wo-master
Mechanical Engineering
University of Groningen (RUG)

4 July 2018

NVAO limited initial accreditation

Panel report

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1 Executive summary

The Accreditation Organisation of the Netherlands and Flanders (NVAO) received a request for an initial accreditation regarding a proposed academic master programme Mechanical Engineering at the University of Groningen (RUG). NVAO convened an expert panel, which studied the information available and discussed the proposed programme with representatives of the institution and the programme during a site visit.

The following considerations played an important role in the panels assessment.

The proposed two-year academic master programme in Mechanical Engineering of the University of Groningen has the objective to *train and prepare students to apply principles of engineering, science and mathematics in the modelling, analysis, design and realization of physical systems, components and processes*[1]. The programme has four tracks: (1) Advanced Instrumentation, (2) Smart Factories, (3) Process Design for Energy Systems and (4) Materials for Mechanical Engineering.

The panel considers the Mechanical Engineering programme well aligned with the strategic goals of the university. The programme strongly originates from and is embedded in an existing network of knowledge institutions and research groups from both the University of Groningen as well as regional partners from the industry. Therefor it connects to the challenges in the north of the Netherlands. The intended learning outcomes match the (international) 'domain specific' reference frameworks, they are however broadly formulated. The panel thoroughly questioned the connection between the intended learning outcomes and the requirements from the (international) field as defined in several frameworks. It had concerns on the level of mechanical design skills in some of the possible tracks. The panel suggests that a more specific Groningen focus could help.
The professional field is involved and is eager to employ the future graduates, if they have sufficient technical knowledge and design skills. The expectations of the professional field are high and the potential employers are enthusiastic to contribute in further developing the programme (for example by handing cases for projects, internships).
The two tracks that were designed first (Advanced Instrumentation and Smart Factories), are embedded well in the research and educational environment. The two other tracks: Process Design for Energy Systems and Materials for Mechanical Engineering, are in an earlier stage of development and need to be developed further. Considering the opportunities provided by the network, the means available and the results in the other tracks the panel trusts that the programme management is willing and able to do this successfully.
The programme meets standard 1.
The panel **recommends** the programme management to ensure that in the further development of the programme the intended learning outcomes are made more specific to better match the requirements as defined in the international 'domain specific' reference framework and stay aligned with the expectations from the professional field.

The structure of the programme is clear and the panel considers the intended learning outcomes on programme level being translated well into learning goals for the different components of the study programme. The use of a Course Unit Assessment Overview

[1] Taken from the information file

(CUAO) per course is helpful for staff as well as for the Board of Examiners and Programme Committee to have a clear programme overview.
Skills development is a point of attention for the programme, according to the panel. Engineering and societal skills are integrated in the courses. Lecturers provided examples of how these skills are trained but the panel was not convinced of a systematic approach on these learning outcomes. Under the next standard the panel will come back to this since also the assessment of these skills is rather unclear. The panel considers this as an opportunity to connect more closely to the professional field.

Currently there are enough staff members to execute the programme and they have expertise in the field of Mechanical Engineering. Most staff members have a PhD and are experienced lecturers (most of them have a UTQ certificate or equivalent). The current staff members expressed their willingness to teach the courses (they also developed the courses) and have sufficient expertise to guide students. The programme also would benefit from new lecturers. The panel has confidence in the current actions being taken to attract new staff.
The admission of students was a recurring topic during the site visit. The deficiency matrix that was presented to the panel during the visit defines which Groningen bachelor programmes prepare for the mechanical engineering programme and what are the deficiencies of students graduating from these programmes. The focus of this document however is on the course titles from these programmes. The panel therefor advises the programme management to explain the deficiencies on the level of knowledge and skills. The panel acknowledges the plans for the minor programme (mainly intended for Groningen students) and pre-master programme (mainly meant for external students). These programmes will result in a more similar entrance level for all students starting the mechanical engineering programme.
The programme meets standard 2.
The panel **recommends** the programme management to explicitly outline the admission requirements by defining the specific knowledge and skills students need to be admissible to the programme and to apply the admission requirements and procedures strictly.

The University of Groningen is known for their clear format regarding the Board of Examiners' policies. The Faculty policy is in line with the university policy and the use of the CUAOs is helpful for the board to carry out their tasks, according to the panel. The choice to use the same assessment form for both the design and research project could be reconsidered. According to the panel a specific form for each type of project may fit the assessment better, since the outcomes of the project differ. The Board of Examiners, that will be formed, has a good overview of the actions that need to be taken and the instruments that are available. The panel trusts the board to also be pro-actively involved during the development of the new programme. A point of attention for the board and the management is that all lecturers obtain their UTQ certificate and continue to professionalise when it comes to testing and assessment.
The programme meets standard 3.

The panel comes to the conclusion that the programme meets all standards. Given these considerations, the panel advises NVAO to take a positive decision regarding the quality of the proposed wo-master programme Mechanical Engineering at the University of Groningen (RUG).

The Hague, July 4, 2018

On behalf of the assessment panel convened for the initial limited accreditation assessment of the wo-master programme Mechanical Engineering at the University of Groningen (RUG),

Prof.dr. Joris De Schutter (chair)	Anke Schols MSc MA (secretary)

2 Introduction

2.1 The procedure

NVAO received an application for an initial accreditation procedure including an information file regarding a proposed academic master programme Mechanical Engineering. The application was received on 9 January 2018 from the University of Groningen (RUG).

