an introduction week for the new students, guided by their mentors. The relatively small number of MSE students ensures more individual attention during classes and fosters a sense of community. Students receive coaching from the staff within the courses and from a supervisor during their graduation project. The panel appreciates the various initiatives to enhance student well-being. It values the good handling of diverse backgrounds of students, mainly by providing additional study materials and guidance, as well as the extra tutoring sessions (with teaching assistants and teachers), which have been incorporated into some courses. Additionally, special study groups are organized to aid in exam preparation and exercises, allowing students to collaborate with students who have successfully completed the course or PhDs. The students informed the panel that these study groups are beneficial. Furthermore, MSE students are regularly informed of the latest developments in the department and invited to events organized by the MSE department. The panel observes that students feel well-supported throughout the programme and are very positive about the ease of contact with peers and professors.

Academic counsellors play a key role in referring students to the right resources. For example, students with mental health issues can see student psychologists or attend training sessions on personal well-being. Furthermore, the panel noted that the study association Tubalkaïn takes an active role in supporting students to find their way, amongst others by organizing a variety of academic and social activities, including co-organizing the introduction week. The association is also actively involved in advisory bodies such as the Board of Studies, which advises the director of studies on the quality of the MSE study programme. At the faculty level, Gezelschap Leeghwater promotes the interests of the students.

The panel acknowledges that the programme effectively provides information to students through the digital learning environment Brightspace in an accessible and timely way. This platform also features tools like Buddy Check. Additionally, the programme considers the needs of all students, including those with functional impairments. In alignment with the TUD Note on "Duty of Care", this includes personal and/or separate provisions such as extra time for exams or separate exam settings, and adjusted schedules.

Teaching staff

The MSE teaching staff have a background in materials science, aerospace engineering, mechanical engineering, physics, or chemistry. The staff includes 4 full professors, 10 associate professors, 8 assistant professors, 1 teacher and 2 junior teachers, who are all involved in education. The hiring of new faculty since the last accreditation results in a favourable student/faculty ratio, as well as the strengthening and broadening of the programme's content, which the panel appreciates. Additionally, the panel notes that approximately 50% of the teaching staff is of international origin and 32% is female, supporting the international orientation of the programme and an inclusive environment. All staff members engage in

research and actively contribute to the development of their disciplines, providing a research-intensive educational programme. Most staff members hold PhDs, aligning with faculty policy. The panel is positive about the staff's close ties to the department's Industrial Platform, which provides opportunities for students in terms of internships and research projects. Furthermore, the panel values that the MSE department follows a cooperative principal investigator (CPI) governance model, which emphasizes that the scientific staff collectively shares teaching and research responsibilities. There are several departmental committees; an education committee operates alongside the Board of Studies in an advisory role and includes a representative from the student association.

In the interviews, the panel has seen experienced, well-organized and engaged faculty who cover the academic scope of the programme. The panel notes with appreciation that teaching quality is ensured through an academic development policy that focuses on both teaching and research qualifications. While a significant number of lecturers are in the possession of a University Teaching Qualification (UTQ), the panel observes that around 18% do not (yet) hold a UTQ and encourages the programme to proactively stimulate this group to acquire their UTQ. New staff members are required to complete the UTQ within three years. The lecturers have strong connections with the professional and societal field through their own research activities. In addition, the panel appreciates that lecturers cultivate individual contacts with students; students report that they are easily accessible, dedicated and responsive. Moreover, the professional field values the drive and positive attitude of the staff, who are very motivated to improve the programmes.

Internationalization
The programme has an inherently international orientation, as the materials science and engineering sector has a global character and increasingly international labour market. The panel approves of the choice and underlying argumentation for an English name and language of instruction. According to the panel, this aligns well with the international nature of the professional and academic field. Through the international focus, students are exposed to different perspectives and gain experience in collaborating within international teams. Thus, they are prepared to work in an international context.

