NVAO THE NETHERLANDS

INITIAL ACCREDITATION

MASTER SYSTEM DESIGN

Fontys University of Applied Sciences

FULL REPORT
11 March 2022

Content

1 Peer review

The Accreditation Organisation of the Netherlands and Flanders (NVAO) determines the quality of a new programme on the basis of a peer review. This initial accreditation procedure is required when an institution wishes to award a recognised degree after the successful completion of a study programme.

The procedure for new programmes differs slightly from the approach to existing programmes that have already been accredited. Initial accreditation is in fact an ex ante assessment of a programme. Once accredited the new programme becomes subject to the regular review process.

The quality of a new programme is assessed by means of peer review. A panel of independent peers including a student reviews the plans during a site visit to the institution. A discussion amongst peer experts forms the basis for the panel's final judgement and the advisory report. The agenda for the panel visit and the documents reviewed are available from the NVAO office upon request.

The outcome of this peer review is based on the standards described and published in the limited NVAO Assessment framework for the higher education accreditation system of the Netherlands (Stcrt. 2019, nr. 3198). Each standard is judged on a three-point scale: meets, does not meet or partially meets the standard. The panel will reach a conclusion about the quality of the programme, also on a three-point scale: positive, conditionally positive or negative.

This report contains the findings, analysis and judgements of the panel resulting from the peer review. It also details the commendations as well as recommendations for follow-up actions. A summary report with the main outcomes of the peer review is also available.

NVAO takes an accreditation decision on the basis of the full report. The NVAO decision can be positive, conditionally positive or negative. Following a positive NVAO decision with or without conditions the institution can proceed to offer the new programme.

Both the full and summary reports of each peer review are published on NVAO's website www.nvao.net. There you can also find more information on NVAO and peer reviews of new programmes.

Because of COVID-19 temporary measures apply for this peer review.

2 New programme

2.1 General data

Institution	:	Fontys University of Applied Sciences
Programme	:	System Design
Mode of study	:	Full-time and part-time
Degree	:	Master
Tracks	:	-
Location	:	Eindhoven
Study load	:	120 EC[1]
Field of study	:	Technics

2.2 Profile

Graduates of the master System Design will develop a personal profile based on an engineering specialism and selected projects. They will have the communication and management skills to work in a multidisciplinary way and coordinate this work, developing and realizing high-tech systems after some years. The professional field was closely involved in the development of the profile. The programme consists of courses combined with a project to apply the acquired knowledge and skills. The graduation project covers the second year and is supported by courses aimed at developing communication and managerial skills. Graduation projects will be fulfilled in the industry.

2.3 Panel

Peer experts

1. Prof. dr.ir. Han Brezet (*chair*), professor Sustainable Product Innovation, University of Aalborg (Denmark) and professor emeritus of the Faculty Industrial Design, TU Delft;
2. Dr.ir. G.M. Bonnema, PDEng, associate professor Systems Engineering, and Multidisciplinary Design University of Twente;
3. Dr.ir. Adrian Matthias Rankers, managing partner & trainer Mechatronics Academy. CTO Mechatronics, High Tech Institute;
4. Dr. Corina Vogt-van Haarlem, programme manager & lecturer Master Smart Systems Engineering, European Master in Renewable Energy & European Master in Sustainable Energy System Management, Hanze University of Applied Sciences, Groningen;
5. Laura Janssen (*student*), student of the master Civil Engineering and Management, University of Twente.

Assisting staff

– Drs. Riekje de Jong, secretary;
– Drs. Jona Rovers, NVAO policy advisor and process coordinator.

Site visit (online)
January 28th 2022

[1] European Credits

3 Outcome

The NVAO approved panel reaches a conditionally positive conclusion regarding the quality of the master System Design offered by Fontys University of Applied Sciences. The programme complies with one standard of the limited NVAO framework and partially complies with the other two standards.

The master System Design facilitates students to understand and develop the main functions of high-tech systems and do technical research. The Industrial Board was closely involved in defining the profile. Graduates will develop a personal profile based on an engineering specialism and selected projects. They will have the communication and management skills to work in a multidisciplinary way and coordinate this work, developing and realizing high tech systems after some years.