An initial accreditation procedure is required to be registered as a programme eligible to issue legally recognized degrees. Only recognized institutes can submit an application. The same standards apply as in the case of re-accreditation of existing programmes, with the exception of the standard on the realisation of intended learning outcomes. The initial accreditation however is an ex ante assessment of a programme based on the design of the programme as a whole. The design of the first year has to be well elaborated; course descriptions have to be available to the panel. The programme becomes subject to the normal accreditation procedures once initial accreditation has been granted.

To assess the program, the NVAO convened an international panel of experts (see also Annex 1: Composition of the panel). The panel consisted of:

- Prof.dr. Joris De Schutter (chair) – Professor Mechanical Engineering, chair of Department Mechanical Engineering, KU Leuven;
- Prof.dr. Wim Van Petegem – Professor and Policy coordinator Learning Technologies, Faculty of Industrial Technology, KU Leuven;
- Ir. Janjoris van Diepen – Senior sustainability consultant at Blonk Consultants, board member KIVI department Sustainable Technology;
- Vera Broek (student member) - Student Biomedical Sciences, Leiden University.

On behalf of the NVAO, Frank Wamelink and Anke Schols were responsible for the process coordination and the drafting of the panel report.

The panel composition reflects the expertise deemed necessary by NVAO. (Annex 1: Composition of the panel). All the panel members signed a statement of independence and confidentiality.

The panel has assessed according to the standards and criteria stated in the NVAO Assessment framework for the higher education accreditation system of the Netherlands (Stcrt. 2016, nr 69458).

The following procedure was undertaken. The panel members prepared the assessment by analysing the documents provided by the institution (Annex 3: Documents reviewed). The panel organised a preparatory meeting on May 8th, the day before the visit, in Groningen. During this meeting, the panel members shared their first impressions and formulated questions for the site visit.

The site visit took place on May 9th, 2018 at the University of Groningen (RUG). During this visit, the panel was able to discuss the formulated questions and gather additional information during several sessions (Annex 2: Schedule of the site visit). Some additional documents were provided to the panel. At the end of the site visit, the panel discussed the findings and considerations and pronounced its preliminary assessments per theme and standard. These initial findings were presented to the institution.

Based on the findings, considerations and conclusions the secretary wrote a draft advisory report. After all the panel members had commented on the draft report, the chair endorsed the report. On 19 June 2018 the advisory report was sent to the institution, which was given the opportunity to respond to any factual inaccuracies in the report. The institution replied on 25th of June 2018. All suggested corrections were adopted. Subsequently the final report was endorsed by the panel chair. The panel composed its advice fully independently and offered it to NVAO on 4th of July 2018.

2.2 Panel report

The first chapter of this report is the executive summary of the report, while the current chapter is the introduction.

The third chapter gives a description of the programme including its position within the institution, the University of Groningen and within the higher education system of the Netherlands.

The panel presents its assessments in the fourth chapter. The programme is assessed by assessing the themes and standards in the Initial Accreditation Framework. For each standard the panel presents an outline of its findings, considerations and a conclusion.

Chapter five describes the panel's conclusion about the extended duration of the intended master programme.

The outline of the findings are the objective facts as found by the panel in the programme documents, in the additional documents and during the site visit. The panel's considerations consist of the panel's judgments and subjective evaluations regarding these findings and their relative importance. The considerations presented by the panel are at the basis of a concluding overall assessment.

The panel concludes the report with a table containing an overview of its assessments per standard.

3 Description of the programme

3.1 General

Country	:	The Netherlands
Institution	:	University of Groningen (RUG)
Programme	:	Mechanical Engineering
Level	:	academic (wo)
Orientation	:	master
Specialisations	:	Advanced Instrumentation; Smart Factories; Process Design for Energy Systems; Materials for Mechanical Engineering
Degree	:	Master of Science
Location(s)	:	Groningen
Study Load (EC)	:	120 EC
Field of Study	:	Technical (In Dutch: Techniek)

3.2 Profile of the institution

The University of Groningen was founded in 1614. It is organised in eleven faculties that offer degree programmes and courses in the fields of Humanities, Social Sciences, Economics and Business, Spatial Sciences, Life Sciences and Natural Sciences and Technology. In total these faculties offer 167 master's programmes and 48 bachelor's programmes. The University of Groningen has 30,000 students of which 6,000 are international students. It employs 3,000 fte academic staff, including 400 professors and 2,000 PhD students. The University of Groningen has a positive result for the Institutional Audit as of July 29th, 2014.
The Faculty that will host the new programme has recently been renamed to "Faculty of Science and Engineering" (FSE). The Faculty currently offers 13 Bachelor's and 26 Master's degree programmes. The new master programme in Mechanical Engineering will be embedded in the Graduate School.