The diverse background of both teachers and students supports a globally oriented educational environment. The university has adequate professionalization policies in place for ensuring lecturers' proficiency in English. Students with international prior education must demonstrate proof of English-language proficiency. The panel appreciates the opportunity for students to follow part of the programme abroad. It is also positive about the attention to intercultural collaboration, and the careful monitoring of English proficiency levels of both staff and students.

Considerations
The panel considers the curriculum to be well-structured and coherent. The curriculum covers all ILOs and provides students with a broad foundation in materials science and engineering, thus offering a unique programme for the international industry. The panel appreciates the comprehensive set of core courses, which also cover relevant ethical and societal-oriented aspects. According to the panel, the curriculum integrates an attractive mix of experimental techniques and fundamentals. The four specializations provide a wide variety of options, offering much flexibility for students and a broad (interdisciplinary) focus. In addition, the panel is positive about the attention to personal skills development. Concerning the scheduling of courses, the panel encourages the programme to seek a structural solution to resolve any course overlaps in the scheduling of electives and core courses.

The panel appreciates how the curriculum is continuously updated in response to developments in the professional and academic fields. In general, there is a need for improved monitoring through the PDCA

(Plan-Do-Check-Act) cycle, particularly in relation to the connection with the ILOs. To facilitate this process, the panel believes that the role of programme directors could be strengthened. While it values the formal and informal evaluation of courses, the panel is of the opinion that more attention could be paid to include monitoring data with, amongst others, study progress, student number evolutions and course success rates, and by providing feedback on students' feedback.

The panel is positive about the small-scale, student-centred learning environment, providing opportunities for the development of an academic community, and the active role of the study association. The courses offer varied teaching methods, including blended learning and project-based education, and an appropriate balance between theoretical knowledge and practical skills. The panel highlights the importance of keeping a focus on AI in the programme. Student awareness could be increased by (further) integrating AI into teaching. The panel appreciates the interdisciplinary focus of the programme, including the Joint Interdisciplinary Project (JIP), as well as the increased emphasis on student integration and personal development. The strong ties of the programme with the industry provide students with enriching learning opportunities. According to the panel, students are well-supported throughout the programme, with staff actively engaged in this effort. The panel concludes that all students receive adequate guidance and support. Furthermore, the admission criteria, the information provided to students, and the facilities available for students with disabilities are all satisfactory.

The panel considers the curriculum of the programme to be feasible, although it encourages the programme to pay further attention to the study duration, building upon the progress that has been made in recent years. In this context, the panel appreciates the introduction of a progress monitoring system. Additionally, the panel recommends reassessing the allocation of EC for certain courses and closely monitoring the workload for each course.

The panel is impressed with the quality and enthusiasm of the teaching staff of the programme, who come from a variety of (international) backgrounds. They are all pedagogically qualified and are experts in their diverse fields, covering the broad academic scope of the programme. All staff members engage in research and have strong connections with the professional and societal field through their research activities, thus providing a research-intensive environment. In addition, the panel appreciates that lecturers value personal contacts with students; they are easily accessible and are dedicated and responsive towards students. Furthermore, the cooperative principal investigator (CPI) governance model is valued for fostering teamwork and encouraging active participation in education.

The English-taught programme is internationally oriented, which is reflected in the international community of students and staff. According to the panel, the choice of an English name and language of instruction is well substantiated and aligns well with the international nature of the professional and academic field.

Conclusion

The panel concludes that the master's programme Materials Science and Engineering meets standard 2.

Standard 3. Student assessment

The programme has an adequate system of student assessment in place.

Findings

Assessment system

Assessment in the programme is aligned with the Education and Examination Regulations and the educational vision of the TUD as well as the faculty, embracing the constructive alignment principle of education. This includes a combination of formative and summative assessment in each course, with a gradual reduction in the number of formative tests as students take greater control of their own learning. The faculty aims to adjust and align its quality assurance handbook and assessment policy with the TUD assessment framework, published last year, by the end of 2024. In programme-specific assessment plans, all assessments and courses are aligned with the ILOs of the programmes. The panel observes that there is a well-defined university-wide assessment policy and sufficient standardization, for example through standard rubrics for the literature research and MSc thesis. Also, students are properly informed about the examination procedures and assessment criteria.

