

Besluit

Accreditatierapport en -besluit met een positieve beoordeling van de accreditatieaanvraag voor de opleiding Master of Science in de ingenieurwetenschappen: biomedische ingenieurstechnieken / Master of Science in Biomedical Engineering¹ (master) van de Universiteit Gent in samenwerking met de Vrije Universiteit Brussel.

datum	1. Inleiding
30 september 2013	Bij brief van 29 maart 2013 heeft het instellingsbestuur van de Universiteit Gent te Gent een accreditatieaanvraag ingediend bij de Nederlands-Vlaamse Accreditatieorganisatie (NVAO)
onderwerp	voor de opleiding Master of Science in de ingenieurwetenschappen: biomedische ingenieurstechnieken / Master of Science in Biomedical Engineering (master). Het betreft
Definitief	een interuniversitaire opleiding die wordt georganiseerd te Gent (Universiteit Gent) en
accreditatierapport en -besluit	Brussel (Vrije Universiteit Brussel). Deze aanvraag is ontvangen op 29 maart 2013 en
(001686)	ontvankelijk verklaard op 21 mei 2013.
bijlage	
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De accreditatieaanvraag steunt op het visitatierapport van een externe beoordeling uitgevoerd door een visitatiecommissie ingesteld door de Vlaamse Universiteiten en Hogescholen Raad (Vluhr).

De visitatiecommissie kende de volgende samenstelling:

Voorzitter:

- Prof. dr. em. Dick van Campen, gewezen decaan faculteit werktuigbouwkunde, Technische Universiteit Eindhoven, gewezen Secretaris-Generaal International Union of Theoretical & Applied Mechanics;

Leden:

- Prof. dr. em. René Van den Braembussche, Honorary professor von Karman Institute (idem);
- Ir. Jan Bens, Directeur-generaal van het Federaal Agentschap voor Nucleaire Controle (idem);
- Prof. Frans Van der Helm, hoogleraar biomechanics and bio-robotics, Technische Universiteit Delft (idem)
- Prof. dr. Peter Van Petegem, gewoon hoogleraar onderwijskunde, Universiteit Antwerpen (idem) (onderwijsdeskundige);
- Dhr. Dieter Van Isterdael, masterstudent werktuigkunde-elektrotechniek Vrije Universiteit Brussel (idem) (student-lid).

¹ Engelstalige variant

Pagina 2 van 11 Secretaris:

- Dhr. Jasper Stockmans en Dhr. Andreas Smets, stafmedewerkers van de Cel Kwaliteitszorg van de Vlaamse Interuniversitaire Raad (VLIR), traden op als projectbegeleider en secretaris voor deze visitatie.

De visitatie heeft plaatsgevonden op 14 t/m 16 mei 2012. Het visitatierapport dateert van februari 2013.

2. Formele overwegingen

De NVAO komt tot de volgende vaststellingen:

- De externe beoordeling is opgesteld en onderbouwd overeenkomstig het toepasselijke Accreditiekader bestaande opleidingen hoger onderwijs Vlaanderen van de NVAO en volgens de daarbij behorende beslisregels;
- De visitatiecommissie heeft voor de externe beoordeling het door de Vluhr vastgestelde visitatieprotocol gevolgd;
- De externe beoordeling verschaft inzicht in de samenstelling van de visitatiecommissie;
- De externe beoordeling bevat een onderzoek ten gronde naar de aanwezigheid van voldoende generieke kwaliteitswaarborgen.

De NVAO is in het licht van het vorenstaande tot de slotsom gekomen dat de externe beoordeling over de voorliggende opleiding regelmatig en gedegen tot stand is gekomen.

3. Inhoudelijke overwegingen

De NVAO steunt haar inhoudelijke besluitvorming in hoofdzaak op de onderstaande elementen uit het visitatierapport.

Het panel heeft drie sterk verweven programma's beoordeeld en daarover in één beoordelingsrapport gerapporteerd.

Het gaat om de programma's:

- Master of Science in de ingenieurswetenschappen: biomedische ingenieurstechnieken (maBIT)
- Master of Science in Biomedical Engineering (maBIOM)
- International master of Science in Biomedical Engineering (Erasmus Mundus) (EMmaBIOM)

In dat beoordelingsrapport wordt voldoende duidelijk een onderscheid gemaakt waar dat relevant is. Het panel komt tot facet scores separaat voor de reguliere opleiding (Nederlandstalige en Engelstalige taalvariant) en het Erasmus Mundus programma. Dit rapport betreft de Nederlandse en Engelstalige variant van de reguliere opleiding.

