



B Werktuigbouwkunde
M Mechanical Engineering
M Automotive Technology
Eindhoven University of Technology

© 2025 Academion

www.academion.nl
info@academion.nl

Project code P2321

Contents

- Summary 4
 - Score table 5
- Introduction..... 7
 - Procedure..... 7
 - Panel 8
 - Information on the programmes..... 9
- Description of the assessment..... 10
 - Previous accreditation’s panel’s recommendations..... 10
 - Standard 1. Intended learning outcomes 10
 - Standard 2. Teaching-learning environment..... 14
 - Standard 3. Student assessment 20
 - Standard 4. Achieved learning outcomes 24
 - General conclusion 25
 - Recommendations 25
- Appendix 1. Intended learning outcomes 26
- Appendix 2. Programme curriculum..... 28
- Appendix 3. Programme of the site visit..... 30
- Appendix 4. Materials 31

Summary

Standard 1. Intended learning outcomes

The panel concludes that the mission and profiles of the bachelor's programme *Werktuigbouwkunde* (referred to in this report by its English equivalent 'Mechanical Engineering' (ME)) and the master's programme *Mechanical Engineering* (ME) and the master's programme in *Automotive Technology* (AT) align well with TU/e's vision of educating engineers of the future. The ME programmes successfully emphasize developing T-shaped professionals with strong technical expertise, research skills, and ethical responsibility. The AT programme's focus on equipping students with a systems engineering perspective is particularly suited to addressing industry challenges, such as sustainability and logistics.

The intended learning outcomes meet academic and professional standards. At the same time, the panel found them rather general due to their alignment with TU/e-wide directives. The programmes have addressed this by including programme-specific ILOs, but the panel found that this could be further expanded, and recommends further refining the ILOs to enhance programme focus. Additionally, to strengthen ties with the professional field and ensure continuous curriculum relevance, it suggests to better structure the process of getting information from industry. In this light, the panel encourages the re-establishing of a departmental advisory board, but also to taking it more to the programme level.

Standard 2. Teaching-learning environment

The panel commends the ME bachelor's programme's curriculum for its structured progression, balance between core subjects and electives, and integration of Challenge-Based Learning. The inclusion of group work and multidisciplinary projects is seen as a strong point, adding significant attention to the development of soft skills. The panel appreciates the addition of a manufacturing elective and encourages further emphasis on classical production techniques. While the AI-related elective offerings are strong, the panel supports the addition of a mandatory course and recommends a dedicated learning line spanning multiple years. The panel praises the ME master's programme for its clear structure and well-defined specializations, and highlights the programme's leadership in AI education. The panel concludes that the curriculum is trying to find balance between academic and professional components, being more inclined to academic research component. It recommends placing slightly more emphasis on industry-relevant professional skills to better prepare students for diverse career paths. The panel recognizes the AT master's programme for its strong interdisciplinary approach and focus on systems thinking. The panel notes challenges in interdepartmental coordination, but believes that the proposed revisions, including specialization profiles and clearer learning trajectories, will enhance programme coherence and student guidance.

The panel supports the decision to conduct the bachelor's and master's programmes in ME and the master's in AT in English, aligning with TU/e's international strategy. It appreciates TU/e's measures to ensure English proficiency among students and staff. It also approves of the intended name change of the ME bachelor's programme. The panel finds the admission requirements for the programmes appropriate and acknowledges the success of the selection process that was introduced along with the *numerus fixus* for the ME bachelor's programme. The *numerus fixus* resulted in reduced inflow in the bachelor's programme. In addition, the selection tests appear to result in improved student performance. Given the expected growth of the master's programmes, the panel encourages similar selection measures for these programmes. It also notes the prolonged study durations in the master's programmes, mainly due to delays in the thesis preparation phase, and recommends providing more guidance at the start of the thesis process. The panel commends the strong learning environment, including student mentoring and academic support. However,

it warns that maintaining these resources amid programme growth will be challenging. It also notes concerns about workspace availability, particularly in the PROTO/zone workshop, and suggests future investments. Finally, the panel praises the teaching staff's engagement, professional development, and integration of industry experts, which enhance education quality.

Standard 3. Student assessment

The panel concluded that the assessment systems for the bachelor's and master's programmes are well-structured, transparent, and supported by a variety of methods aligned with course objectives. Rubrics are effectively used to ensure consistency, including for peer evaluations, which the panel praised for enhancing fairness. While the Assessment Committees contribute significantly to aligning courses with intended learning outcomes, the panel recommends implementing regular evaluations for all courses in the ME programmes to prevent misalignment over time. Furthermore, the panel recommends adopting a systematic PDCA cycle approach for changes made in the programmes, in the curricula and in methods of teaching and assessment, with clear delineation of who is responsible for what. If this loop is not closed, the intended and expected growth of the programmes might endanger the quality assurance and viability of the programmes in the future. The panel commended the procedures for assessing bachelor's and master's theses. It highlighted the comprehensive rubrics for the bachelor's theses and the multi-examiner approach for master's theses, which enhance validity and reliability. However, the panel noted inconsistencies in the scope and format of AT master's theses and recommends standardizing requirements across students to ensure fair assessments. The panel recognizes the Examination Committees for their diligent work, and finds that the ME and AT committees fulfil their roles diligently. At the same time, they also face challenges due to growing student numbers. The panel recommends empowering the committees further, improving front-end processes to address student concerns early, and adopting more structured procedures to ensure sustained quality.

Standard 4. Achieved learning outcomes

The panel found the theses of all three programmes to be of high quality, clearly demonstrating that students achieve the intended learning outcomes. It praised the relevance of the thesis topics to both research and industry. Regarding graduate performance, most ME bachelor's graduates continue with a master's degree, often at TU/e or other universities in Europe, facilitated by the programme's English instruction. ME and AT master's graduates are sought after, with most securing positions in industry, including prominent automotive companies for AT graduates, or pursuing academic careers. Alumni expressed high satisfaction with the knowledge, skills, and professional mindset developed during their education, confirming that the programmes effectively prepare students for their careers.

Score table

The panel assesses the programmes as follows:

Bachelor's programme Mechanical 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

Master's programme Mechanical 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

Master's programme Automotive Technology

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, panel chair

Yannick Slagter MA, panel secretary

Date: 13 March 2025

Introduction

Procedure

Assessment

On 27 and 28 November 2024, the bachelor's programme *Werktuigbouwkunde* (from here on out referred to by its English equivalent 'Mechanical Engineering' (ME)), the master's programme *Mechanical Engineering* and the master's programme *Automotive Technology* of Eindhoven University of Technology (TU/e) 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/e. 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 Hilderling 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. Yannick Slagter acted as panel secretary in the site visit of the TU/e.

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 department composed a site visit schedule in consultation with the coordinator (see appendix 3). The department selected representative partners for the various interviews. It 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 programmes provided the coordinator with lists of graduates over the period between 2022 and 2024 for both *Mechanical Engineering* programmes and between 2019 and 2024 for the *Automotive Technology* programme. In consultation with the coordinator, the panel chair selected 15 theses of each programme. She took the diversity of final grades and examiners into account, as well as the various tracks (see appendix 4). This selection reflected the number of graduates in each particular specialization proportionally. Prior to the site visit, the programmes provided the panel with the theses and the accompanying assessment forms. They also provided the panel with the documentation 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 documentation and the theses, as well as the division of tasks during the site visit. The panel was also informed on 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 a draft report based on the panel's findings and submitted it to an Academion colleague for peer assessment. Subsequently, the secretary sent the report to the panel for feedback. After processing this feedback, the secretary sent the draft report to the TU/e Department of Mechanical Engineering in order to have it checked for factual irregularities. The secretary discussed the ensuing comments with the panel chair and changes were implemented accordingly. The panel then finalised the report, and the coordinator sent it to the Department of Mechanical Engineering of the TU/e.

