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Appendices

to

Teaching and Examination Regulations

2020-2021

Bachelor's degree programme in Biomedical Engineering

Appendix I Learning outcomes of the Bachelor's degree programme (Article 1.3.a)

A. Generic learning outcomes — Knowledge

A1. Bachelor's graduates have general knowledge and understanding of mathematics, natural sciences (biology, physics, chemistry), life sciences (biochemistry, anatomy, physiology) and engineering sciences (mechanical, electrical) underlying biomedical engineering.

A2. Bachelor's graduates are familiar with the quantitative nature of mathematics, natural sciences and engineering sciences, and have a general understanding of the models and methods used in these fields, including computer-aided methods.

A3. Bachelor's graduates are familiar with the learning methods necessary to follow developments in biomedical engineering. They are able to engage in lifelong learning and are prepared to continue in any Master's programme on Biomedical Engineering.

B. Generic Learning outcomes — Application of knowledge

B1. Bachelor's graduates are able to apply knowledge of mathematics, natural sciences, life sciences and engineering sciences to conduct research on basic biomedical problems; to contribute to design of new solutions to biomedical problems and to contribute to the further development of devices, instruments or materials.

B2. Bachelor's graduates are familiar with materials, equipment and technologies typically used in the biomedical practice. They know how to perform measurements on biological systems and are able to interpret the data, and are aware of the problems associated with the interaction between living and non-living materials and systems.

B3. When involved in design, research and/or development, Bachelor's graduates demonstrate the ability to critically formulate the relevant questions, choose or propose appropriate methods, procedures and/or systems.

C. Generic Learning outcomes — Decision making

C1. Bachelor's graduates are aware of the key aspects of professional, ethical and societal responsibilities linked to the biomedical engineering practice, to decision making and to formulating judgments.

C2. Bachelor's graduates are able to reflect on professional, ethical and social responsibilities of biomedical engineering.

D. Generic Learning outcomes — Communication

D1. Bachelor's graduates have a general understanding of functioning methods of multidisciplinary teams and are able to function effectively as team members, contributing to meet deliverable, schedule and budget requirements.

D2. Bachelor's graduates are familiar with the established methods/tools of communication and their limitations.

D3. Bachelor's graduates are able to identify the appropriate method to effectively, clearly and unambiguously communicate their findings/results in a multidisciplinary setting.

Appendix II Majors and Minors of the degree programme (Article 2.1.4)

The programme consists of a core part, laying down the foundations for all biomedical engineers, and a 60 ECTS specialization in one of the following three specializations:

- Biomaterials Science and Engineering (BSE)
- Medical Imaging (MI)
- Medical Device Design (MDD)

Each specialization includes a 15ECTS deepening minor in period 1a of year 3. A minor from the collection of university and faculty minors in this period is permitted but not recommended.

Appendix III Course units in the propaedeutic phase

- **List of course units; Article 3.1.1**
- **Compulsory order of examinations; Article 8.2**

Course elements year 1

The propaedeutic phase comprises a number of compulsory course units, each with a workload of 5 ECTS, listed in the table below. Course details, mode of assessment and examination are described in Ocasys.

Compulsory course

Course unit name	**ECTS**
Anatomy and Physiology	5
Biomaterials 1	5
Biomechanics	5
Calculus 1 (for IEM)	5
Cell Biology	5
Linear Algebra for BME	5
Materials Science	5
Design of Biomedical Products 1	5
Microbiology	5
Molecules of Life	5
Physics Lab for BME Ethics 1: Philosophy of Science & Scientific Integrity	3 2
Statistics for BME	5

Appendix IV Course units in the post-propaedeutic phase

- **List of course units; Article 6.1.1**
- **Compulsory order of examinations; Article 8.2**

Course elements year 2

Year 2 consists of compulsory course units and elective courses. All course units in the second year comprise a workload of 5 ECTS. Course details, mode of assessment, examination and entry requirements are described in Ocasys.