The programme employs various methods for both formative and summative assessment: written exams, oral exams, such as presentations, individual and group project work, as well as homework assignments. Every course contains at least one summative test. In some courses, peer review is included as a component of the assessment. In the obligatory course Ethics and Engineering, the individual performance of the student is assessed by a written examination, presentation and participation during working group sessions. The panel characterizes the assessment in the programme as well thought out. It appreciates that the programme has introduced an assessment matrix for the project-based courses Materials Elective Project and the External Research Project. The panel observes that lecturers are well-acquainted with the faculty's assessment materials and policies, and feel adequately informed about the current situation; they receive consistent updates on the latest rubrics and other relevant information. Nevertheless, the programme notes that teachers can benefit from more structural monitoring of the assessment methods used in their courses. For the new teaching staff, an introduction to the assessment policy and methods can be beneficial. The panel agrees with the programme and recommends regular calibration regarding assessment in general, to promote consistency in assessment practices.

The panel considers the assessment system of the programme to be well-designed and coherent, with assessment methods that are appropriate for the courses' learning goals and sufficient attention to skills. It appreciates the assessment plan linked with the ILOs and the diversity in assessment methods used. The panel observes that appropriate procedures are in place to ensure and enhance the quality of assessment. For example, examiners apply the four-eyes principle when constructing tests. Furthermore, the panel notes that new lecturers are not designated as examiners for major courses in their first three years of service and are paired with senior colleagues who act as mentors. An educational advisor with assessment expertise monitors the quality of assessment by providing regular feedback on the assessment for all courses, focusing on issues such as reliability, validity, construction and the safeguarding of learning goals. Additionally, a bi-weekly walk-in session and a two-monthly workshop for teachers were initiated to improve communication with teachers about assessment quality. The panel acknowledges the enhancements that have been implemented and values the assistance provided by ESA in this regard.

Final assessment

The programme is completed with a thesis project of 35 EC. In preparation of the thesis, students perform a literature review (10 EC), although the topic does not have to be related. The deliverables of the literature review include a written report and a presentation. These presentations are open to all MSE members and take place monthly as colloquiums. The thesis entails a thorough exploration of a challenging problem, usually related to a scientific or societal need, and developing a new theoretical approach or a new design method to address that issue. Students have to write a structured scientific report, which includes relevant parts of their literature review, present their findings at a public colloquium, and defend their work before a graduation committee. Industrial partners can take part in the committee as guests. The programme informed the panel that it puts a strong emphasis on the quality and level of thesis projects, which the panel appreciates. The thesis work is assessed according to uniform assessment criteria, set out in the Master Thesis Grading Rubric. This includes criteria about time management and planning (transferable skills). As part of the accreditation process, the panel reviewed a selection of 15 MSc theses, including the corresponding assessment forms. The rubric specifies the assessment criteria based on the ILOs, is well-defined and consistently used; it is also available for students. The panel agrees with the grades awarded to the theses, which are generally of expected quality and show a strong focus on experimental research. It found the grades to be well substantiated.

As for the duration of the graduation project, the panel learnt that faculty management is looking to streamline processes and ensure consistency across programmes and supervisors; stricter compliance with the thesis rubric and guidelines is considered crucial. The panel fully supports the focus on this matter. It finds it essential to pursue further action to avoid a ‘grey area’. Currently, extending the graduation project may occasionally result in a higher grade, while in other situations it could lead to a grade reduction, irrespective of the particular circumstances related to the delay. According to the panel, a more defined timeline with specific start and end dates and further intensified guidance would be beneficial for students, as it would help eliminate prolongation, especially when this is caused by enthusiastic supervisors that focus on project results and lose sight of the envisioned timeline.