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/e;
- 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 and master's programme Mechanical Engineering and the master's programme Automotive Technology at TU/e consisted of the following members:

- Prof. dr. 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. K. (Kari) Tammi D.Sc., Lic.Sc., M.Sc., professor in Design of Mechatronic Machines at Aalto University (Finland);
- M.A. (Maartje) Janszen BSc., master's student Mechanical Engineering at the TU Delft [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 programmes

Name of the institution:	Eindhoven University of Technology
BRIN-number:	21PG
Adress:	Postbus 513, 5600 MB Eindhoven
Status of the institution:	Publicly funded institution
Result institutional quality assurance assessment:	Positive
Programme name:	B Werktuigbouwkunde
ISAT number:	56966
Level:	Bachelor
Orientation:	Academic
Number of credits:	180 EC
Educational minor:	Applicable
Location:	Eindhoven
Mode(s) of study:	Fulltime
Language of instruction:	English
Awarded degree:	BSc.
Submission date NVAO:	1 May 2025
Programme name:	M Mechanical Engineering
ISAT number:	60439
Level:	Master
Orientation:	Academic
Number of credits:	120 EC
Specialisations or tracks:	Advanced Manufacturing Across the Scales Computational Engineering Energy Conversion and Storage Engineering Fluid Mechanics Engineering Solid Mechanics Materials for High-Tech Systems Design Mechatronic Systems Design Robotics
Location:	Eindhoven
Mode(s) of study:	Fulltime
Language of instruction:	English
Awarded degree:	MSc.
Submission date NVAO:	1 May 2025
Programme name:	M Automotive Technology
ISAT number:	60428
Level:	Master
Orientation:	Academic
Number of credits:	120 EC
Location:	Eindhoven
Mode(s) of study:	Fulltime
Language of instruction:	English
Awarded degree:	MSc.
Submission date NVAO:	1 May 2025

Description of the assessment

Previous accreditation's panel's recommendations

In the previous reaccreditation of the bachelor's programme *Werktuigbouwkunde* and the master's programme *Mechanical Engineering*, the assessment panel made two key recommendations. First, it noted that the Intended Learning Outcomes (ILOs) were formulated too generally and did not sufficiently define the domain of mechanical engineering. This was partly attributed to the Bachelor College format of Eindhoven University of Technology, which includes general skills and electives. The panel recommended making the ILOs more specific to the mechanical engineering discipline. Second, while the assessment system appeared well-developed and implemented, the panel found a lack of clarity regarding the role and functioning of the Assessment Committee. It advised the Examination Committee to take a more proactive approach in ensuring the quality assurance of assessments and to demonstrate greater ownership in this area.

For the master's programme in *Automotive Technology*, the panel also provided two recommendations. It found that the ILOs were too broadly formulated and could apply to other engineering programmes, limiting their distinctiveness for *Automotive Technology*. The panel recommended refining the ILOs to better reflect the specific domain of the programme. Additionally, while the teaching staff was deemed to be of good quality and highly enthusiastic, the programme relied on a small group of experts, making it somewhat vulnerable. To ensure long-term stability and continuity, the panel emphasized the urgency of attracting new teaching staff.

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 *Mechanical Engineering (ME)* at Eindhoven University of Technology (TU/e) are offered by the department of Mechanical Engineering. The master *Automotive Technology* is an interdepartmental master, for which the department ME is the coordinating department. The bachelor's programme is part of the TU/e Bachelor College in which all bachelor's programmes are accommodated, and both master's programmes are similarly part of the TU/e Graduate School together with all TU/e master's programmes. The three programmes are developed to align closely with the university's mission of educating 'engineers of the future' to tackle societal, technical, and scientific challenges. TU/e emphasizes developing T-shaped or π -shaped professionals with deep disciplinary expertise and broad interdisciplinary skills, fostering collaboration in diverse disciplines and environments. The TU/e aims to incorporate flexible, hybrid learning systems and Challenge-Based Learning to offer authentic, integrative education tailored to modern challenges. Self-directed learning is a core component, enabling students to focus on personal development and professional identity. These features aim to prepare TU/e graduates to meet the evolving demands of the engineering field while maintaining high academic and professional standards.

The *bachelor's programme in Mechanical Engineering* is designed to provide a strong academic foundation in mechanical engineering. It focusses on the mechanical engineering disciplinary competence, a scientific approach, and intellectual skills, to teach students the competence to address societal and technological

challenges with ethical responsibility. The three-year programme emphasizes flexibility, self-directed learning, and challenge-based projects to equip students with a T-shaped professional profile that combines disciplinary depth with interdisciplinary collaboration skills. Central to the programme's vision is its focus on the integration of theoretical knowledge with practical application through Challenge-Based Learning (CBL). Students work in groups on open-ended problems with societal relevance, gradually developing professional and personal skills alongside technical expertise.

The *master's programme in Mechanical Engineering* builds on the foundational knowledge of the bachelor's programme, offering eight specialization tracks that are related to the core research clusters of the Mechanical Engineering department - Thermo Fluids Engineering, Computational and Experimental Mechanics, and Dynamical Systems Design. Students do not have to, but they can choose from one of these eight specialization tracks:

- **Advanced Manufacturing Across the Scales:** which focuses on developing innovative manufacturing processes and systems across various scales, from nano to macro, to enhance production efficiency and product quality.
- **Computational Engineering:** which emphasizes the use of advanced computational methods and simulations, preparing students to solve complex engineering problems through numerical analysis and modelling.
- **Energy Conversion and Storage:** which is centred on the principles and technologies involved in converting and storing energy efficiently, addressing challenges in sustainable energy systems.
- **Engineering Fluid Mechanics:** which focuses on the behaviour of fluids in motion, equipping students with the knowledge to analyse and design systems involving fluid flow in various engineering applications.
- **Engineering Solid Mechanics:** which delves into the design and optimization of products, components, and structures by predicting their rigidity, deformability, strength, and durability.
- **Materials for High-Tech Systems Design:** which concentrates on the properties and applications of advanced materials, teaching students to quantify and improve material properties for use in complex structures across industries like automotive and aerospace.
- **Mechatronic Systems Design:** which integrates precision mechanical engineering, control systems, and system thinking to develop high-tech solutions for complex problems, such as precision surgical robots and components of complex machines.
- **Robotics:** which focuses on the design and development of autonomous robots and intelligent systems, preparing students to create machines that collaborate with humans and revolutionize various industries.

This two-year programme emphasizes depth and breadth, enabling students to focus on advanced topics within these research clusters or explore interdisciplinary applications. The programme's vision aligns with TU/e's mission to cultivate T-shaped professionals who combine technical expertise with a broad understanding of related disciplines. Students are encouraged to develop self-directed learning paths through elective courses, internships, and graduation projects. The incorporation of professional and personal development modules further prepares graduates to address societal challenges and technological advancements with ethical responsibility. Key elements of this strategy include modularized course offerings, selected major courses from the programme that are made available online, to support 'learning in time' and personal learning paths, integration of industry-driven challenges, and opportunities for international collaboration.

The *master's programme in Automotive Technology* is unique in the Netherlands, providing interdisciplinary education, cultivating T- or π -shaped automotive engineers, focused on systems thinking. The programme

focuses on the rapidly evolving automotive industry, emphasizing sustainable and smart mobility through high-tech systems that integrate mechanics, electronics, sensors, and software. Future automotive engineers are trained to approach vehicles as complex, multidisciplinary systems, equipping them with the skills to develop safe, reliable, and innovative automotive solutions. The programme's mission is to train engineers who can address the challenges of modern mobility systems, from smart and autonomous vehicles to sustainable transportation solutions. Its vision emphasizes equipping students with a systems engineering perspective, enabling them to approach complex problems holistically. This two-year programme is coordinated by the Department of Mechanical Engineering and integrates expertise from the five departments involved in the programme: Mechanical Engineering, Electrical Engineering, Industrial Engineering & Innovation Sciences, Mathematics and Computer Science, and Industrial Design. A domain-specific reference framework has been established for the programme, providing a definition of the scope and content of Automotive Technology. Strategically, the programme leverages its interdisciplinary framework to offer a curriculum that spans automotive-related engineering disciplines while maintaining a strong emphasis on sustainability, ethics, and societal impact. Students participate in internships, research projects, and industry collaborations, ensuring a well-rounded education grounded in practical application. The programme's close ties with the Brainport ecosystem and international research networks provide students with opportunities to engage with cutting-edge technologies and global trends.

The panel studied the mission and profile of the programmes and discussed this with various programme stakeholders during the site visit. It concludes that the bachelor's and master's programmes in ME have an appropriate and well-developed mission to educate mechanical engineers with a T-shaped profile. It also concludes that the master's programme in AT has an appropriate and well-developed mission to educate π -shaped automotive engineers with a systems engineering perspective. The panel appreciates the aim to develop strong topical skills with research emphasis already on bachelor level. It also appreciates how the master's programme builds further upon the basis of the bachelor's programme, showing a clear learning line, while offering the opportunity to specialize in several core research themes within mechanical engineering. Furthermore, the panel appreciates the inclusion of ethical responsibility in the mission, aiming not only to teach academic skill, but also to instil critical thinking, ethical responsibility, and the ability to navigate the societal context of technology. The panel also applauds the emphasis on social context and sustainability in the AT master's programme, because the logistics sector is particularly struggling with acceptance and emission challenges. It further concludes that the vision of the master's programme in AT to equip students with a systems engineering perspective in order to develop their skills to approach complex problems holistically is very important and suitable for the current demand of the industry.