3.3 Profile of the programme

The new two-year academic master programme in Mechanical Engineering (120 EC) that will be offered by the University of Groningen has four proposed specialisations: Advanced Instrumentation; Smart Factories; Process Design for Energy Systems; Materials for Mechanical Engineering.
The University of Groningen wishes to expand the number of engineering programmes and connects to their existing research topics when starting the Mechanical Engineering programme. The mission of the programme is to "train and prepare students to apply principles of engineering, science and mathematics in the modelling, analysis, design and realisation of physical systems, components and processes".
The 4TU institutes Delft University of Technology, Eindhoven University of Technology and University of Twente all offer a bachelor's and master's programme in Mechanical Engineering.
The programme applies for an initial accreditation with extended duration.

4 Assessment per standard

This chapter presents the evaluation of the standards by the assessment panel. Firstly the standard is stated. For each standard the panel presents (1) a brief outline of its findings based on the programme documents and on documents provided by the institution and the site visit, (2) the considerations the panel has taken into account and (3) the panel's conclusion. The panel presents a conclusion for each of the standards, as well as a final conclusion.

The panel assessed according to the standards and criteria stated in the NVAO Assessment framework for the higher education accreditation system of the Netherlands (Stcrt. 2016, nr 69458). The assessment is the result of an open discussion among peers on the content and quality of the new programme.

On each of the standards the assessment panel formulates a substantiated decision using a three-point scale: i) meets the standard, ii) does not meet the standard or iii) partially meets the standard. In conclusion the panel subsequently argues for a general advice on the quality of the programme as a whole: i) positive, ii) conditionally positive or iii) negative.

4.1 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.

Outline of findings
Intended learning outcomes
The intended learning outcomes of the programme are benchmarked with international relevant ('domain specific') reference frameworks defining expectations on the level of disciplinary and professional requirements for graduates of similar programmes. These are the Dublin Descriptors, the European Accreditation of Engineering programmes (EUR-ACE) and the Accreditation Board for Engineering and Technology (ABET). In the design of the intended learning outcomes of the programme these frameworks were used as a reference. The learning outcomes were specified and reformulated according to the specific profile of the programme also resulting from the regional expectations in Groningen.

In the application documents the programme demonstrated that the fifteen learning outcomes of the programme cover the five categories of the Dublin Descriptors (knowledge and understanding, application of knowledge and understanding, judgement, communication skills and learning skills). One of the learning outcomes is related to the specific track students are graduating from and therefor divides into four separate variants. The other learning outcomes apply to all tracks.

The programme strongly originates from an existing network of knowledge institutions and research groups both from the University of Groningen and regional partners coming also from industry.
The tracks of the new programme therefor have a relation to the research expertise and topics that are at the core of the strategy of the University of Groningen.

Initially the programme developed two intended tracks (Advanced Instrumentation and Smart Factories) and presented these in the first application for macro efficiency[2]. After that two tracks were added (Process Design for Energy Systems and Materials for Mechanical Engineering). This broader programme, now including four tracks, aligns better with the international Mechanical Engineering context. The university already offers courses related to any of the topics, but these courses are now combined into the Mechanical Engineering programme as specialisation tracks. The topics are geared to the context and the needs of industrial companies and research and engineering institutes in the Northern Netherlands.

Professional field

The professional field was involved in the development of the programme. This was substantiated by the letters of support that were made available during the visit. As mentioned the programme is also explicitly connected to research and engineering institutes (for example the *Innovatiecluster Drachten* and the *Region of Smart Factories*), as well as to smaller and larger companies from the region.
Representatives of the professional field being interviewed by the panel explicitly mentioned the urgent need for a mechanical engineering programme in the region of Groningen. They expressed their need for graduates of the programme, with specific mechanical engineering competencies in terms of technical knowledge and design skills.

Scientific master level

The learning outcomes are on master's level and have an academic focus. The programme is strongly connected to the research themes and has a research focus. The research environment covers the mechanical engineering topics, however spread over several research groups and institutes.

Considerations

The panel was convinced that the intended level and orientation of the programme meet that of an academic master. The new master programme of mechanical engineering aligns with the strategic goals of the university to expand the number of engineering programmes and fits into broader developments in this respect. The University of Groningen has an excellent research agenda and the panel was impressed by the ability of the university to connect this to the educational focus in the programme. From the interviews the panel concluded that the staff that developed the programme is very dedicated, agrees on the intended learning outcomes and is involved in further specification of the details. For some positions new staff will be recruited. There will be room for these staff members to contribute to the development of the programme, building on their specific expertise.

The learning outcomes were geared to relevant international 'domain specific' reference frameworks. The panel thoroughly questioned the connection between the intended learning outcomes and the requirements from the (international) field as defined in several frameworks. It had concerns about the level of mechanical design skills in some of the possible tracks. Topics are manufacturing technology and production technology and more broadly, a more multidisciplinary approach caused similar concerns by the panel. However, the panel was convinced that these aspects will be paid sufficient attention to in the programme during further development. The intended learning outcomes are broadly defined and the panel concluded that the process of designing these was well structured. It

[2] Application at CDHO, this is the assessment establishing the demand for graduates in the labour market

suggests that the intended learning outcomes could benefit from having a more pronounced (Groningen) profile.