Board of Examiners

The ME programmes fall under the responsibility of the ME Board of Examiners, one of the two faculty-wide Boards of Examiners. Based on the documentation and the interviews during the site visit, the panel concludes that the Board of Examiners adequately safeguards the quality of assessment in the programme. It proactively controls the quality of assessment in various ways, such as appointing examiners (holding a UTQ or in the process of obtaining a UTQ), and assessing the quality of examinations through a random sampling of exams and final projects. It inspects the thesis works and accompanying assessment forms twice a year and assesses whether the graduation committees made fair judgements leading to the final grades, as well as the distribution of grades. Furthermore, the Board of Examiners has set strict rules for the compilation of graduation committees and for graduating with distinction. The rules for graduation committees have been revised and now include a mandatory member with experience in assessment. Moreover, one of the staff members needs to be independent, not having been involved in the graduation project. One extra scientific staff member, employed in another department, is added to the committee in cases where the candidate is eligible for the designation cum laude.

The Board of Examiners also deals with reports of suspicions of fraud and complaints. Complaints regarding courses (approximately 30 per year) are forwarded to the responsible lecturers or addressed through mediation. There are virtually no complaints regarding thesis grades. The Board of Examiners believes this is likely connected to the 'green light meetings,' during which students are given a go/no go decision for their thesis; in case of a ‘no go’, students can either make repairs or start over. The Board of Examiners has regular

meetings with the Dean, the director of education, the head of the ESA department, the educational advisor on assessment and the quality assurance department. It also meets with other TUD Boards of Examiners to discuss common concerns and to improve assessment. The panel is pleased to see that the Board of Examiners clearly contributes to the quality of assessment in the programme.

Considerations

The panel concludes that the assessment system is transparent and well designed. Adequate procedures, such as the four-eyes principle, are in place to ensure and enhance the quality of assessment. The assessment methods used are diverse and appropriate, and include assessment of skills. Amongst others, the panel appreciates the attention for constructive alignment, the standard rubrics for the literature research and MSc thesis, and the support offered by ESA. In addition, the panel appreciates the introduction of an assessment matrix for the project-based courses, as well as the efforts of the programme to inform (new) lecturers about assessment materials and policies more consistently.

The graduation project covers all ILOs of the programme at an individual level. The panel appreciates the set-up of the thesis project and the way it is evaluated according to uniform assessment criteria, set out in a clear rubric. The panel considers the assessment procedure to be well thought out, and the grades awarded to be sufficiently substantiated. As for the duration of the graduation project, the panel encourages the programme to streamline processes and ensure consistency across supervisors, while pursuing stricter adherence to the thesis rubrics and guidelines. According to the panel, establishing a clear timeline and providing more intensive guidance would help students successfully finish their thesis within 7 months.

According to the panel, the Board of Examiners proactively contributes to the quality of assessment in the programme. It has a clear task and safeguards the quality of assessment in the programme in various ways, including the continuous assessment of the quality of examinations.

Conclusion

The panel concludes that the master's programme Materials Science and Engineering meets standard 3.

Standard 4. Achieved learning outcomes

The programme demonstrates that the intended learning outcomes are achieved.

Findings

Theses

The thesis is regarded as the programme's final project in which students demonstrate that they achieved the programme's ILOs at an individual level. In preparation for the site visit, the panel examined a selection of 15 theses. In the selection, a proper distribution across grades and topics was ensured. In the opinion of the panel, the level of the examined theses is appropriate for an academic master's programme. The theses demonstrate the achievement of the ILOs. In general, they are of expected quality. The panel observes that the topics of the theses are quite diverse, reflecting the broad scope of the programme.