Intended learning outcomes

The intended learning outcomes (ILOs) for the three programmes are included in their respective Programme and Examination Regulations (PER), established by the board of the department of Mechanical Engineering. The PER's have been adapted to reflect the latest directive of the TU/e Bachelor College and the Graduate School guideline. The ILOs for each programme are made up of ten general learning outcomes applicable to all degree programmes and a smaller number of requirements specific to the programme that have been based on the domain-specific reference frameworks for mechanical engineering and automotive technology. There are three extra learning outcomes formulated for the ME bachelor's programme, four for the master's programme ME and two for the master's programme AT (see appendix 1). These programme specific requirements have been added since the previous accreditation.

To keep the programmes aligned with the evolving expectations of the professional field, the department of Mechanical Engineering is re-establishing an advisory board with members from the relevant industries. In the past, the board of the department regularly met with a departmental advisory board, but this link has

become inactive since the Covid pandemic. From the documentation provided by the programmes as well as the discussions with the programmes' management and teaching staff, it is clear that the department has maintained ties with industry, particularly in the Eindhoven Brainport region, by other means. Industrial stakeholders are actively involved in research projects, as industrial partners as part of these projects. Part-time or hybrid teachers from industry further enrich the curriculum with practical expertise. Additionally, internships play a crucial role, with many master's students completing industry or international research placements, providing benchmarking opportunities.

The panel observed that the ILOs for the bachelor's and master's programmes in Mechanical Engineering, as well as the master's programme in Automotive Technology, are appropriately formulated at academic bachelor's and master's levels, in line with the Meijers criteria. It concluded that the ILOs align with the requirements of their respective fields, as outlined in the domain-specific reference frameworks, and they sufficiently indicate what could be expected from degree programmes at a bachelor's and master's level. The panel also noted that the ILOs for all three programmes are quite general and primarily shaped by the university-wide ILOs from the directive of the Bachelor College and the Graduate School guidelines. This generality, while useful for alignment, seems to have limited the ability to tailor the ILOs to the specific needs of each programme. Discussions with the programme management during the site visit revealed that these overarching directives have constrained the perceived ability to develop more programme-specific ILOs, as there is little room for changing the general ILOs. The programmes did follow up on suggestions by the previous assessment panel to make the ILOs more specific and tailored to the programmes by adding a limited number of programme specific requirements. However, the panel thinks that the programme specific requirements are still quite broad and believes that further specification is needed to support their use in curriculum development, providing directions for curriculum choices. The panel therefore recommends the use of specific learning outcomes that are more programme oriented. It recommends further refining and specifying the ILOs for each programme to better support their development and focus.

Additionally, the panel acknowledged several formal and informal interactions with industry, which provide valuable input for the programmes and ensures that the ILOs of all programmes remain aligned with the expectations of the professional field. However, it found that these interactions are not consistently structured at the programme level, with no formalized advisory board embedded in the programme structure. The panel believes that creating a more systematic approach to gathering and incorporating industry feedback would enhance the relevance of the programmes. For this reason, the panel commends the initiative to re-establish the advisory board, formalizing these ties and establishing mechanisms at programmes' level to better utilize industry connections for continuous improvement, and encourages the programmes to realize this.

Considerations

The panel concludes that the mission and profiles of the bachelor's and master's programmes Mechanical Engineering and the master's programme in Automotive Technology align well with TU/e's vision of educating engineers of the future. The ME programmes successfully emphasize developing T-shaped professionals with strong technical expertise, research skills, and ethical responsibility. The AT programme's focus on equipping students with a systems engineering perspective is particularly suited to addressing industry challenges, such as sustainability and logistics.

The intended learning outcomes meet academic and professional standards. At the same time, the panel found them rather general due to their alignment with TU/e-wide directives. The programmes have addressed this by including programme-specific ILOs, but the panel found that this could be further expanded, and recommends further refining the ILOs to enhance programme focus. Additionally, to

strengthen ties with the professional field and ensure continuous curriculum relevance, it suggests to better structure the process of getting information from industry. In this light, the panel encourages the re-establishing of a departmental advisory board, but also to taking it more to the programme level.

Conclusion

The panel concludes that the bachelor's programme Mechanical Engineering meets standard 1.

The panel concludes that the master's programme Mechanical Engineering meets standard 1.

The panel concludes that the master's programme Automotive Technology 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 BSc ME

The bachelor's programme in Mechanical Engineering at TU/e spans three years and comprises 180 EC. The curriculum provides a structured yet flexible progression through foundational courses, elective opportunities, and hands-on projects. In the first year, students focus on core subjects, including Mathematics, Mechanics, Thermodynamics, and Materials Science. These courses provide a solid academic foundation. Alongside traditional lectures, students engage in Challenge-Based Learning projects, integrating their theoretical knowledge into practical problem-solving. Students are also introduced to Professional Skills modules, which enhance their teamwork, communication, and ethical reasoning abilities. By the end of the first year, students have typically completed 60 EC, comprising a mix of theoretical and applied learning. The second year builds on the foundational knowledge with advanced courses such as Fluid Dynamics, Dynamics and Control, and Structural Mechanics. Elective courses start to play a significant role, allowing students to tailor their studies toward specific interests or career goals. The elective programme consists of 45 credits, in which courses can be chosen based on the students interests and ambitions. Students need to choose at least two 5 EC courses from eight core elective courses offered by the programme, such as Mechatronic Design, Dynamics and Control of Robotic Systems, and Thermofluids Engineering. The department also offers eight free elective courses that students can choose from, such as Solar Heat System, Computer Aided Engineering, and Dynamics of Energy Systems, though students are not obligated to pick any of these courses. It is also possible for students to follow electives from other departments, after approval from the Examination Committee. Starting 2025-2026, a new elective on manufacturing will be added to the department's offer of free electives. When discussing the topic of AI during the site visit, staff mentioned that it was discussed within the programme that all students should follow a course on the proper use and a critical approach to Artificial Intelligence. For bachelor's students that are interested in a teaching profession, it is possible to be educated as a so called "tweede graads" (second grade) teacher in either physics, mathematics or *onderzoeken & ontwerpen*. Students are offered the possibility to follow a so called "Statutory teacher-training minor" (educational minor) as part of their electives. The final year focuses on specialization and independent research. Students choose electives aligned with emerging fields like Robotics, AI in Engineering, or Sustainable Energy Systems. The year concludes with the Bachelor Final Project, a 10 EC capstone where students conduct independent research or design work, often in collaboration with industrial partners.

As of the academic year 2023-2024, the ME bachelor's programme was redesigned as part of an initiative to address findings from an extensive evaluation in 2019 of the Bachelor College. The main goals of this initiative were to improve programme coherence, strengthen essential learning lines, and better align programmes' curricula with modern educational and professional demands. Key aspects include the introduction of Challenge-Based Learning and Professional and Personal Development (P&PD) as mandatory learning lines. In the ME bachelor's programme, the redesign increased space for core courses, allowing the inclusion of three new courses: an introductory course on design and programming in year 1, a dedicated course on statistics in year 2, and a micro-manufacturing course in year 3. A series of CBL projects have also been introduced into the curriculum. All CBL projects in year 1 and 2 are connected with a more theoretical course in the same or previous quartile.

The panel commends the structure of the ME bachelor's programme, which strikes a balance between foundational courses in mechanics, mathematics, thermodynamics, and fluid dynamics, while offering opportunities for specialization and personal development. Students can select electives and engage in multidisciplinary projects to pursue specific interests and explore emerging areas, effectively preparing them for diverse career paths or further studies. Noting the importance of manufacturing in engineering, the panel appreciates the upcoming addition of a manufacturing core course. It also encourages the programme to expand this focus further, particularly by incorporating more classical production techniques, which the panel feels is somewhat underrepresented in the current curriculum. Additionally, the panel commends the strong emphasis on group work, which is well-guided and includes significant attention to soft skills development. The panel also sees great potential in the newly introduced CBL learning line, noting its ability to connect with ILOs that deal with design, interdisciplinarity and the societal context. Regarding AI, the panel praises TU/e's leadership in this area, which is ahead of many other universities. Several expert electives are taught on the topic by well-informed staff. The panel does encourage integrating AI into the bachelor's programme more. It supports the discussed addition of a mandatory course on the proper use and a critical approach to AI in the programme, but also recommends a cohesive learning line integrated in courses across the curriculum, starting early in the programme.