The professional field representatives pointed out to the panel that they are eager to employ the graduates with a mechanical engineering profile, but they expect sufficiently broad technical knowledge and design skills. That should be the added value of this programme. Other existing programmes in Groningen offer this to a limited degree. The expectations of the professional field are high and potential employers are enthusiastic to contribute in further developing the programme (for example by providing cases for projects, internships). This intensive involvement of the professional field is considered by the panel as important and a safeguard for well qualified graduates meeting intended learning outcomes that are in line with the international standards and expectations of the regional field. The panel suggests the programme management to continue and expand the involvement of the network in which the programme is embedded.

The two tracks that were designed first (Advanced Instrumentation and Smart Factories), are embedded well in the research and educational environment. The two other tracks: Process Design for Energy Systems and Materials for Mechanical Engineering, are in an earlier stage of development and need to be developed further. Considering the opportunities provided by the network, the means available and the results in the other tracks the panel trusts that the programme management is willing and able to do this successfully.

Conclusion
The programme meets standard 1.

The panel **recommends** the programme management to ensure that in the further development of the programme the intended learning outcomes are made more specific to better match the requirements as defined in the international 'domain specific' reference framework and stay aligned with the expectations from the professional field.

4.2 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.

Outline of findings
Curriculum
The 120 EC curriculum consists of 60 EC courses in the first year, a 20 EC design project and a 40 EC research project in the second year. Three courses of 5 EC each (Computational Mechanics I, Experimental Design, Introduction to Data Science) are compulsory for all mechanical engineering students. Though some of the courses are called 'introduction to', sufficient prior knowledge on the topic is required.

Each track also has three 5 EC dedicated compulsory courses. Each student needs to choose a 5 EC course from the elective courses on Management, Business and/or Society list. The five courses of 5 EC that remain, are elective courses that students choose from a list of electives per track. Elective courses will be presented in a learning pathway, to provide guidance to the students. The learning pathway shows the preferred study paths. The students will be advised by the study advisors on their choice of electives (which can

also be courses outside the Faculty). The individual study path resulting from this choice of (elective) courses needs to be approved by the Board of Examiners to ensure coverage of all intended learning outcomes. This implies that students choose their electives early in the study programme, giving the opportunity to students to pursue personal interests while safeguarding the fit of their study programme with the thesis topic. Modifications to the individual study programmes are also assessed by the Board of Examiners.
This structure of the programme is similar to the other master programmes in the Faculty.

About half of the courses are newly developed for the programme. This however remains a feasible effort, since most courses are not developed from scratch but are based on 'building blocks', which are parts that are available in existing courses. The other half of the courses consists of existing courses, already delivered in other programmes. The panel therefor questioned the lecturers about the diversity in backgrounds of students in the classroom. The lecturers argued that they will assist individual students to cope with their deficiencies. Students however remain responsible to take initiative in case they feel they have insufficient prior knowledge.
All course information is digitally available to staff and has a standardised format called the Course Unit Assessment Overview (CUAO). The format is used Faculty wide and is the source for student information on the website.

Courses are evaluated digitally by students, all results are sent to the lecturer and deputy director and a summary of the results is published for feedback purposes. The Programme Committee has insight in previous evaluation results and follow up. In addition an overview for each learning pathway is provided. They discuss the results and offer advice to the deputy director.

The second year consists of the design project and the research project. The design project is a specific assignment carried out in an external organisation. The coordinators have a list of projects, while students are allowed to find their own project and company. The research project is connected to the research topics of the university.
In order to start the design and research project, students need to have completed at least 45 EC from the first year. In order to ensure students graduate in time, Faculty rules for delays in the research project are rather strict. Several feedback moments are put in place during the process (progress and midterm meetings).

Intake and mentoring
Bachelor students from the FSE programmes (applied) physics, astronomy (track informatics and instrumentation), applied mathematics and industrial engineering and management (track production technologies and logistics) are admissible to the programme, after completing a bridging or minor programme. The deficiencies for each of the above bachelor programmes are specified in a deficiency matrix. After sending in the information file to the panel the programme management decided not to admit students holding a chemical bachelor degree, further internal discussion had led to the conclusion that there are too few links with mechanical engineering topics. Students that hold a bachelor degree in mechanical engineering (offered at other institutions in the Netherlands) are directly admissible. The programme counts on a 1/3 intake from University of Groningen bachelor programmes, 1/3 from abroad and 1/3 from other Dutch programmes. Students who have completed an academic bachelor programme (abroad) containing mechanical engineering topics might be admissible after an assessment by the admissions board. The requirements for external students are: sufficient knowledge of mathematics, physics, materials and

mechanics. Besides that, their level of English needs to be minimum 6,5 (IELTS) or equivalent.
In the near future, a specific bridging or pre-master programme will be developed for students that have insufficient knowledge to enter the programme. As of September 2019, a minor programme of 30 EC will start that will ensure that students from the University of Groningen are able to enter the mechanical engineering programme in September 20209.

The expectation of the programme management is that about 40 students will enrol in the programme. When incorporating extra staff that is currently being hired, the programme management expects to have sufficient staff to deliver the programme and to guide students in their projects, internships and master theses.