Alumni

The panel appreciates how students are stimulated through numerous activities to become more acquainted with the future labour market. These include guest lectures, (interdisciplinary) projects, the thesis, and career-related events organized by the study association, such as an annual career fair and lunch lectures with alumni. Career orientation is further supported by the Career Centre TUD. Students view their

career prospects following the programme positively. A recent survey (2023) shows that the respondents consider the programme a good start for their careers. They are prepared for a career in a wide range of industrial and academic areas, such as production, innovation, management, consultancy, and scientific research in the Netherlands and abroad. About 80% find a job within 3 months. They find employment in, for example, research centres, academic institutions, high-tech industries, metal and polymer production sectors, and recycling industries in the Netherlands and abroad. Around 30% of alumni pursue an academic career by continuing with PhD research. The panel observes that alumni are generally positive about the programme and often secure relevant positions after graduation. It appreciates the fact that most alumni found professional positions that match the programme's content and level. As they indicated during the site visit and in the most recent alumni survey, alumni developed valuable knowledge and skills during the programmes and feel well prepared for the labour market. The panel was informed that alumni who remain in the Netherlands typically stay in touch with the department. In addition, alumni are invited to the different events organized by the MSE department during the year, such as the Annual Materials Technology Day and colloquiums with external speakers from (international) institutions and industries, focussing on materials-related topics of technological and societal relevance.

During the site visit, the professional field representatives informed the panel that TUD alumni possess good modelling and problem solving skills as well as a solid knowledge basis. They are highly motivated and show leadership qualities. They do require coaching in time management and collaboration skills, such as engaging with stakeholders. However, according to the panel this is a broader trend that extends beyond just TUD alumni.

Considerations

Based on the examination of a selection of 15 theses from the programme, the panel concludes that the level of the theses is appropriate for an academic master's programme. The theses cover a variety of topics, reflecting the broad scope of the programme, and demonstrate the achievement of the ILOs. The documentation and interviews show that alumni are generally content with the programme and are well prepared to perform successfully in the professional field in the Netherlands and abroad.

Conclusion

The panel concludes that the master's programme Materials Science and Engineering meets standard 4.

General conclusion

The panel's assessment of the master's programme Materials Science and Engineering is positive.

Recommendations

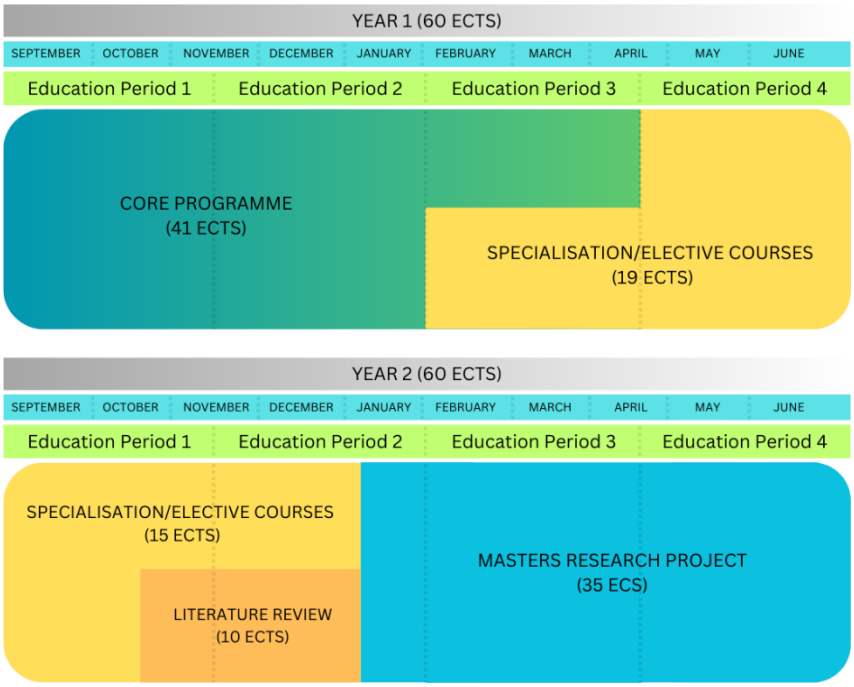
1. Investigate a structural approach to prevent conflicts in course scheduling and to alleviate the tight scheduling of exams.
2. Encourage uniformity in assessment practices, including a more defined timeline for the thesis project, by conducting regular calibration sessions.
3. Increase students' awareness of the AI policy by incorporating AI more extensively into the teaching process.
4. Enhance the monitoring of workload across courses and academic quarters, and reassess the allocation of ECs for certain courses with respect to their workload.
5. Conduct a more comprehensive follow-up on the duration of studies, especially regarding MSc theses.