Curriculum MSc ME

The two-year master's programme in Mechanical Engineering comprises 120 EC. The programme allows students to specialize while maintaining a broad academic perspective. The first year of the programme consists of 60 EC, structured around core courses (20 EC), specialization courses (20 EC), professional skills (5 EC), and free electives (15 EC). Students must complete four core courses of 5 EC each, selected from a predefined list while ensuring no overlap. Core courses provide advanced theoretical and practical knowledge. Additionally, 20 EC must be earned through specialization courses, which are often linked to specific research sections, enabling students to explore interdisciplinary topics such as renewable energy or computational modelling. Most courses carry 5 EC. The programme also includes 5 EC in professional skills, requiring students to complete two mandatory courses focused on coaching, tutoring, career development, or teamwork. Finally, 15 EC of free electives allow students to personalize their curriculum by selecting additional specialization courses, courses from other departments, academic writing courses, or extending their internship. Programme approval must be obtained from a mentor. The second year emphasizes practical experience and independent research. Students undertake an internship (15 EC), often with companies in the Brainport Eindhoven region or abroad. The final 45 EC are dedicated to the Master Graduation Project, a comprehensive research or design project conducted under faculty supervision. This project often aligns with cutting-edge industry challenges or ongoing academic research.

The panel appreciates the well-structured design of the ME master's programme, which is effectively organized around specialized tracks to provide clear alignment within the curriculum. It also commends the

inclusion of courses on artificial intelligence (AI), an area where the programme stands out as a leader, placing it ahead of many other institutions. Speaking with alumni from the programme, the panel found that some graduates would have welcomed more preparation for working in industry. For example, an alumnus mentioned that in terms of professional skills working in groups has been beneficial, however working with non-engineering professionals is something that is learned more from extra-curricular activities. The panel concludes that the curriculum is trying to find a balance between academic and professional components, being more inclined to the academic research component. It recommends placing slightly more emphasis on industry-relevant professional skills to better prepare students for diverse career paths.

Curriculum MSc AT

The master's programme in Automotive Technology spans two years and comprises 120 EC. This programme's interdisciplinary nature is reflected in its curriculum, which integrates courses from multiple engineering domains. The first year focuses on foundational automotive engineering topics. Students have to complete five core courses for 30 EC: Automotive Societal Factors, Smart Vehicles, Automotive Software and Computer Systems, Sustainable Vehicles, and a 10 EC Automotive Systems Engineering Project, in which students collaborate in teams to solve real-world automotive challenges using the Automotive Engineering Science lab. Students furthermore select 30 EC of electives, offered by the various involved departments, from a range of specialization areas, such as Autonomous Driving & Embedded Software, and Internal Combustion Engines and Future Fuels. These electives enable students to tailor their learning to their career aspirations or research interests. Students can choose courses from all areas, but their study programme has to be discussed with their mentor and approved by the Examination Committee. Homologation courses are provided in the first quartile to address differences in entry level knowledge and skills among students from diverse bachelor's profiles, in order to ensure all students are adequately prepared for the remainder of the curriculum. These courses can be part of the free elective space as well. In the second year, students gain practical experience through an internship (15 EC) in the automotive industry or in academic research. The remaining 45 EC are allocated to the Graduation Project, where students address real-world challenges, often in collaboration with industrial partners. This project exemplifies the programme's emphasis on systems thinking and sustainable engineering, preparing graduates for leadership roles in the automotive sector.

In response to the recommendations of the previous reaccreditation, TU/e's Vision 2030, and changes in the Automotive Technology sector, the AT master's programme management worked on a revision during 2022-2024, to ensure the programme remains up-to-date, future-oriented, and clearly distinguished from other master's programmes. To balance breadth and depth, the revision includes the introduction of four new core courses as foundational pillars for specialization. Additionally, specialization profiles across different sections and research groups are being developed to enhance programme identity and better guide new students. Implementation of the revisions starts in the academic year 2024-2025.

The panel appreciates the design of the AT master's programme, with foundational core courses and elective space for students to specialize and tailor their learning to their ambitions and interest. The panel also appreciates the focus of the programme on systems thinking and sustainable engineering, which is well-suited for the current direction of the field. Courses are described by students as being thorough and appreciated for the depth of knowledge they gain, noting that the information they learn is highly applicable in their future careers. Creating clear learning trajectories for students and alignment in the AT master's programme seems to be more difficult in the programme because of less direct lines of communication between departments, but the panel believes the proposed revisions will support improvement a lot.

Language and internationalization

Both the bachelor's programme and master's programme in Mechanical Engineering and the master's programme in Automotive Technology are taught in English, aligning with TU/e's strategy to prepare students for careers in international organizations and high-tech industries such as those in the Brainport Eindhoven region. The bachelor's programme, previously taught in Dutch, transitioned to English in recent years. This change has facilitated the enrolment of international students and expanded the pool of talent available to meet the growing demand for engineers in the high-tech sector. To support this transition, TU/e has established admission requirements on proficiency in English for students, ensuring that all incoming students have a sufficient command of English. These requirements include standardized language proficiency tests, such as TOEFL or IELTS. Additionally, TU/e monitors the English proficiency of its lecturers, all of whom are required to demonstrate CEFR level C1 or higher. This standard can be met through the English Lecturer Assessment, proof of a PhD obtained in an English-speaking country, or international language certifications. Lecturers also have access to resources and assessments to continually improve their language skills.

Most teaching staff are active researchers who already communicate in English through publications, conferences, and international collaborations. Since 2020, English has been the official working language at TU/e for both research and education. As part of ongoing efforts to reflect the programme's international focus, the department is also planning to change the name of the bachelor's programme from the Dutch 'Werktuigbouwkunde' to the English 'Mechanical Engineering,' ensuring consistency with the research of the department and the master's programme and reinforcing its appeal to global audiences.

The panel approves of the choice of English language education for all three programmes. It confirms the TU/e rationale that this corresponds to the internationally oriented nature of the field of mechanical engineering. It appreciates the deliberate attention to intercultural collaboration in both programmes, as well as the careful monitoring of English level proficiency of staff as well as students. In this light, the name change is also supported by the panel. The panel believes that the new name 'Mechanical Engineering' suits the current content and ambitions of the programme and the department. The name Mechanical Engineering is accepted within the Netherlands as an international designation for the field of mechanical engineering in a broad sense, and harmonises with the name of similar programmes in the Netherlands, such as the English-language bachelor's programme Mechanical Engineering and the English-language Master's programmes Mechanical Engineering at the TU/e, UT, TU Delft and RUG.

Admission and feasibility

Admission to the bachelor's programme in ME requires a pre-university (vwo) diploma with a profile including Mathematics B and Physics. Students with *hbo* first-year or university propaedeutical certificates are eligible if they also meet (the equivalent of) these criteria. International applicants must have an equivalent diploma, demonstrate proficiency in Mathematics B and Physics (passing tests with scores of 6 or higher), and provide proof of English proficiency through tests such as IELTS, TOEFL, or Cambridge C1 Advanced. English language requirements must match Dutch vwo final exam standards, ensuring readiness for the programme's academic demands. Admission to the master's programmes ME and AT is open to those who have direct access to these programmes based on a bachelor's degree obtained at TU/e, proof of admission issued by the department board on the basis of the applicable TU/e admission regulations for master's programmes, or possession of a statement issued by the Examination Committee of the relevant bachelor's programme.

The bachelor's programme introduced a numerus fixus with selection tests in 2022-2023 to manage increasing intakes. The selection process initially included a Calculus test (45%), a test on an online lecture

(45%), and high school grades (10%). In 2023-2024, a Physics test was added to emphasize key subjects for the programme, with weights adjusted to 25% for Calculus, 25% for Physics, and 50% for the online lecture. High school grades were excluded due to their limited predictive value for international students. The cap was raised to 500 to target an intake of approximately 400 students. During their first year in the ME bachelor's programme, the 2022-2023 cohort performed far better than the cohorts before them. The percentage of positive Binding Study Recommendation (BSR) increased from 60% (in the three previous years) to 74%, which together with 5% postponed BSR resulted in almost 80% of the intake continuing to the second year. The master's programmes don't have such selection tests. The panel concludes that the programmes have appropriate admission requirements and the selection test for the bachelor's programme seems to be very effective. With the expected growth of the master's programmes, the panel encourages the implementation of similar selection tests for the ME and AT master's programmes to manage the intake.