Objectives

The level and orientation of the objectives of the programme are in line with the Flemish Higher Education Act. The goals are formulated on the basis of the competence model of Ghent University, a tool provided by the central administration of the university, and which ensures the alignment with the Dublin Descriptors. The aims and objectives of the programme are, in the opinion of the panel, ambitious and they are focused on having the students achieve general (academic) competences at an advanced level, and advanced understanding of and insight into scientific, discipline-specific knowledge inherent to the domain of biomedical engineering.

The objectives of the programme appear to be well known by the students and staff. The aims and objectives of the programme correspond with the requirements set by professional colleagues, both nationally and internationally, and the relevant professional field for a programme in biomedical engineering. The panel appreciates the fact that technology appears to be the main focus, in accordance with the envisioned profile of the biomedical engineer. The learning outcomes of the academic master's programme stem from requirements set by the (international) academic practice and the practice in the relevant professional field.

Given that Biomedical Engineering is a rapidly evolving field, the panel appreciates that there is a permanent alertness for tuning the objectives, competences and programme to the needs of the profession. This is achieved via the input from an advisory board and from contacts with industrial and technological societies.

The panel also appreciates the clear formulation and argumentation concerning the objectives of the programme. In conclusion, it sees a great amount of accordance with its own reference frame.

Specific for the Master of Science in Biomedical Engineering is the possibility to follow a specialisation that can lead to the formal professional recognition as 'Expert in Medical Radiation Physics' by the Belgian Federal Agency for Nuclear Control ('Federaal Agentschap voor Nucleaire Controle [FANC]'). To obtain the mentioned recognition, the FANC requires the students to follow an additional clinical internship of minimally 1 year as well. Given the specific requirements (set by the FANC) for the experts in medical radiation physics, the panel defined an extra set of competences for this specialisation.

Programme

The curriculum of the programme is an adequate realisation of the intended learning outcomes with regard to the level, orientation and discipline-specific requirements. The panel has the opinion that the programme enable the students to reach the formulated goals. The panel notes however, that the Dutch and English programmes are implemented with a broad scope. The broad scope in some cases threatens the depth. The panel suggests to improve specialization, depth and focus in individual programmes. It suggests to add more specialised courses and to limit the introductory courses in the electives and at the same time propose coherent clusters with sufficient depth. Also the mandatory courses could be less rigid in the light of the diversity of profiles in the population of incoming students. The panel suggests to insert a greater amount of electives in the first year, which will enable the students to start earlier in their path to specialisation and to reach more depth and focus. The students should also be guided in a more intense manner in the set-up of their individual programme.

The panel appreciates the fact that a competence matrix is used in order to achieve a good representation of the intended learning outcomes in the programme. This enables the management of the programme to provide a quick overview of how the programme realise the envisioned competences, and how each course contributes to them.

The panel is satisfied concerning internationalisation. It noticed that there is clearly the necessary attention for student mobility.

The panel is positive about the way the students develop their knowledge through the interaction between education and research. The programme aims at providing the graduates with the intellectual tools and techniques to apply the acquired knowledge in the many sectors where this knowledge is required. They also aim at stimulating the students towards the academic attitude of searching for links between the courses and (re)organising and reformulating knowledge in their own way.

Pagina 4 van 11 Where appropriate, the curriculum has verifiable links with the current relevant professional practice. The management of the programme takes the necessary initiatives to ensure the alignment of the programme to the aspired ambitions of the professional field. Especially the clear clinical input in the programme deserves the appreciation of the panel.

The panel is positive about the coherency in terms of content. The programme is organised through collaboration between UGent and VUB, which enables the management of the programme to cover most of the relevant domains in a more consistent way. Further initiatives are needed to achieve a more optimal alignment of the programme to the diversity in profiles of incoming students. The first master year offers only a limited number of elective courses. However there is a policy to safeguard the coherence. Overlap between different courses is minimised through intensive consultation between the different lecturers. The follow-up of management of the programme is adequate, but continued attention will remain necessary.

The panel appreciates the fact that study time measurements were carried out and that there is a positive attitude towards the follow-up and refinement of the correspondence between estimated and actual study time.

The panel observed that the work concerning the study load is not finished. Some courses are perceived as rather light. The panel hence wants to state that this heterogeneous population of incoming students, forms a challenging factor towards the spread of the study load and towards the correspondence between estimated and actual study time. It has to be followed up more closely.

The panel observed that the educational concept is in line with the aims and objectives of the programme. Although the panel noticed some variation in the quality of the resources, the educational forms and resources correspond grosso modo with the educational concept. The panel is very positive about some courses, but the panel also sees an urgent need for improvement for those cases where only slides of meagre quality are used. The panel appreciates the extensive use of English articles. Still, the panel notes that further efforts will be necessary, in order to minimise the variation in the quality of the educational resources provided by different lecturers.