The master is offered both as a two year full-time programme and as a four year part-time programme. The first year consists of courses combined with a project to apply the acquired knowledge and skills. The graduation project covers the second year and is supported by courses aimed at developing communication and managerial skills. Students will fulfil their graduation project in the industry. With respect to the programme, the panel is in need of some relevant additional information about the curriculum and wants more explanation about the teaching and learning environment in the programme. Therefore, the panel evaluates standard 2 as conditionally positive.

The assessment policy of the programme is a good point of departure for validity, reliability and transparency in grading. More operational at the level of the courses and projects, the assessment methods are, according to the panel, still insufficiently developed and described with exception of the written exams. The panel therefore evaluates standard 3 as conditionally positive.

Since the final conclusion is 'conditionally positive', the panel posed a number of conditions (see standards 2 and 3 and the summary in 6.5). The panel, however, is convinced that both management and staff will be able to fulfill these conditions within the set timeframe.

Standard	**Judgement**
1 Intended learning outcomes	meets the standard
2 Teaching-learning environment	partially meets the standard
3 Student assessment	partially meets the standard
Conclusion	**conditionally positive**

4 Commendations

The programme is commended for the following features of good practice.

1. ***Strong relationship with the industry*** - the committed Industrial Board is involved in developing the programme, offers project proposals, will provide guest lectures and supervising students.

2. ***Project work*** - every semester of the programme students are working on a project to apply their achieved knowledge.

3. ***Graduation*** - the graduation project is embedded in the industry.

5 Recommendations

For further improvement of the programme, the panel recommends a number of follow-up actions, next to the formulated conditions in the next chapter.

1. ***Develop a deficiency programme*** - students with a bachelor of technical sciences are admitted to the programme but will not always have the appropriate level of knowledge. Develop a deficiency programme that enables motivated bachelor students of other engineering studies to reach the necessary entry level.

2. ***Clarify professional skills*** - students will also develop professional skills in project work. Clarify in more detail what professional skills are integrated in the learning activities of the first year projects and how these skills will be assessed.

3. ***Pay attention to an inclusive learning environment*** - although the professional world of the graduates is international, there is less attention in the programme for developing communication skills that facilitate working in an inclusive environment. The panel advices to pay attention to this.

6 Assessment

6.1 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.

Judgement
Meets the standard.

Findings, analysis and considerations
The graduates' profile of the master System Design has been developed in close cooperation with experts from the high-tech industry in the region of Brainport Eindhoven. This profile facilitates students to understand and develop the main functions of high-tech systems and do technical research. The profile consists of eight intended learning outcomes (ILO's), defined in terms of what the student learns. The ILO Innovation Engineering includes research. Professional skills cover communication and management skills but still have to be defined and detailed. The graduation project covers five of the eight ILO's.

Graduates will have developed a personal profile as system design engineer with an engineering specialism based on engineering or mechatronics and their selected projects. They will also have developed communication and management skills to work in a multidisciplinary way, which enable them to coordinate the work of a variety of engineering specialists that is needed in developing and realizing high tech systems. According to the teaching staff and Industrial Board, the graduated system design engineer will be prepared to steer up in their career to system design architect. Especially the discussion with the Industrial Board has convinced the panel that the ILO's tie in with the expectations of the professional field.

Initially it was not clear for the panel what the focus of the master was within the field of system engineering and how professional skills were embedded in the ILO's of the programme. The management has explained that the level of ILO's of the master enhanced the level of the bachelor competences in complexity, independency and collaboration in a multidisciplinary context. The involved team of lecturers further explained that research is integrated in the projects in which students have to solve various problems to arrive at appropriately designed solutions. The Industrial Board convincingly presented how the competence profile of the graduated system design engineer could meet the needs of their industry. After discussions during the online site visit, the panel now understands that students of the master System Design will apply research to develop a system design and solve problems in system designs. The panel combined the different perspectives in the discussions about the profile into a picture that clarified the T-shaped profile of the system design engineer. All stakeholders of the programme agreed on this summarized profile presented by the panel.