The study duration for the ME bachelor's programme is close to 3,5 years (40 months). The study duration of the master's programmes ME and AT are close to 3 years (33 months), which is higher than the TU/e average for master degree programmes. According to students, the programmes are feasible, although there can be a high (but manageable) workload at times. The panel agrees that the programmes are feasible, and particularly commends the favourable success rates of the bachelor's programme. Both master's programmes take students longer than the intended two years. From the interviews with both teaching staff and students from the programmes, it became clear that a large part of the delay can be explained by the thesis process. The thesis process has three phases: first the preparation phase, in which students try to understand the problem, get the question right, and figure out the right methodology to approach the problem. Then the second phase is when the actual thesis is developed, which should take 6-8 months. The final phase is the finishing of the project, with a defence before the graduation committee. The first phase is supposed to last only 4-6 weeks, but in practice students can take as long as they need. Often it takes much longer as students struggle to get a good grip on the problem. During the site visit, several students told the panel that the preparation phase took (much) longer than planned. The panel appreciates the efforts to regulate the amount of time for the master's thesis by dividing the process into clear phases, but also notes that the preparation phase often takes longer than it is supposed to. It recommends providing more guidance to master's students at the beginning of the project to help them keep their project on track.

Learning environment

First-year ME bachelor's students are assigned a student mentor, a senior ME bachelor's student, to assist with practical questions. They also meet quarterly with a teacher coach, who is member of faculty, for additional guidance. In the ME and AT master's programmes, students are assigned a faculty mentor at the start of their programme. Additionally, new TU/e master's students receive support from a student mentor within their programme to ease their transition. For more complex concerns, a team of dedicated academic advisors is available for all three programmes, when necessary referring students to TU/e's central team of coaches, counsellors, and psychologists. The programmes also provide comprehensive support for students with impairments through university-wide arrangements. Information about these support structures is communicated during student meetings and is readily accessible through the education guides for the bachelor's in ME, the master's in ME, and the master's in AT. During the site visit, students said they felt it was clear to them who they could turn to in case of issues, and they also felt that their feedback is taken into account, even leading to changes in the curriculum if for example workload was experienced as too high according to students. The panel appreciates the strong focus on student well-being and personal attention in all programmes, with individual mentors providing valuable guidance. They also found facilities and regulations for students with impairments to be well in place. However, the panel does note it will be a challenge to maintain this level of support and guidance with the intended and expected growth of the programmes.

The PROTO/zone workshop is a vital workspace for the CBL component of the ME bachelor's programme, allowing students to build, test, and present their designs and prototypes. In the ME master's programme, lab sessions and experimental projects take place in the department's research labs, covering all ME disciplines. AT students have access to relevant labs across multiple departments. Additionally, the Automotive Technology Lab serves both as a research facility and a home base for students and staff. An issue that was reoccurring according to students, mentioned to the panel during the site visit, is that there sometimes is too little space available, in exam periods especially. After visiting the facilities, the panel was in fact impressed by the space available, which left a strong impression. They observed that, under current conditions, effective assignment and use of the available space are particularly key. However, with the expected growth of the programmes, this will become even more critical and could present challenges in the future. A particular area of concern is the PROTO/zone workshop, which is already nearing maximum capacity. To support continued expansion of the ME bachelor's programme, additional investments will be necessary to meet future demands.

Teaching staff

Education and research in the Department of Mechanical Engineering are closely intertwined, ensuring that students across the bachelor's and master's programmes in Mechanical Engineering and the master's programme in Automotive Technology are exposed to the latest developments in the field. Most scientific staff are active researchers associated with one of the department's research sections as full, associate or assistant professor, providing a strong connection between academic content and current research. During discussions with the teaching staff, they showed themselves to be very engaged to the programmes and their students. Additionally, several part-time or 'hybrid' teachers from industry bring real-world insights to the classroom, in both the bachelor's and master's courses. During the site visit, students have expressed particular appreciation for these teachers' contributions, highlighting the practical perspective they bring. The department ensures teaching quality through its extensive UTQ programme, tailored to varying levels of prior teaching experience. Most staff in the Mechanical Engineering programmes either possess their UTQ or are in the process of obtaining it. With a student-staff ratio of 28:1 in the Mechanical Engineering programmes, the department is making progress despite TU/e-wide challenges of increasing student numbers and workload pressures. Recent staff recruitment efforts are already showing a positive impact on these issues. The revision of the AT programme that was discussed in the paragraph about its curriculum, has led to more departments, sections, and groups now being actively involved in the programme, having led to a 55% rise in faculty participation in the development of new courses. Each core course includes members from at least two different sections or departments, ensuring broader expertise. Additionally, the Built Environment department's new involvement further strengthens the programme's stability.

The panel commends the department for its highly engaged teaching staff and well-established UTQ programme. It noted that most staff either possess their UTQ or are in the process of obtaining it, reflecting a strong commitment to professional development. The panel praised the flexible UTQ tracks tailored to staff roles and experiences. Additionally, the panel found the integration of part-time industry professionals into the teaching staff to be a major strength, as their industry expertise provides valuable context for students. Overall, the panel concludes that the department's approach to staff professionalization and the blend of academic and industry expertise contribute significantly to the high quality of education across all three programmes. The panel also applauds the increased faculty commitment in the AT programme, effectively addressing the previous assessment panel's concerns about staff vulnerability in the AT programme.

Considerations

The panel commends the ME bachelor's programme's curriculum for its structured progression, balance between core subjects and electives, and integration of Challenge-Based Learning. The inclusion of group

work and multidisciplinary projects is seen as a strong point, adding significant attention to the development of soft skills. The panel appreciates the addition of a manufacturing elective and encourages further emphasis on classical production techniques. While the AI-related elective offerings are strong, the panel supports the addition of a mandatory course and recommends a dedicated learning line spanning multiple years. The panel praises the ME master's programme for its clear structure and well-defined specializations, and highlights the programme's leadership in AI education. The panel concludes that the curriculum is trying to find balance between academic and professional components, being more inclined to academic research component. It recommends placing slightly more emphasis on industry-relevant professional skills to better prepare students for diverse career paths. The panel recognizes the AT master's programme for its strong interdisciplinary approach and focus on systems thinking. The panel notes challenges in interdepartmental coordination, but believes that the proposed revisions, including specialization profiles and clearer learning trajectories, will enhance programme coherence and student guidance.

The panel supports the decision to conduct the bachelor's and master's programmes in ME and the master's in AT in English, aligning with TU/e's international strategy. It appreciates TU/e's measures to ensure English proficiency among students and staff. It also approves of the intended name change of the ME bachelor's programme. The panel finds the admission requirements for the programmes appropriate and acknowledges the success of the selection process that was introduced along with the *numerus fixus* for the ME bachelor's programme. The *numerus fixus* resulted in reduced inflow in the bachelor's programme. In addition, the selection tests appear to result in improved student performance. Given the expected growth of the master's programmes, the panel encourages similar selection measures for these programmes. It also notes the prolonged study durations in the master's programmes, mainly due to delays in the thesis preparation phase, and recommends providing more guidance at the start of the thesis process. The panel commends the strong learning environment, including student mentoring and academic support. However, it warns that maintaining these resources amid programme growth will be challenging. It also notes concerns about workspace availability, particularly in the PROTO/zone workshop, and suggests future investments. Finally, the panel praises the teaching staff's engagement, professional development, and integration of industry experts, which enhance education quality.

Conclusion

The panel concludes that the bachelor's programme Mechanical Engineering meets standard 2.
The panel concludes that the master's programme Mechanical Engineering meets standard 2.
The panel concludes that the master's programme Automotive Technology meets standard 2.

Standard 3. Student assessment

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

Findings

System of assessment

The *bachelor's programme in Mechanical Engineering* employs a structured and comprehensive assessment system to ensure that students meet the intended learning outcomes. Assessment is an integral part of every course and learning activity, covering a range of components such as individual assignments, group projects, and final exams. The goal is to evaluate both theoretical knowledge and practical skills while fostering critical thinking and problem-solving abilities. The assessments are conducted by academic staff, often

supported by teaching assistants, with oversight from the Examination Committee to ensure quality and fairness. Courses typically include a combination of written exams, practical assignments, and group projects. Written exams focus on testing students' grasp of fundamental concepts in mathematics, physics, and engineering principles, using standardized rubrics to maintain consistency. Practical assignments require students to apply theoretical concepts to real-world problems, often involving laboratory work or computational simulations. These assignments are graded based on predefined criteria, such as accuracy, creativity, and problem-solving ability. Group projects, particularly within Challenge-Based Learning (CBL), are a key component of the assessment system. These projects are designed to replicate professional engineering scenarios, requiring teams to collaborate, develop solutions, and present their findings. Assessment of group projects includes both the quality of the final deliverable and individual contributions, which are tracked through peer reviews and self-assessment forms. In the interview with students, the panel learnt that students are provided rubrics to assist them in the conducting of peer evaluation.