Appendix 1. Intended learning outcomes

A graduate in Materials Science & Engineering is able to...

1. Competent in the scientific discipline Materials Science & Engineering
   - 1A …apply physics, chemistry, characterisation and computational methods in materials science. 1B …design, carry out and evaluate experiments.
   - 1C …relate processing, structure, properties and performance of materials.
   - 1D …identify, select and modify materials in relation to specific material applications.
   - 1E …describe the interaction between materials and the environment.
2. Competent in doing research
   - 2A ... characterise and describe different microstructural aspects of materials at various length scales. 2B ... generate knowledge within the discipline of Materials Science and Engineering.
3. Competent in designing
   - 3A ... systematically design new materials aiming at specific properties or performance.
   - 3B ... generate innovative contributions to the discipline of Materials Science and Engineering.
4. A scientific approach
   - 4A ... apply paradigms, methods and tools to characterise and (re)design materials.
   - 4B …manage own scientific research independently.
   - 4C …formulate and interpret scientific results.
   - 4D …analyse problems and use theory, modelling, simulation, design, experiments and integration towards solutions.
5. Basic intellectual skills
   - 5A …analyse and solve technological problems in a systematic way.
   - 5B …plan and execute research and design in changing circumstances.
   - 5C …integrate knowledge in an R&D project, considering ambiguity, incompleteness and limitations.
   - 5D …identify and acquire lacking expertise.
   - 5E …critically reflect on own knowledge, skills and attitude.
   - 5F …remain professionally competent.
   - 5G …take a standpoint with regard to a scientific argument within the research area.
6. Competent in operating and communicating
   - 6A …work both independently and in multidisciplinary teams.
   - 6B …present and report in good English.
   - 6C …explain and defend outcomes from the research area to academia and industry, to specialists and laymen.
7. Considering the temporal and social context
   - 7A …evaluate and assess the technological, ethical and societal impact of own work.
   - 7B …act responsibly with regard to sustainability, economy and social welfare.

Appendix 2. Programme curriculum



Core courses:

- *Structure* and *Properties*
- *Thermodynamics and Kinetics*
- *Characterization of Materials*
- *Metals Science, Polymer Science*
- *Functional Ceramics*
- *Society's Needs*
- *Ethics and Engineering*

Specialization options:

- *Materials in Engineering Applications*
- *Metals Science and Technology*
- *Materials for Sustainable Development*
- *Self-defined specialization*

The core of the specializations (at least 14 EC) consists of two obligatory courses and a selection of 2-3 specialization-specific electives. The remaining credits (at least 34 EC) are completed with a selection of electives from the recommended course list (offered by MSE or other programmes). Other courses are also possible after consultation with the coordinator. The requirements for a self-defined specialization are:

1. The theme should not be covered by one of the pre-defined specializations;
2. At least 14 EC of the modules should form a consistent set related to the theme of the specialization;
3. The majority of the modules should connect to the exit qualifications of the master MSE
4. Students should submit a motivation explaining why they want to define their theme, motivating the relevance of the selected courses and how they will deal with a possible lack of pre-knowledge.