Representatives of the faculty have discussed the profile and programme of the master System Design in a partnership of engineering and science faculties of international universities and universities of applied sciences. The management of the programme considers the recognition and support of international colleagues as an informal international benchmark.

In conclusion, the panel appreciates the involvement of the industry in developing a profile for the master System Design that offers good career opportunities for graduated students and fits the need of well-educated system design engineers in the high-tech industry. The description and the orientation of the intended learning outcomes facilitate the graduates to start in their profession in a junior function and steer up their career in a relatively short time. The panel concludes that the level and orientation of the ILO's tie in with the expectations of the professional field and international requirements.

6.2 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.

Judgement
Partially meets the standard.

Findings, analysis and considerations
The new master consists of 120 EC and is offered both as a two year full-time programme and as a four year part-time programme. The programme is structured in four semesters according to the Fontys semester structure. Every semester in the first year consists of four courses and two projects to integrate the acquired knowledge and skills. In the second year the graduation project covers the whole year and consists of a design and realization phase. The graduation project is supported by courses aimed at developing communication and managerial skills. Students will fulfil their graduation project in the industry and need to realize five of the programme ILO's.

The panel discussed with the different representatives of the programme how research is integrated in the programme and how students will learn how to deal with uncertainty in designing systems. The team of lecturers explained that despite a lot of goals to be achieved and documents to deliver for the presented first project assignment, students will encounter many new aspects that have to be designed in realizing their project. The focus in the projects lies on applied research. Students will investigate design solutions by analysing data and comparing different alternatives to create the best possible design solutions. The projects will challenge students to be creative and students will learn how to deal with uncertainty. In the innovation course students will start from scratch, making something new and/or with a certain patent potentiality. Research methods are part of the innovation models that students have to use in their projects. Presented projects could also be connected to research tracks of Fontys School of Engineering in which system design lecturers are involved.

Reflecting on the discussions with respect to the teaching-learning environment, the panel concludes that, in particular with respect to research and system design, more clarity about the learning outcomes and coherence in the programme is needed. Also the ideas about supervision and coaching during projects is not entirely clear to the panel. Students are seen as independent learners, applying the knowledge from the other courses in the projects. Although the panel agrees that this approach fits the programme, it is not sure how students will be coached during the projects by the involved teachers. The panel thinks that this is an important issue, since developing communication and managerial skills is not addressed in

detail yet for the first year. Elaboration of the professional skill courses is therefore also part of the conditions the panel imposes for standard 2.

The panel is positive about the quality of the envisioned lecturers. Most of them have a PhD and are involved in the research programme of Fontys School of Engineering. Most of the staff has worked in the high-tech industry for years. The panel appreciates the new Fontys strategic policy to facilitate more differentiation in staff's tenure. Lecturers are used to teach in both undergraduate and graduate programmes. The strategic policy of offering more master programmes will allow the staff of master programmes to prioritize research next to teaching. Fontys lecturers are obliged to have a university teaching qualification (BKO) and an examination qualification (BKE or SKE).

The language of the programme will be English. The panel affirms English as language of instruction because it is de-facto the language in the high-tech industry. The professional environment will be a mixture of nationalities and cultures. Intercultural collaboration and cooperation is one of the objectives of the Innovation course within the programme. The involved lecturers emphasize that the best opportunity to get insight and learn from an international context will be the graduation project in the industry. In the panel's view an international working environment demands more than fluency in English. Inclusiveness is an important topic. The panel recommends to consider this in a broader perspective, also on its implications for educational policy and human resources management.

The most preferable enrolment in the master System Design is from a Fontys bachelor degree of Mechanics or Mechatronics. Graduated bachelors from other engineering programmes in the Netherlands have to compare their profile with the Body of Knowledge and Skills of Mechanics or of Mechatronics to decide on enrolment. Students with other engineering bachelor programmes are also admitted to the programme. They will be invited for an intake to discuss the appropriate level of knowledge. Along that line, the panel suggests to develop deficiency programmes that enable motivated bachelor students to reach the necessary level of knowledge.