The *master's programmes in Mechanical Engineering and Automotive Technology* use an advanced assessment framework to evaluate students' command of specialized knowledge, research skills, and professional competencies. In Automotive Technology there is an added focus on interdisciplinary systems thinking. Group and individual assessments often involve integrating knowledge from multiple domains, reflecting the programme's unique emphasis. Assessments are carried out by lecturers and supervisors, with quality assurance managed by the Examination Committee. Core and elective courses are assessed through written exams, individual assignments, and group projects. Written exams test in-depth theoretical knowledge, while assignments often involve complex problem-solving tasks, such as simulations or advanced design work. Group projects emphasize interdisciplinary collaboration, with grading based on the technical quality of the outcome, teamwork, and individual contributions, as captured through peer assessments. The internship, mandatory in both master's programmes, is assessed using a combination of reflective reports, oral presentations, and evaluations by both the academic supervisor and the host organization (if applicable). This ensures a holistic evaluation of the student's ability to apply their skills in real-world settings. The assessment is partly based on input from the external supervisor, who also uses a standard form for this.

Feedback mechanisms are integral to the assessment system of all three programmes, ensuring continuous improvement and alignment of the courses and its instruments for assessment with the intended learning outcomes. Sub-committees to the Examination Committee, an Assessment Committee for the two Mechanical Engineering programmes and an Assessment Committee for interdepartmental programmes including Automotive Technology, are in place to follow up the feedback mechanisms. Courses are selected for evaluation, and the results are reported back to the teacher of the course who can then implement changes for improvement. When discussed with the Examination Committee during the site visit, the panel learned that for the AT programme core courses are evaluated every three or four years. For the ME programmes, courses are evaluated based on outliers in student evaluations or course results, or by random sampling.

The panel concludes that the assessment systems for the bachelor's and master's programmes are well-structured and transparent, with clear processes and careful evaluation supported by standardized rubrics. Assessment methods are varied and appropriate to the course objectives. The panel praises that students are provided rubrics to aid them in peer evaluation, noting the approach as a good method to enhance fairness in the assessment process of peer evaluation. The panel also appreciated the work done by the Assessment Committees to continuously improve courses and make sure they are aligned with the intended learning outcomes. However, whereas in the AT master's programme every course is evaluated on a regular basis, this is not necessarily the case for the courses in the ME programmes, where courses are evaluated in

case of outliers in terms of course results or student evaluations. The panel notes that this does not guarantee that all courses will be structurally evaluated, meaning that some courses may be out of scope for an extended period of time and theoretically out of sync with the rest of the programme. The panel therefore recommends to adapt a structure for regular evaluation of all courses, ensuring that every course in the ME programmes is regularly evaluated by the Assessment Committee. In response to the Examination Committee's comments that the number of ME courses is too large for regular evaluation, the panel suggests that a multi-year schedule be established, similar to that used for AT. In a related issue, it did not become entirely clear to the panel how the programmes keep track whether the CBL projects that are relatively new to the curriculum are aligned with the ILOs. The implementation of CBL in every programme is a university-wide design, aimed at general learning outcomes for all degree students, but it should also be tailored to fit with the specific intended learning outcomes of the programmes. The panel feels this process is not entirely clear and needs a more structured approach. The panel recommends adopting a more systematic approach to programme changes, like the introduction of a new teaching and assessment instrument like CBL, using a PDCA cycle, including a clearer delineation of responsibilities, to make sure to close the loop. This will be extra important with the intended and expected growth of the programmes.

Assessment bachelor and master assignment

The Bachelor Final Project, a 10 EC capstone, is the culmination of the ME bachelor's programme and is comprehensively assessed. Students work under the supervision of a faculty mentor and are evaluated by at least one assessor using an extensive rubric. The evaluation covers the written report, planning and organizational skills, self-reliance and professional behaviour, analytical capacity, and a formal presentation. External stakeholders, such as industry representatives, may also provide feedback during project assessments, ensuring alignment with professional expectations.

The Master Graduation Project is the most significant assessment component of the ME and AT master's programmes, accounting for 45 EC. Students are required to conduct independent research or design work under faculty supervision. The assessment process includes a written thesis, a formal defence, and feedback from an assessment committee comprising at least three faculty members and, when applicable, external experts. The supervisor composes the assessment committee, which must be approved by the Examination Committee. Students are evaluated on their approach and execution of the thesis, autonomy and analytical ability, inventive and creative skills, report quality, and presentation and defence. The final grade is calculated as the weighted average of these components.

The panel is positive about the procedures for the assessment of bachelor's and master's theses. It commended the extensive rubric used for the assessment of the bachelor's theses and the involvement of several examiners in the assessment of the master's theses, which enhances validity and reliability of the assessment. The panel mostly agreed with the grades assigned to the assignments it read for all three programmes prior to the site visit, and felt that they were justified with good comments on the assessment forms. When reading the theses prior to the site visit, the panel noticed the difference in the scope and format of the theses in the AT programme. During their interview the teaching staff acknowledged the differences, noting that it may differ per specialization area, but that there are also differences between students, with some already capable of making it into a research paper. The panel understands that these differences can occur throughout the process, but also notes that it can make alignment in assessment and grading between examiners and project difficult. The panel therefore suggests making clear requirements that are the same for all students.

Examination Committee

The Examination Committee (EC) for the two Mechanical Engineering programmes consists of departmental staff and one external member from another department. It is chaired by a senior department member with expertise in educational evaluation and assessment. The EC for Automotive Technology oversees three interdepartmental master's programmes. It includes two experienced teachers from each programme and is chaired by an external expert in educational assessment. Both ECs meet monthly, and the chairs meet regularly with the programme directors to discuss examination issues and provide advice if there is a need for it. The panel commends the ECs for fulfilling their roles diligently and with great seriousness. In the interview with members of both ECs, it also became clear to the panel that with the increase in student numbers, the committee members are reaching the limits of what they can do in the time designated for their EC duties. The panel recognizes efforts by the department to strengthen their functioning, such as appointing a secretary, but emphasizes the need for further empowerment by management to safeguard effective decision-making. The panel also noted from the EC interview that part of the workload is related to the increasing number of student appeals, including some far-fetched cases that are unrealistically likely to succeed but can still take up a significant amount of committee time. To combat this, the panel suggests establishing stronger front-end processes to address concerns early. It recommends adopting a more structured approach to improve procedures and ensure continuous quality improvement. By refining processes and encouraging proactive measures, the committees can better handle challenges and maintain their high standards.

Considerations

The panel concluded that the assessment systems for the bachelor's and master's programmes are well-structured, transparent, and supported by a variety of methods aligned with course objectives. Rubrics are effectively used to ensure consistency, including for peer evaluations, which the panel praised for enhancing fairness. While the Assessment Committees contribute significantly to aligning courses with intended learning outcomes, the panel recommends implementing regular evaluations for all courses in the ME programmes to prevent misalignment over time. Furthermore, the panel recommends adopting a systematic PDCA cycle approach for changes made in the programmes, in the curricula and in methods of teaching and assessment, with clear delineation of who is responsible for what. If this loop is not closed, the intended and expected growth of the programmes might endanger the quality assurance and viability of the programmes in the future. The panel commended the procedures for assessing bachelor's and master's theses. It highlighted the comprehensive rubrics for the bachelor's theses and the multi-examiner approach for master's theses, which enhance validity and reliability. However, the panel noted inconsistencies in the scope and format of AT master's theses and recommends standardizing requirements across students to ensure fair assessments. The panel recognizes the Examination Committees for their diligent work, and finds that the ME and AT committees fulfil their roles diligently. At the same time, they also face challenges due to growing student numbers. The panel recommends empowering the committees further, improving front-end processes to address student concerns early, and adopting more structured procedures to ensure sustained quality.

Conclusion

The panel concludes that the bachelor's programme Mechanical Engineering meets standard 3.
The panel concludes that the master's programme Mechanical Engineering meets standard 3.
The panel concludes that the master's programme Automotive Technology meets standard 3.

Standard 4. Achieved learning outcomes

The programme demonstrates that the intended learning outcomes are achieved.

Findings

Theses

As preparation for the site visit, the panel studied 15 bachelor assignments for the bachelor's programme in Mechanical Engineering and 15 master assignments for both the master's programme Mechanical Engineering and the master's programme Automotive Technology. The panel generally found the reports to be of a high level for all three programmes, convincingly showing that students realize the intended learning outcomes of the programme. The panel also appreciates the topical nature of the theses for both research and industry.