Concerning the electronic learning environments (Minerva for UGent and PointCarré for VUB) the panel is positive

Concerning the educational forms, the panel is positive on the whole line. It sees a great amount of variation in forms. Ex-cathedra classes, exercise- sessions, practical work, lab-sessions, project work, pc-sessions, and other forms which generate hands-on experience, occupy an important place.

The panel is satisfied with the quality of the evaluation methods and with the variety of evaluation forms, concerning all involved programme. The students are assessed in an adequate manner which is insightful to them to determine whether they have achieved the intended learning outcomes.

The panel values the presence of clear interuniversity exam regulations, but the concrete organisation of exams leaves room for improvement in the context of the interuniversity collaboration.

At last the panel is positive about the transparency of the evaluation. It is common practice among lecturers to provide sample exam questions and to provide details about how the exams, projects, and other evaluations are weighed in the final score.

The master's programme is concluded with the master's thesis whereby the students demonstrate the ability for analytic and synthetic reasoning, and independent problem solving at an academic level. The panel has studied a representative selection of theses

Pagina 5 van 11 and sees that the general critical reflective attitude and the research attitude of the students are reflected in the end products. The level of the theses is also sufficiently in line with the number of attributed credits (24 credits). The panel is satisfied about the preparation, the guidance and the evaluation. The students are guided in an efficient cooperation, in the first place with the AAP-members and in second order by the ZAP-members. The panel also appreciates the evaluation of the theses. The scores are in line with the level of the end products, the evaluation criteria are clear, and some theses even result in a publication.

Students with an academic bachelor (or master) diploma in engineering (university level) may enter the programme without any additional prerequisites, except students with a bachelor or master degree in architecture. Direct admission also holds for students with a master degree in bio-engineering. There is a dedicated bridging programme for a total of 120 credits, for students with a master degree in industrial science. There is no dedicated bachelor programme optimally preparing the student for these master programme. Overall, the admission requirements of the Dutch and English programme are in line with the qualifications of the incoming students. However, the panel learned that the heterogeneity of the incoming student population, complicates the matter and, in some cases, results in a loss of depth. The panel sees opportunities to align the basic background courses with the already achieved competences of the students.

Staff

The staff deployed is sufficiently qualified to ensure that the aims and objectives of the programme, in terms of content, didactics and organisation, are achieved. The responsibility for the content and the organisation of the courses is in the hands of the tenured faculty professors (ZAP). For a number of courses the responsibility is shared with other tenured faculty or post-doctoral researchers. The responsible lecturers are usually members of the ZAP, or sometimes post-doctoral associates.

The panel is positive about the human resources management. For the Dutch and English programme, it is organised in the framework of the general human resource policy of the universities involved, which in turn is governed by the decree for higher educational institutes of the Flemish Region.

The panel notes that the staff has the necessary didactical competences, but asks for a continuous refinement of these competences, by means of more attention to professionalization of the staff.

The lecturers who are ZAP personnel appear to have an important research activity in a domain that is still in development.

The panel understands that teaching is mainly provided by researchers who contribute to the development of the discipline of biomedical engineering. But the discipline itself is currently still in expansion. In this context, the panel is satisfied by the academic dimension of the staff and is also positive about the relation between education and research. The staff is clearly competent and also covers sufficient parts of the discipline.

The panel is positive about the knowledge of and insight in the professional field. There is a sufficient amount of clinical input and a clear link with the global professional field. The panel also understands that the management of the programme take the role, which they can play in the further development of the field, very serious.

The Master of Science programme in Biomedical Engineering consists of 17 compulsory courses. Some courses are given in parallel at UGent and VUB, while others are either given by UGent or VUB staff.

The panel assesses the quantity of the staff as positive. Clearly sufficient staff are deployed to realise the intended quality of the programme and to provide the opportunities for the

Pagina 6 van 11 students to reach the goals. The panel also sees that there is a good balance between research and education, in the job description of the different categories of staff.

Facilities and guidance

The panel assesses the housing and facilities as clearly adequate for the realisation of the curriculum. The different labs are spread over the involved research groups. Especially the labs and the equipment deserve the valuation of the panel. The departments supporting the education in the master programme have an extensive scientific research activity, and, for some exercises and projects, students use the same laboratory equipment which is used in daily medical practice and research. All the labs at the different faculties are clearly up to date. Especially the equipment concerning image-acquisition is very positively valued by the panel. The panel is also positive about the fruitful cooperation with the UZ in Ghent and the strong involvement of the faculty of medicine.