Staff
The current staff has developed the new courses and is able to teach these courses. The majority already teaches courses in other technical programmes. There are a number of vacancies (professor, tenure track positions) in order to strengthen the mechanical engineering team both in research and in education. The FSE Fellowship programme allows the programme management to hire staff for four years that will spend 30% of their time on education and 70% on research. Additionally teaching staff is being recruited (100% dedicated to teaching). One fellow and one lecturer have already been assigned to the mechanical engineering programme.

Nearly all academic staff has a PhD and is involved in research in the mechanical engineering topics. Although they are spread over the campus and research institutes, they are working closely together in educational programmes.
All teaching staff is obliged to complete the UTQ programme. This is a university wide policy. Some lecturers are still in the process of obtaining their qualification.

Facilities
The panel had a short tour of the facilities. The number of laboratories will be expanded and a dedicated study space (Learning Community) will be made available for the mechanical engineering students to work on assignments and projects. A new dedicated building for the Faculty of Science and Engineering will ensure sufficient room for the growth in number of students. This building will be ready in 2022.

Considerations
The panel has found that the intended learning outcomes on programme level have been translated systematically to learning goals for the different components of the study programme. To safeguard this, the programme uses the standardised Course Unit Assessment Overview (CUAO) per course. During the interviews and by study of the documentation, the panel could verify the CUAOs provide clarity on expectations for staff also the student information derived from this provided clarity for students.
Engineering and societal skills are integrated in the courses. Lecturers provided examples of how these skills are trained but the panel was not convinced of a systematic approach on these learning outcomes. Under the next standard the panel will come back to this since also the assessment of these skills is rather unclear. The panel considers this as an opportunity, in order to connect more closely to the professional field.

The lecturers that the panel spoke to have the required expertise to teach the (new) courses in the programme. While education is research-driven, the current staff members both have

sufficient didactical knowledge and are involved in research that is connected to mechanical engineering topics, according to the panel. The current staff members expressed their willingness to teach the courses (they also developed the courses), but the programme would also benefit from new lecturers. The panel has confidence in the current actions being taken by the management: the published vacancies, the Fellowship programme and hiring of extra lecturers.
The lecturers the panel interviewed have sufficient expertise to guide students. In doing this they manage to find a balance between stimulating students to take responsibility for their learning process and providing them with structure and support when necessary.

The admission of students was a recurring topic during the site visit. The deficiency matrix that was presented to the panel during the visit defines which Groningen bachelor programmes prepare for the mechanical engineering programme and what are the deficiencies of students graduating from these programmes. The focus of this document however is on the course titles from these programmes. In some respects a more detailed comparison might be needed. Realized outcomes on design skills may be very different in a programme for physics students than in a programme in industrial engineering and management. The panel suggests that it would be useful to have the deficiency information available on knowledge and skills level, tailor-made for this mechanical engineering programme.

The panel acknowledges the minor programme for students from the University of Groningen, since it will speed up study progress for students when entering the mechanical engineering programme. The programme will also benefit from the pre-master programme for students from other institutes (including hbo graduates), according to the panel. This will prepare prospective students for the master programme and provide them with a more similar entrance level.

Conclusion
The programme meets standard 2.

The panel **recommends** the programme management to explicitly outline the admission requirements by defining the specific knowledge and skills students need to be admissible to the programme and to apply the admission requirements and procedures strictly.

4.3 Standard 3: Assessment

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

Outline of findings
Assessment policy
The assessment policy of the Mechanical Engineering programme is according to the Faculty policy, which is in line with the university wide policy. On programme level an Assessment Plan is available. The plan needs to be approved by the Faculty management team and consists of the programme objectives, learning outcomes, components of the curriculum (courses and projects) including the number of EC, modes of instruction and assessment and the examiner(s). An overview is provided showing the learning outcomes linked to the components of the curriculum. This is presented for each track.
For each course, a Course Unit Assessment Overview (CUAO) will be available. Course unit coordinators draft the CUAO, which is then checked by the Board of Examiners. All

coordinators are appointed by the Board of Examiners as examiners, they are permanent staff members holding a UTQ certificate or equivalent. The CUAO is source for the online study guide available for students from which they can see the required prerequisite knowledge, learning outcomes, course description, modes of teaching and assessment. All assessments are drafted or checked by two lecturers.
The panel also gained insight into the assessment forms of the design project and the research project. These forms are prescribed for the whole faculty.

Safeguarding
The Board of Examiners (BoE) will be responsible for the examination and assessment of the programme. The board is independent from the programme management and is appointed by the Faculty board. An external member is added to the Board of Examiners, that consists of three members and the external member. This external member has expertise on testing and assessment.
The BoE has four main responsibilities when carrying out their task. Firstly they are responsible for the quality of the assessment in the programme and they check this by looking at both procedure as well as content. Individual courses are evaluated by the board at least once every three years.
Secondly the board approves the individual study programmes of students and checks that the intended learning outcomes are covered by the courses selected by the student.
The third task is advising the management about the Assessment Plan of the programme. For this the board checks for internal consistency (does the assessment fit the course goals), for alignment of the course with the programme goals and whether the knowledge and skills are tested appropriately.
Lastly the board randomly checks the quality of the final reports and theses, taking into account the different grades awarded.