Performance of graduates

Graduates from the ME bachelor's programme usually continue with a master's degree, many of them at TU/e. A substantial number continue in the ME master's programme. In the 2024 alumni survey of TU/e ME alumni, out of the 84 respondents 88% graduated from the master's programme and 55% graduated from the bachelor's programme, suggesting a considerable amount of students progressing from the bachelor's into the master's programme. A significant number of students also leaves TU/e to pursue a master's degree at Delft University, and, enabled by the English language of the bachelor's programme at TU/e, elsewhere in Europe. 70% of graduates from the ME master's programme work at a company and 23% works at a university, whereas 81% of graduates from the AT master's programme work at a company and 17% works at a university. Others work at research institutes, or have started their own company. Of the graduates from the AT master's programme, 75% hold positions directly related to the automotive sector, working at companies like DAF Trucks, Volvo Cars, and XYZ Dynamics. In the 2024 alumni survey, alumni from the ME and AT master's programmes also expressed themselves very positively about knowledge acquisition, skill development, and fostering a mindset geared towards continuous professional growth during their education, giving them high scores.

Based on the post-graduation careers of students and the positive feedback from alumni in the 2024 alumni survey and during the site visit, the panel supports the conclusion that students meet the ILOs: bachelor's graduates are admitted to relevant master degree programmes, and MSc graduates are in demand by industry and universities. The panel highlights that the English language of the bachelor's programme is also a stepping stone, as shown by the number of students continuing with a master's degree abroad.

Considerations

The panel found the theses of all three programmes to be of high quality, clearly demonstrating that students achieve the intended learning outcomes. It praised the relevance of the thesis topics to both research and industry. Regarding graduate performance, most ME bachelor's graduates continue with a master's degree, often at TU/e or other universities in Europe, facilitated by the programme's English instruction. ME and AT master's graduates are sought after, with most securing positions in industry, including prominent automotive companies for AT graduates, or pursuing academic careers. Alumni expressed high satisfaction with the knowledge, skills, and professional mindset developed during their education, confirming that the programmes effectively prepare students for their careers.

Conclusion

The panel concludes that the bachelor's programme Mechanical Engineering meets standard 4.

The panel concludes that the master's programme Mechanical Engineering meets standard 4.

The panel concludes that the master's programme Automotive Technology meets standard 4.

General conclusion

The panel's assessment of the bachelor's programme Mechanical Engineering is positive.

The panel's assessment of the master's programme Mechanical Engineering is positive.

The panel's assessment of the master's programme Automotive Technology is positive.

The panel supports the name change for the BSc Werktuigbouwkunde to 'Mechanical Engineering'.

Recommendations

1. Further refine the ILOs for all three programmes to enhance programme focus.
2. Improve the process of obtaining information from industry for all programmes. In this regard, the panel encourages re-establishing a departmental advisory board, but also taking it more to the programme level.
3. Introduce a dedicated AI learning line from early on in the ME bachelor's programme.
4. Place greater emphasis on industry-relevant professional skills in the ME master's programme to better prepare students for a variety of career paths.
5. Provide more guidance at the beginning of the thesis process in the ME and AT master's programmes to better help students keep their project on track and avoid delays in the preparation phase.
6. Implement regular evaluations for all courses in both ME programmes to ensure alignment with the other courses in the programme and to prevent discrepancies over time.
7. Adopt a systematic Plan-Do-Check-Act (PDCA) cycle approach for changes in the programmes, curricula, teaching methods, and assessment practices, with clear accountability for each step. Considering the intended and expected growth of the programmes, failure to close this loop may risk compromising the quality assurance and viability of the programmes in the future.
8. Standardize requirements for the AT master's thesis across all students to ensure fair and consistent assessments.
9. Further empower the Examination Committees for both the ME and AT programmes, improving front-end processes to address student concerns early, and adopting more structured procedures to maintain sustained quality.

Appendix 1. Intended learning outcomes

Bachelor's programme Mechanical Engineering

Bachelor of Science graduates:

- are academically qualified to degree level within the domain of engineering science and technology,
- are competent in the relevant domain-specific discipline(s) at the level of a Bachelor of Science, as specified below
- are able to conduct research and design under supervision,
- are aware of the significance of other disciplines,
- take a scientific approach to non-complex problems and ideas, based on current knowledge,
- possess intellectual skills and are able to reflect critically, reason and form opinions under supervision,
- have the ability to communicate the results of their learning, thinking, acts and decision-making processes,
- can plan and execute their activities,
- are aware of the temporal and societal contexts of science and technology (understanding and analysis)
- in addition to a recognizable domain-specific profile, possess a sufficiently broad basis to be able to work or collaborate in an interdisciplinary and multidisciplinary context. Here, multidisciplinary means focusing on other relevant disciplines needed to solve the design or research problem in question.

Specifically for the bachelor Mechanical Engineering (based on the DSRF Mechanical Engineering):

- have sufficient knowledge of the basic sciences mathematics, physics and thermodynamics,
- have sufficient knowledge of the engineering fields solid and fluid mechanics, dynamics and control,
- are able to integrate this knowledge in a group effort working on design problems, using specification, synthesis, modelling, optimization, manufacturing and evaluation

Master's programme Mechanical Engineering

Master degree program graduates (Master of Science):

- are academically qualified to degree level within the domain of 'science, engineering & technology',
- are competent in the relevant domain-specific discipline(s) at the scientific master's degree level, as indicated below

- are able to conduct research and design independently,

- have the ability and attitude to include other disciplines in their research, where necessary,

Automotive Technology equips individuals with profound scientific and technical knowledge in automotive-related engineering disciplines such as electrical engineering, mechanical engineering, computer science, and human factors, enabling them to apply this expertise in the automotive sector. Additionally, these studies provide a comprehensive system overview of interrelated research problem areas, from smart to sustainable mobility concepts, and train individuals to approach these challenges from a systems engineering perspective.

- have a scientific approach to complex problems and ideas, possess intellectual skills that enable them to reflect critically, reason and form opinions,

- have the ability to communicate the results of their learning, thinking and decision-making processes at an international level,

- are aware of the temporal and societal context of science and technology (comprehension and analysis) and can integrate this context in their scientific work,

- in addition to a recognizable domain-specific profile, possess a sufficiently broad basis to be able to work or collaborate in an interdisciplinary and multidisciplinary context. In this context, multidisciplinary means being focused on other relevant disciplines needed to solve the design or research problem in question,
- have the ability and attitude to seek new potential applications, taking the societal context into consideration.

Specifically for the master Mechanical Engineering (based on the DSRF Mechanical Engineering) Master's of Science graduates of the ME Master's program:

- have a profound understanding of at least one of the core disciplines of Mechanical Engineering: Systems, Dynamics & Control, Mechanics & Materials, Energy & Flow,
- are able to maintain and expand their expertise in this field,
- have good knowledge of the basic sciences that underlie this field,
- are able to apply this knowledge and understanding to analyze and synthesize structures, machines, devices, systems or processes that accomplish a desired objective in a safe, ethical and sustainable way.

Master's programme Automotive Technology

Master degree program graduates (Master of Science):

- are academically qualified to degree level within the domain of 'science, engineering & technology',
 - are competent in the relevant domain-specific discipline(s) at the scientific master's degree level, as indicated below
 - are able to conduct research and design independently,
 - have the ability and attitude to include other disciplines in their research, where necessary,
- Automotive Technology equips individuals with profound scientific and technical knowledge in automotive-related engineering disciplines such as electrical engineering, mechanical engineering, computer science, and human factors, enabling them to apply this expertise in the automotive sector. Additionally, these studies provide a comprehensive system overview of interrelated research problem areas, from smart to sustainable mobility concepts, and train individuals to approach these challenges from a systems engineering perspective.
- have a scientific approach to complex problems and ideas, possess intellectual skills that enable them to reflect critically, reason and form opinions,
 - have the ability to communicate the results of their learning, thinking and decision-making processes at an international level,
 - are aware of the temporal and societal context of science and technology (comprehension and analysis) and can integrate this context in their scientific work,
 - in addition to a recognizable domain-specific profile, possess a sufficiently broad basis to be able to work or collaborate in an interdisciplinary and multidisciplinary context. In this context, multidisciplinary means being focused on other relevant disciplines needed to solve the design or research problem in question,
 - have the ability and attitude to seek new potential applications, taking the societal context into consideration.

Specifically for the master Automotive Technology (based on the DSRF Automotive Technology):

Master's of Science graduates of the AT Master's program:

- have a system overview and are able to work from a systems engineering perspective.
- have a profound knowledge in one of the automotive related engineering sciences (electrical engineering, mechanical engineering, computer science, human factors) and are able to apply this knowledge in the automotive field.