The panel is also positive about the other student and teacher facilities, both in terms of quality as in terms of accessibility. The panel learned during the meetings with the students that there is a great amount of satisfaction concerning the computer-facilities.

All lecture rooms are fully equipped (pc, fixed projector, screen, blackboard). The teaching facilities deserve the appreciation of the panel.

The library facilities also deserve the appreciation of the panel.

The panel assesses the provision of information to students as adequate in view of study progress and in view of the students' needs, including the provision of information before the start of the master programme. Because the incoming students have different backgrounds, there are some services available to support the new incoming students in the master programme.

The guidance and tutoring of the students are adequate. The close contact with the AAP- and also the ZAP-members, is fruitful in this context.

Internal quality assurance

The quality assurance policy at UGent and VUB is based on a number of feedback mechanisms that involve several actors and measurement instruments. The central and most important actor is always a quality control unit (QCU). For the Master of Science in Biomedical Engineering, the Flemish regulations of the partners UGent and VUB are the same and hence the local quality assurance plans are very similar and easy to harmonise. Interfacing the local QA plans is guaranteed via the Programme Board which comprises members of both UGent and VUB.

At present, there are three important instruments with which the education quality is actively measured: the educational evaluation survey, the study programme evaluation and the study time measurements. Another important feedback loop, the curriculum monitoring, acts on a higher level and takes into account the outcomes of all measurement instruments. Concerning the educational evaluation survey, the panel appreciates the approach, both at the UGent as at the VUB. The panel gives a concrete description of the instruments and procedures at both institutions.

The permanent curriculum monitoring runs synchronous with the educational and study programme evaluations. The panel is positive about the instruments that are used in the light of internal quality assurance and that are provided by the central levels of the UGent and the VUB. The panel also values the ad hoc evaluations which are carried out on the initiative of the management of the programme.

Finally, the panel studied the reactions of the management of the programme and learned that a number of measures for improvement are already taken.

Pagina 7 van 11 Both the degree to which past targets were achieved as the degree to which the targets for the future are well founded, satisfy the panel.

However, the Master of Science in Biomedical Engineering is still a very young programme, so it is very early to draw anything else than preliminary conclusions about the degree to which the above mentioned targets have been reached. Nevertheless, the panel is positive about the thoughtfulness of the management of the programme towards future improvement. The outcomes of the evaluations clearly form the basis for verifiable measures for improvement that contribute to the achievement of the objectives. The panel also values the fact that there is a positive attitude towards improvement on the informal level, complementary with the formal approach. In conclusion, the panel states that there is a very fast response towards improvement.

The panel appreciates the quality of the self-assessment report, although it is of the opinion that it is too extensive in size. The panel was satisfied with the openness during the visit.

The staff is in an adequate manner involved with the quality of the programme. The panel is very satisfied with the vivid dynamics it observed within the staff. The voices of the students of the programme are clearly heard by the management.

The panel sees more opportunities for future increase of the involvement of the alumni and the professional field. An Advisory Board (which includes representatives of the biomedical professional field) has been installed.

Results

The achieved learning outcomes of the master programme 'biomedische ingenieurstechnieken' and the master programme 'biomedical engineering' correspond with the aims and objectives regarding level, orientation and discipline-specific requirements.

The level of the programme clearly meets international standards. Hence, the panel is very satisfied about the degree to which objectives are achieved. Also, the students and the graduates seem to be satisfied about the study programme. A large majority of the alumni feel that the objectives of the master programme are well to very well achieved.

Also, the high level of the master theses can be regarded as a good indication of the level that is reached by the graduates of the English and the Dutch speaking programme. Both the high scores as well as the representativeness of the scores towards the level of the end products, underline the adequate level of the programme. The panel appreciates in this context that some master's theses are accepted for publication as abstracts and proceedings of conferences, or in peer-reviewed publications (in so-called 'A1' journals).

The students are positive about the way and intensity they are prepared to enter the job market, about their future employment profile and the content and level of their employment. All alumni found a job, most of them within one to three months after graduating. A large amount of the students seems to find a way towards a PhD.

The panel sees that the level that is reached, in a certain way depends on the previously acquired competences of the students, especially in terms of the depth and specialisation that is reached. The panel believes that a more close attention towards admission requirements, could imply a great benefit towards the level that is reached at the end.

The panel is positive about the success rate of the English and Dutch speaking programme. The overall success rate is relatively high, and comparable to the other master programme in the faculties of engineering at UGent and VUB.