Research and design projects
The design project and the research project are individual projects for students. The assessment is done by two supervisors. The first supervisor is responsible for the daily supervision and is a staff member from the Faculty. This supervisor needs to ensure the academic quality of the project. The second supervisor is just involved for the assessment of the project and has no role in guidance. In case there is an external supervisor, s/he will also be consulted on the students' performance.
Feedback is provided throughout the project process; this is done weekly by the first supervisor. A midterm examination is a feedback moment for the student and implies a go-no go decision for the project.
The assessment for the projects consists of multiple criteria. Each criterion needs to have a sufficient grade (5.5 or higher), otherwise the student fails and needs to do additional work to obtain a pass grade (remediation trajectory). This can take up to a maximum of 30% of the original time set for the project. In case a student fails the remediation trajectory, a new project needs to be executed. Both projects are assessed by using the same form.

Considerations
The assessment policy and its execution is in line with the Faculty policy, according to the findings of the panel. The CUAOs provide a clear format for all users (staff, boards). The actual CUAOs of courses that the panel studied were in line with the assessment policy.
The choice to use the same assessment-form for both the design and research project could be reconsidered. However this is prescribed Faculty wide. According to the panel

there are different skills being developed and assessed by the two projects, so a specified form may fit the assessment better.
At the time of the site visit, the Board of Examiners was still being formed. According to the panel the BoE members had a good overview of the actions that need to be taken and the instruments that are available, though it would be good for them to be already pro-actively involved during the development of the new programme.
From the meetings the panel understood that the board will appoint the examiners for the mechanical engineering programme. Not yet all of the lecturers have obtained a UTQ or equivalent certificate; this is a point of attention for the Board of Examiners and the programme management.

Conclusion
The programme meets standard 3.

4.4 Qualification and field of study (CROHO)

The panel advises to award the degree 'Master of Science' to the wo-master Mechanical Engineering. The panel supports the program's preference for the CROHO field of study 'techniek'.

4.5 Conclusion

The panel concludes that the master programme in Mechanical Engineering of the University of Groningen meets all three standards. Therefor, the panel assesses the quality of the programme as positive.

The panel made two specific recomendations. These recomendations are not hindering the positive conclusion of the panel.

5 Assessment of the Programme Extension

The panel assessed the request of the institution for the extension of the programme according to the Protocol for programme extension of 8 October 2003.
In the assessment of applications for programme extension, NVAO primarily focuses on the question whether the programme demonstrably requires extension of the curriculum in order to meet one or both of the criteria below:

- attaining the exit level desired from an international perspective;
- attaining the exit level based on the requirements of the professional field.

5.1 International perspective

When the bachelors and masters were introduced in the Netherlands, technical academic programmes, leading to the title ir. (ingenieur) were set at a duration of five years (300 EC; three years bachelor; two years master) in order to allow the students to attain an internationally comparable level. The international standard for the programmes was five years. Offering an education of four years, implying a one-year master's programme, would have put graduates of Dutch programmes in an unfavourable position compared to their peers abroad, regarding the knowledge and skills they would have acquired.
The learning outcomes and outline of the programme are at a level that is comparable with those of similar (international) programmes.

The programme demonstrated that it aims for specialisation and technical knowledge as well as for a solid scientific focus with practice oriented components. According to the panel this requires, in addition to the theoretical education and training, a design project and a research (graduation) project. This justifies the additional workload.

5.2 Professional field

The learning outcomes to be attained by the students should enable them to meet the standards in the professional field on an equal basis with their peers from other countries. Therefor they will have mastered disciplinary expertise in the field of Mechanical Engineering as well as specialised expertise from one of the four specialisations. Moreover, and representatives of the professional field emphasised this, students not only should have obtained in-depth disciplinary knowledge, including the various methodologies, the relations between disciplines and their interdisciplinary integration, but also ought to have acquired research skills, communication skills, practical lab skills and business skills. The thesis should explicitly demonstrate the technical knowledge, applied to a specialised topic. This validates the workload of 40 EC.

The panel is convinced that these arguments are valid. It therefor agrees that the programme needs two years to cover all the qualifications that graduates should master in order to be competitive on the international academic Mechanical Engineering job market.

6 Overview of the assessments

Standard	Assessment
Intended Learning outcomes *Standard 1 : 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*	Meets the standard (weighted and substantiated).
Teaching-learning environment *Standard 2 : The curriculum, the teaching-learning environment and the quality of the teaching staff enable the incoming students to achieve the intended learning outcomes.*	Meets the standard (weighted and substantiated).
Student assessment *Standard 3: The programme has an adequate system of student assessment in place.*	Meets the standard (weighted and substantiated).
Conclusion	Positive (weighted and substantiated)

Annex 1: Composition of the panel

Chair: Prof. dr. Joris de Schutter
Joris De Schutter received an MSc degree in mechanical engineering from the Katholieke Universiteit Leuven (Belgium), an MSc degree from the Massachusetts Institute of Technology (USA), and the PhD degree in mechanical engineering, also from KU Leuven. Following work as a control systems engineer in industry he became a lecturer in the Department of Mechanical Engineering at KU Leuven, where he has been a full professor since 1995. Since 2017 he is also the chair of the Department of Mechanical Engineering. He teaches courses in kinematics and dynamics of machinery, control, robotics and optimization. His research interests include sensor-based robot control and programming, optimal motion control of mechatronic systems, and modelling and simulation of human motion.