Appendix 2. Programme curriculum

Bachelor's programme Mechanical Engineering

1.1		1.2		1.3		1.4	
Course code	Name	Timeslot	Course code	Name	Timeslot	Course code	Name
2WB80	Calculus	A	4CAL0	Principles of design and programming	C	4CA20	Signals and systems
Resp. lecturer level	P. Vrancken, J. Remmers level 1	5 ECTS W&I	P. Vrancken, J. Remmers level 1	5 ECTS W-CST	SECTS W-AMM	P. Chanfreut level 2	SECTS W-CST
4RA00	Mechanics	B	4DA00	Dynamics	A	4CBLA30	Energy storage and transport
Resp. lecturer level	M. Zakhari/L. van Breemen level 1	5 ECTS W-PP	R. Fey/L. Habets level 1	5 ECTS W-DC	SECTS W-PF	C. Verhoosel level 2	A+B 5 ECTS W-ET
4CBLA00	Introduction mechanical engineering and truss structure	C+E	4CBLA10	Design of launching mechanism	B+E	4CBLA20	Control of a flexible robot system
Resp. lecturer level	P. Anderson/R. Lutjge level 1	5 ECTS W-PP	I. Cortes Garcia level 1	5 ECTS W	A+B SECTS W-MS	Y. Wang level 1	C-E SECTS W-CST W
2.1			2.2			2.3	
4EB00	Thermodynamics	C	4DB00	Dynamics and control of mechanical systems	E	4MB00	Solid Mechanics
Resp. lecturer level	D. Smeynders level 2	SECTS W-ET	C. Murgula Rendon level 2	SECTS W-DC	M. Gees level 2	H. Kuerten level 2	E SECTS W-PF
2DW10	Probability and statistics for ME	D	4CBLB10	Sustainable Fuels: Plan A or B?	C+D	4CBLB20	Control of a flexible robot system
Resp. lecturer level	to be determined level 2	SECTS WSX	B. Somers level	SECTS W-PF	G. van Hattum/ R. Kunnen level 2	B. van Esch level 2	C-D SECTS W
Free electives		A or B 5 ECTS	Free electives		A or B 5 ECTS	Free electives	A or B 5 ECTS
3.1			3.2			3.3	
4MC10	Computational mechanics	E	4UC10	Micromanufacturing	D	4WC00	Bachelor Final Project
Resp. lecturer level	R. Peerlings level 3	5 ECTS W-AMM	J. den Toonder level 3	5 ECTS W-MS	Research groups Mechanical Engineering level 3	Research groups Mechanical Engineering level 3	X 10 ECTS W
4LVX40	Impact of Technology : Engineering for Society	B	Free electives		A or B or C 5 ECTS I&E&S-TS	Core electives	C or D or E 5 ECTS
Resp. lecturer level	F. Altemade level 2	5 ECTS I&E&S-TS	Free electives		Choose from a list of Core electives level 3	Choose from a list of Core electives level 3	Choose from a list of Core electives level 3
Free electives		A or B or C 5 ECTS	Free electives		A or B or C 5 ECTS	Free electives	A or B or C 5 ECTS
3.4			3.4			3.4	
4WC00	Bachelor Final Project	X	4WC00	Bachelor Final Project	X	4WC00	Bachelor Final Project
Research groups Mechanical Engineering level 3	Research groups Mechanical Engineering level 3	10 ECTS W	Research groups Mechanical Engineering level 3	10 ECTS W	Research groups Mechanical Engineering level 3	Research groups Mechanical Engineering level 3	10 ECTS W
Core electives		A or B or C 5 ECTS	Core electives		A or B or C 5 ECTS	Core electives	C or D or E 5 ECTS
Choose from a list of Core electives level 3	Choose from a list of Core electives level 3	Choose from a list of Core electives level 3	Choose from a list of Core electives level 3	Choose from a list of Core electives level 3	Choose from a list of Core electives level 3	Choose from a list of Core electives level 3	Choose from a list of Core electives level 3
Free electives		A or B or C 5 ECTS	Free electives		A or B or C 5 ECTS	Free electives	A or B or C 5 ECTS

Curriculum Bachelor Mechanical Engineering cohort 2023 and after

Legend	
Core	21 courses + BEP: 10 ECTS
Core electives	10
ITEC	2 courses to choose from a list of Core electives
Free electives	2 courses
	9 courses free to choose
	45

Master's programme Mechanical Engineering

Programme structure:		
Core	20 EC	Choose 4 core courses
Specialization	20 EC	Choose 20 EC from the list of specialization courses
Individual programme	15 EC	Free choice of all master's courses at TU/e
Professional skills	5 EC	Two mandatory courses
Trainee-/Internship	15 EC	
Graduation project	45 EC	

Master's programme Automotive Technology

Programme structure:		
Year 1	30 EC	Core courses
	15 EC	Specialization elective courses
	15* EC	Free electives
Year 2	15** EC	Internship
	45 EC	Graduation Project

* or 10, in case of extended internship

** you can use 5 EC from the free electives to extend your internship

Appendix 3. Programme of the site visit

Day Program Re-accreditation BSc & MSc Mechanical Engineering and MSc Automotive Technology		
Wednesday, November 27, 2024		
08:30-09:00	Welcome and preparation	
09:00-09:45	Interview management	
09:45-10:00	Break	
10:00-11:00	Students & Alumni of all programs	
11:00-12:00	Thematic session 1 - Growth	Staff, support staff
12:00-13:00	Lunch break	
13:00-14:30	Tour of facilities, meet involved staff, support staff, students	
14:30-15:30	Thematic session 2 - Community	Staff, students, support staff
15:30-15:45	Break	
15:45-16:30	Thematic session 3 - Oral exams and individual feedback	Staff, support staff
16:30-17:00	Internal panel meeting	
17:30-19:30	Committee diner at Zwarte Doos	
Thursday, November 28, 2024		
08:30-09:00	Arrival and preparation	
09:00-10:00	Thematic session 4 - AI	Staff
10:00-10:45	Interview board of examiners	
10:45-11:00	Break	
11:00-12:00	Thematic session 5 - System thinking	Staff
12:00-13:00	Lunch break	
13:00-13:30	Final management interview	
13:30-14:30	Internal panel meeting	
14:30-15:00	Oral feedback to programmes	

Appendix 4. Materials

Prior to the site visit, the panel studied 15 theses of the bachelor's programme Mechanical Engineering, 15 theses of the master's programme Mechanical Engineering and 15 theses of the master's programme Automotive Technology. When choosing their track in the ME master's programme, students are assigned to a corresponding research section. Weighing the number of theses per specialization within the programme, 3 theses were selected from Control Systems Technology, 2 from Dynamics and Control, 2 from Energy Technology, 2 from Mechanics of Materials, 2 from Microsystems, 2 from Power & Flow, 1 from Processing and Performance, and 1 from Robotics. Information on the theses is available from Academion upon request.

The panel also studied other materials, which included:

- Bachelor College Directive TU/e, Graduate School Guideline TU/e
- Strategy 2030 TU/e
- Program & Examination Regulations BSc Mechanical Engineering, Program & Examination Regulations MSc Mechanical Engineering and Automotive Technology
- DSFR Mechanical Engineering, DSFR Automotive Technology
- Overview ILOs, Connection ILOs and Meijers criteria
- Summary course evaluations and planning
- End of year surveys BSc ME, MSc ME & MSc AT
- Transfer surveys BSc ME, MSc ME & MSc AT
- NSE analyses BSc ME, MSc ME & MSc AT
- Curriculum BSc Mechanical Engineer 2022-2023 and before, and 2023-2024 and after
- External Review of Bachelor College
- Specialization Statutory teacher-training minor
- List of core & specialisation courses MSc Mechanical Engineer & MSc Automotive Technology
- Revision document Automotive Technology
- Overview educational methods BSc ME, MSc ME & MSc AT
- UTQ programme information
- English lecturer assessment
- List of staff involved in the programmes
- Assessment policy ME, Assessment AC-IM & MECH
- TU/e Exam Framework
- Advice Work Group Assessment – Bachelor College 2.0
- Evaluation pilots – Heat and Flow, and Digital progress tests in 1st year courses ME
- Rubrics for Engineering Design courses & first year CBL courses
- Overview of the assessment methods used in the core courses
- Programme & Examination Regulations Masters
- Examination Committee Regulations ME & interdepartmental Masters (IMs), including AT
- Programme & Examination Regulations Bachelor Mechanical Engineering
- Annual Reports Examination Committees AT & ME
- Assessment plan format
- National Alumni Survey Results ME & AT
- SWOT analyses bachelor's programme Mechanical Engineering, master's programme Mechanical Engineering, and master's programme Automotive Technology
- Quality Assurance Plan department Mechanical Engineering
- Annual report bachelor's programme Mechanical Engineering, graduate programme Mechanical Engineering, and graduate programme Mechanical Engineering