The panel is also positive about the policy of the study programme with respect to the study progress, the pass rates, the analysis of student advancement and policy with respect to the limited amount of failures and dropouts.

Pagina 8 van 11 *Conclusie*

De NVAO is in het licht van het vorenstaande tot de slotsom gekomen dat het eindoordeel van de commissie deugdelijk is gemotiveerd. De NVAO kan zich dan ook aansluiten bij de bevindingen en overwegingen voor alle facetten en onderwerpen, zoals verwoord in het visitatierapport. De eindconclusie uit het visitatierapport wordt gevolgd.

De tabel geeft per onderwerp en per facet het oordeel van de visitatiecommissie weer.

ONDERWERP	OOORDEEL	FACET	OOORDEEL
1 Doelstellingen opleiding	V	1.1 niveau en oriëntatie	V
		1.2 domeinspecifieke eisen	G
2 Programma	V	2.1 eisen gerichtheid	V
		2.2 relatie doelstellingen - programma	V
		2.3 samenhang programma	V
		2.4 studielast	V
		2.5 toelatingsvoorwaarden	V
		2.6 studieomvang	OK
		2.7 afstemming vormgeving - inhoud	V
		2.8 beoordeling en toetsing	V
		2.9 masterproef	G
3 Inzet van personeel	V	3.1 eisen gerichtheid	G
		3.2 kwantiteit	V
		3.3 kwaliteit	V
4 Voorzieningen	V	4.1 materiële voorzieningen	G
		4.2 studiebegeleiding	V
5 Interne kwaliteitszorg	V	5.1 evaluatie resultaten	V
		5.2 maatregelen tot verbetering	V
		5.3 betrokkenheid	V
6 Resultaten	V	6.1 gerealiseerd niveau	G
		6.2 onderwijsrendement	V

Eindoordeel: positief

De onderstaande tabel geeft per onderwerp het globaal oordeel van de NVAO weer.

ONDERWERP	ORDEEL
1 Doelstellingen	V
2 Programma	V
3 Inzet personeel	V
4 Voorzieningen	V
5 Interne kwaliteitszorg	V
6 Resultaten	V

Eindoordeel: positief

6. Besluit²

betreffende de accreditatie van de Master of Science in de ingenieurwetenschappen: biomedische ingenieurstechnieken/ Master of Science in Biomedical Engineering (master) van de Universiteit Gent in samenwerking met de Vrije Universiteit Brussel.

De NVAO,
Na beraadslaging,
Besluit:

Met toepassing van het decreet van 4 april 2003 betreffende de herstructurering van het hoger onderwijs in Vlaanderen, wordt het accreditatierapport en –besluit met positief eindoordeel voor de opleiding Master of Science in de ingenieurwetenschappen: biomedische ingenieurstechnieken/ Master of Science in Biomedical Engineering (master) van de Universiteit Gent goedgekeurd en wordt de opleiding geaccrediteerd. Het betreft een interuniversitaire opleiding zonder afstudeerrichtingen die wordt georganiseerd te Gent (Universiteit Gent) en Brussel (Vrije Universiteit Brussel).

De in het eerste lid bedoelde accreditatie geldt vanaf de aanvang van het academiejaar 2013-2014 tot en met het einde van het academiejaar 2020-2021

Den Haag, 30 september 2013

Voor de NVAO


A.H. Fijerman
(voorzitter)

² Conform de bepalingen vermeld in de handleiding accreditatie kan een instelling opmerkingen en bezwaren formuleren op het ontwerp van accreditatierapport. Bij e-mail van 24 september 2013 heeft de instelling gereageerd op het ontwerp van accreditatierapport. Dit heeft geleid tot enkele aanpassingen in het accreditatierapport.

– naam instelling	Universiteit Gent
– adres instelling:	Sint-Pietersnieuwstraat 25 9000GENT BELGIË
	Vrije Universiteit Brussel Pleinlaan 2 1050 BRUSSEL BELGIË
– aard instelling	ambtshalve geregistreerd
– graad, kwalificatie, specificatie	Master of Science in de ingenieurswetenschappen: biomedische ingenieurstechnieken/ Master of Science in Biomedical Engineering ³
– niveau en oriëntatie	master
– studieomvang	120 studiepunten
– opleidingsvarianten	
– afstudeerrichtingen:	geen
– studietraject voor werkstudenten:	nee
– vestiging opleiding	Gent, Brussel (Vrije Universiteit Brussel)
– onderwijstaal	Nederlands/Engels
– (delen van) studiegebieden	Toegepaste wetenschappen
– bijkomende titel	burgerlijk ingenieur

³ Engelstalige variant