Member: Prof.dr. Wim Van Petegem
Wim Van Petegem holds an MSc degree in Electrical Engineering from the University of Ghent (Belgium), an MSc degree in Biomedical Engineering from the KU Leuven (Belgium) and a PhD degree in Electrical Engineering from KU Leuven. He has worked at the University of Alberta, Edmonton (Canada), at the Open University of the Netherlands and at the Leuven University College (Belgium). From 2001 till 2012 he was the head of the Media and Learning Center and later he became Director of the Teaching and Learning Department at KU Leuven (Belgium). Currently he is Professor at the Faculty of Engineering Technology at KU Leuven, where he is Policy Coordinator Learning Technologies. He is also actively involved in different networks of universities (like SEFI, EDEN, and MEDEA). His current research interests are in the field of multimedia production, new educational technology, networked e-learning, virtual mobility, lifelong learning, open and distance learning, knowledge transfer, science communication, XXIst century skills and engineering education. He has been a member of several review panels for NVAO since 2008.

Member: ir. Janjoris van Diepen
Janjoris van Diepen holds an MSc degree from Twente University, Mechanical Engineering. He graduated in the field of sustainable energy. After being in South America for four years, he worked several years in consultancy and is now senior sustainable consultant at Blonk Consultants. In addition to that, he is board member of the KIVI department Sustainable Technology.

Student Member: Vera Broek
Vera Broek is 3rd year student in the bachelor programme of Biomedical Sciences at Leiden University. She was trained by the NVAO as a student member for panels.

Secretaries
Frank Wamelink, Anke Schols (policy advisors, NVAO)

Annex 2: Schedule of the site visit

The panel visited the University of Groningen on May 9th, 2018 as part of the external assessment procedure regarding the wo-master programme Mechanical Engineering.

Program for Initial Accreditation
wo-ma Mechanical Engineering - Groningen University (6376)

Program for the site visit on Wednesday May 9th 2018

Groningen University – Bernouilliborg Building

NVAO panel

Joris De Schutter (chair) – Professor Mechanical Engineering, chair of the Department of Mechanical Engineering, KU Leuven
Wim Van Petegem – Professor, Policy coordinator Learning Technologies, Faculty of Industrial Technology, KU Leuven
Janjoris van Diepen – Senior sustainability consultant at Blonk Consultants, board member KIVI department Sustainable Technology
Vera Broek – Student Biomedical Sciences, Leiden University

Support by:
Frank Wamelink (NVAO, process coordinator);
Anke Schols (NVAO, secretary).

08.15 – 08:30 Arrival at the university

08.30 – 9.30 Meeting of the committee and study of documents (private)

9.30 – 10.15 Session 1 – Program management

Prof. Dr. J. Knoester
Dean Faculty of Science and Engineering
Prof. Dr. K. Poelstra
Vice Dean Faculty of Science and Engineering
Prof. Dr. P. Rudolf
Director Graduate School of Science and Engineering
Prof. Dr. Ir. J.M.A. Scherpen
Full Professor Discrete Technology and Production Automation
Director Engineering and Technology Institute Groningen
Interim Deputy Programme Director Master Mechanical Engineering
Teacher of the course Modelling and Control of Complex Nonlinear Engineering Systems
Dr. E.J.M. Vertelman
Educational Developer
Interim Degree Programme Coordinator Master Mechanical Engineering

10.15 – 10.30 Short break

10.30 – 11.30 Session 2 – Teaching staff (incl. admissions, education committee)

Dr. P.G. Dendooven

Associate Professor Medical Physics
Teacher of the course Advanced Instrumentation and Extreme Environments
Teacher of the course Medical Imaging Instrumentation
Intended member of programme committee
Prof. dr. ir. RWCP Verstappen
Associate Professor Computational Science
Teacher of the course Computational Mechanics I
Teacher of the course Computational Mechanics II
Prof. Dr. Ir. H.J. Heeres
Full Professor Chemical Reaction Technology
Developer of the course Advanced Reactor Technologies
Developer of the course Advanced and Sustainable Process Design
Prof. Dr. B. Jayawardhana
Full Professor in Mechatronics and Control of Nonlinear Systems
Teacher of the course Opto-Mechatronics
Teacher of the course Fitting Dynamical Models to Data
Developer of the course Multibody and Non-Linear Dynamics
Prof. Dr. Ir. B.J. Kooi
Full Professor Nanostructured Materials and Interfaces
Teacher of the course Structure at Macro, Meso and Nano Scale
Teacher of the course Characterisation of Materials
Developer of the course Engineering Materials
Dr. A. Vakis
Assistant Professor Advanced Production Engineering
Teacher of the course Multiscale Contact Mechanics and Tribology
Developer of the course Advanced Processing for Complex Materials
Developer of the course Advanced Process and Material Modelling
Developer of the course Design of Smart Factories
Intended member of admissions committee

11:30 - 11:45 Short break

11:45 – 12:30 Session 3 – Members of the Board of Examiners (examencommissie)