Appendix 3. Programme of the site visit

Day 1: Tuesday 5 November

08.45 – 09.00	Welcome
09.00 – 09.30	Preliminary internal panel meeting
09.30 – 10.00	Session faculty management
10.00 – 10.45	Session programme directors
10.45 – 11.15	Break
11.15 – 12.00	Session bachelor's students Maritime Technology
12.00 – 12.45	Session master's students Marine Technology
12.45 – 13.45	Lunch break
13.45 – 14.30	Session teaching staff BSc + MSc MT
14.30 – 14.45	Break
14.45 – 15.30	Session Board of Examiners
15.30 – 15.45	Break
15.45 – 16.15	Theme session BSc Maritime Technology
16.15 – 16.45	Theme session MSc Marine Technology
16.45 – 17.15	Session programme directors BSc + MSc MT
17.15 – 17.45	Internal panel review meeting (BSc + MSc MT)

Day 2: Wednesday 6 November

08.45 – 09.00	Preliminary internal panel meeting
09.00 – 09.45	Session bachelor's students Mechanical Engineering
09.45 – 10.30	Session master's students Mechanical Engineering
10.30 – 11.00	Break
11.00 – 12.00	Session teaching staff BSc + MSc Mechanical Engineering
12.00 – 13.00	Lunch break
13.00 – 14.00	Theme session BSc Mechanical Engineering
14.00 – 14.30	Theme session MSc Mechanical Engineering
14.30 – 15.00	Break
15.00 – 15.45	Faculty tour
15.45 – 16.15	Session programme directors BSc + MSc ME
16.15 – 16.45	Internal panel review meeting (BSc + MSc ME)
16.45 – 17.30	Session alumni / professional field master's programmes (ME, MSE, MT, ODE)
17.30 – 18.00	Internal panel review meeting (BSc + MSc ME)

Day 3: Thursday 7 November

08.45 – 09.00	Preliminary internal panel meeting
09.00 – 09.30	Session master's students Materials Science and Engineering
09.30 – 10.00	Session teaching staff MSc Materials Science and Engineering
10.00 – 10.15	Break
10.15 – 10.45	Theme session MSc Materials Science and Engineering
10.45 – 11.00	Session programme director MSc MSE
11.00 – 11.30	Internal panel review meeting (MSc MSE)
11.30 – 12.00	Session master's students Offshore and Dredging Engineering
12.00 – 12.30	Session teaching staff MSc Offshore and Dredging Engineering
12.30 – 13.15	Lunch break
13.15 – 13.45	Theme session MSc Offshore and Dredging Engineering
13.45 – 14.00	Session programme director MSc ODE
14.00 – 14.30	Internal panel review meeting (MSc ODE)
14.30 – 15.00	Final session faculty management
15.00 – 16.30	Concluding panel session
16.30 – 16.45	Oral feedback session
16.45 – 18.00	Drinks

Appendix 4. Materials

Prior to the site visit, the panel studied 15 theses of the master's programme Materials Science and Engineering. Information on the theses is available from Academion upon request.

The panel also studied other materials, which included:

- Self-evaluation report MSc Materials Science and Engineering, including the following appendices:
    - Overview NVAO and midterm recommendations and measures taken
    - Comparison with similar programmes
    - Final Qualifications MSc MSE
    - Relationship between the final qualifications and the obligatory and specialisation courses of MSc MSE
    - TU Delft Note on "Duty of Care"
    - Overview MSc MSE curriculum 2023-2025
    - Examples of self-defined specialisations
    - Complete list of changes and updates in the MSc MSE curriculum courses from 2017-2018 to 2023-2024
    - Overview of MSc MSE teaching staff
    - National Student Survey Results
    - Assessment Matrices for the project-based courses Materials Elective Project (MS4370x) and the External Research project (MS53200)
    - MSE Master Graduation Procedure
    - MSc MSE Graduation Assessment Rubric

Also included were:

- TU Delft Vision on Education
- Faculty ME Vision on Education
- Annual Report MSE 2022-2023
- Assessment framework TUD
- Assessment in ME (including assessment programme)
- Teaching and Examination Regulations MSc MSE 2023-2024
- Rules and Guidelines Board of Examiners
- Annual reports Board of Examiners
- Overview of Master graduations presented on the last two years 2022-2023
- Selected MSc thesis works and rubrics