Summarizing from the documents and interviews the panel has met a committed teaching staff that is well qualified in research and experienced in the high-tech industry. The panel agrees on the choice of using English in the programme as it reflects the professional context of graduates of System Design. The panel is, however, in need of some relevant additional information about the curriculum and wants more explanation with respect to the teaching and learning environment. The panel decides to evaluate Standard 2 as conditionally positive.

Condition
The conditions to be met within a period of 6 months are the following.

The programme should elaborate the overall coherence in the programme, by (1) providing a clear description of the research and system design intended learning outcomes on course level and by (2) providing an answer to the question how supervision and coaching are integrated in the semester projects in the first year.

In addition, the programme should (3) operationalize the professional skills track and show how professional skills are integrated in the courses and first year projects.

6.3 Standard 3: Student assessment

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

Judgement
Partially meets the standard.

Findings, analysis and considerations
Fontys' assessment policy is described in detail and embedded in the Teaching and Examination Regulations (TER) of the master System Design. The panel therefore got a clear picture of the assessment policy at the faculty level.

The graduation project is split up in a design phase (24EC) and a realization phase (20EC). The students receive a mentor, based on their project proposal. The graduation student will also be supervised on the job by a company supervisor. After the design phase an intermediate assessment will take place. Next to the graduation project professionalization skills are offered to develop the required managerial competences (16EC). Students have to apply these skills in realizing their graduation project. Different experts are involved in the assessment of the graduation project: the mentor, a second assessor (lecturer/expert in the field), and the supervisor on the job in an advisory role. They together assess the graduate's project report and oral defence. In case of disagreement between the assessors, the graduation coordinator will act as co-assessor. Assessment criteria are in place and available for the students beforehand. Skills are mainly judged by assessing the attitude to look broadly to the topic; rubrics are not used.

The panel discussed the assessment of courses and projects. Knowledge is assessed by written exams. In developing the written exams, the 4-eyes principle is used. Based on examples of written exams the panel concludes that these are of good quality. Dealing with uncertainty and creativity is assessed in the projects. Written personal reports or reflection documents are not used as assessment methods; the panel suggests to look into the possibilities of including these.

The teachers' team explains that in assessing papers and project results a list of assessment criteria is used. The criteria are shared with the students beforehand. After assessment students will get feedback. Although one project description was part of the information dossier and discussed with the teachers, no additional information was available about the other project learning objectives or assessment criteria.

The panel concludes that the assessment policy of the programme is a good point of departure for validity, reliability and transparency in grading. More operational at the level of the courses and projects, the assessment methods are still insufficiently developed and described with exception of the written exams. The panel therefore requires more information about the assessments of projects, papers and communication and managerial skills, to be convinced that the programme has an adequate system of student assessment in place. The panel therefore decides to evaluate Standard 3 as conditionally positive.

Condition
The conditions to be met within a period of 6 months are the following.

The programme should (1) clarify its vision on the potential variety of assessments methods envisaged for application in the program, in such a way that students are enabled to achieve the intended learning outcomes of the master and (2) clarify systematically and in more detail the planned assessment methods of projects, papers and professional skills (communication and managerial skills).

6.4 Degree and field of study

The panel advises awarding the following degree to the new programme: Master of Science. The panel supports the programme's preference for the following field of study: Technics.

6.5 Overview of conditions

In this report, a number of conditions have been set. Below, these conditions have been put in a schedule for purposes of clarity:

Standard	Time	Condition
2	6 months (before September 1st 2022)	The programme should elaborate the overall coherence in the programme, by (1) providing a clear description of the research and system design intended learning outcomes on course level and by (2) providing an answer to the question how supervision and coaching are integrated in the semester projects in the first year. In addition, the programme should (3) operationalize the professional skills track and show how professional skills are integrated in the courses and first year projects.
3	6 months (before September 1st 2022)	The programme should (1) clarify its vision on the potential variety of assessments methods envisaged for application in the program, in such a way that students are enabled to achieve the intended learning outcomes of the master and (2) clarify systematically and in more detail the planned assessment methods of projects, papers and professional skills (communication and managerial skills).

The full report was written at the request of NVAO and is the outcome of the peer review of the new programme professional master System Design of Fontys University of Applied Sciences

Application no: AV-1104

NVAO

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