Prof. Dr. G.J.W. Euverink
Full Professor Products and Processes for Biotechnology in the Biobased Economy
Chair Board of Examiners
Prof. Dr. C. de Persis
Full Professor Smart Manufacturing Systems
Secretary Board of Examiners
Teacher of the course Analysis and Control of Smart Systems
Prof. Dr. Y. Pei
Full Professor Advanced Production Engineering
Member Board of Examiners
Teacher of the course Surface Engineering and Coating Technology

12.30 – 13.15 Lunch panel and study of documents

13.15 – 14:00 Session 4 – Members of the professional field / external advisors

Dr. Ir. G. de Lange
Senior Instrument Scientist at SRON Netherlands Institute for Space Research

Teacher of the course Space Mission Technology
Teacher of the course Advanced Instrumentation and Extreme Environments
Prof. Dr. Ir. J. Post
Strategic partnerships at Philips Health Tech
Honorary Professor Digital Fabrication
Developer of the course Advanced Processing for Complex Materials
Developer of the course Advanced Process and Material Modelling
Developer of the course Design of Smart Factories
Ir. B. Nieuwenhuis
Director R&D at BD Kiestra
S. de Wit-Qian, MSc
Lead buyer at DSM sourcing indirect
Dr. Ir. J. Wildschut
Manager Engineering at Bilfinger Tebodin

14:15 – 14.45 Session 5 – Tour by current students of other programs

Sanne Akkerman
Master student Industrial Engineering and Management
Mariano Perez Chaher
Third year bachelor student Industrial Engineering and Management
Alva Bechlenberg
Master student Industrial Engineering and Management

14:45 - 15:00 Short break

15:00 – 15.15 Session 6 – Possibility for extra meeting

15:15 - 16:45 Committee deliberations

16.45 – 17.00 Brief feedback by chairman of the committee (or earlier if possible)

Annex 3: Documents reviewed

Programme documents presented by the institution

- Information dossier
- Appendices to the information dossier:
    - Appendix 01 – Decision of Ministry of Education macro-efficiency test
    - Appendix 02 - Domain specific framework of reference for Mechanical Engineering
    - Appendix 03 – Schematic curriculum overview
    - Appendix 04A – Description of course units
    - Appendix 04B – Form course unit assessment overview
    - Appendix 05A – Teaching and examination regulations
    - Appendix 05B – Assessment plan
    - Appendix 06A – Overview of committees
    - Appendix 06B – Selection procedure programme committee
    - Appendix 06C – Overview of staff
    - Appendix 06D – Vacancies
    - Appendix 07A – Overview of contacts with professional field
    - Appendix 07B – List of letters of support from the professional field
    - Appendix 08 – Overview of hours and staff-student ratio
    - Appendix 09A – Assessment form Design Project
    - Appendix 09B – Assessment form Research Project
- Documents made available during the site visit:
    - Books of compulsory courses
    - PhD theses of research topics in Mechanical Engineering topics at the RUG
    - Education primer for staff at the Faculty of Science and Engineering
    - Quality Assurance Manual FSE
    - Overview of candidates during all of the interviews
    - Booklet “Engineering in Groningen”
    - Course Unit Assessment Overviews for all courses
    - Support letters of Industrial Partners
    - Vacancy texts
    - Information of courses (if applicable and not available online in a nestor course)
    - Quality Assurance:
        - Handbooks and protocol for committees
            - Rules & regulations Board of Examiners
            - Quality Assurance for teaching staff
            - Programme Committee Handbook
            - Protocol Board of Examiners
        - Oral exams
            - Rules for oral examinations
        - Written exams
            - Rules for written examinations
        - Individual projects
            - Rules for individual projects
        - Teaching and Examination Regulations
        - Quality Assurance Manual
    - Ocasys page for Mechanical Engineering (short description of all courses)

- Nestor courses (information given to all students that have registered for a course, if available):
  - Advances Process and Energy Technologies
  - Analysis and Control of Smart Systems
  - Basic Detection Techniques
  - CFD for Engineers
  - Introduction to Data Science
  - Surface Engineering and Coating Technology
- Nestor Organizations:
  - FSE staff – information given to staff members about study related issues
  - Ephorus plagiarism scanner
  - Master's Design Project IEM – example of how to keep track of individual projects like research project and design project
- Admission requirments matrix (upon request by panel)
- Student numbers, from the macro efficiency report (upon request by panel)
- Example of rubrics for internships, from other masters' programme (upon request by panel)

Annex 4: List of abbreviations

ba	bachelor
BoE	Board of Examiners
BSc	bachelor of science
EC	European Credit
FSE	Faculty of Science and Engineering, University of Groningen
GPA	grade point average
hbo	hoger beroepsonderwijs
ma	master
MSc	master of science
NVAO	Nederlands-Vlaamse Accreditatieorganisatie
RUG	University of Groningen
UTQ	university teaching qualification
wo	wetenschappelijk onderwijs

The panel report was ordered by NVAO for the initial accreditation of the programme wo-master programme in Mechanical Engineering of the University of Groningen.

Accreditation Organisation of the Netherlands and Flanders (NVAO)
Parkstraat 28
P.O Box 85498 | 2508 CD DEN HAAG
T 31 70 312 23 00
E info@nvao.net
W www.nvao.net

File number 006376