Compulsory courses

Course unit name	**ECTS**
Biomedical Instrumentation	5
Cell Biology and Immunology	5
Computer Skills and Numerical Methods	5
Design of Biomedical Products 2 Ethics 2: Biomedical Ethics	3 2
Electricity and Magnetism	5
Imaging Techniques in Radiology	5
Mechanics and Relativity 2	5
Signals and Systems	5
Waves and Optics	5
Electives (3)	15

Electives

In preparation of choosing the specialisation in year 3, in period 2B of year 2, students have to choose three elective courses from *two* of the specialization-specific clusters:

Biomaterial Science and Engineering

Course unit name	**ECTS**
Lab course Biomaterials	5
Surface Characterization	5

Medical Imaging

Course unit name	**ECTS**
Imaging Laboratory 1	5
Therapeutic Imaging	5

Medical Device Design

Course unit name	**ECTS**
Biological Physics	5
Transport in Biological Systems	5

Course elements year 3

Year 3 consists of compulsory course units, elective courses, a bachelor project (15 ECTS) and a minor (15 ECTS). As a general entry requirement for course units in year 3, including the Minor, students must have successfully completed the propaedeutic phase. Course details, mode of assessment, examination and entry requirements are described in Ocasys.

Compulsory courses

Course unit name	**ECTS**
Bachelor Project	15
Research Course	9
Ethics 3: Research Ethics	1
Thermodynamics	5
Electronics	5
Tissue Engineering and Regenerative Medicine	5
Electives (3)	5
Minor	15

Minor

During the first half of the first semester (period 1A) students will have to do a 15 ECTS minor. Within the programme, three deepening minors are offered:

Minor Biomaterial Science and Engineering

Course unit name	**ECTS**
Additive Manufacturing in BME	5
Big Data for BME	5
Biomedical Nanotechnology	5

Minor Medical Imaging

Course unit name	**ECTS**
Applied Medical Visualization	5
Big Data for BME	5
Quantitative Image Analysis	5

Minor Medical Device Design

Course unit name	**ECTS**
Additive Manufacturing in BME	5
Big data for BME	5
Design of Biomedical Products 3	5

Electives

During the first half of second semester (period 2A) students have to choose a specialization course from:

Biomaterial Science and Engineering

Course unit name	**ECTS**
Colloid and Interface Science	5

Medical Imaging

Course unit name	**ECTS**
Imaging Laboratory 2	5

Medical Device Design

Course unit name	**ECTS**
Biomedical Sensors	5

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Appendix V Entry requirements (Article 2.1, article 2.2)

A. Deficient VWO-diploma

1. The following requirements apply to the entrance examination as defined in Article 7.28.3 of the Act:

Bacheloropleiding *Bachelor's degree programme*	**N+T**	**N+G**	**E+M**	**C+M**
Biologie *Biology*	Biologie	Natuurkunde	Wiskunde A of B Natuurkunde Scheikunde Biologie	Wiskunde A of B Natuurkunde Scheikunde Biologie
Farmacie *Pharmacy*	V	Natuurkunde	Natuurkunde Scheikunde	Wiskunde A of B Natuurkunde Scheikunde
Life Science and Technology **Scheikunde** *Chemistry* **Scheikundige Technologie** *Chemical Engineering*	V	Wiskunde B Natuurkunde	Wiskunde B Natuurkunde Scheikunde	Wiskunde B Natuurkunde Scheikunde
Biomedische Technologie *Biomedical Engineering*	V	Wiskunde B Natuurkunde	Wiskunde B Natuurkunde Scheikunde	Wiskunde B Natuurkunde Scheikunde
Informatica *Computing Science* **Technische Bedrijfskunde** *Industrial Engineering and Management* **(Technische) Wiskunde** *(Applied) Mathematics*	V	Wiskunde B	Wiskunde B	Wiskunde B
Kunstmatige Intelligentie *Artificial Intelligence*	V	V	V	Wiskunde A of B
(Technische) Natuurkunde *(Applied) Physics* **Sterrenkunde** *Astronomy*	V	Wiskunde B Natuurkunde	Wiskunde B Natuurkunde	Wiskunde B Natuurkunde

2. The Admissions Board Bachelor's programmes FSE will determine whether deficiencies have been compensated satisfactorily.

B. Dutch HBO (university of applied sciences) or academic propaedeutic certificate

1. The following requirements apply to the entrance examination as defined in Article 7.28.3 of the Act:

Bachelor's degree programme	Subjects at VWO (pre-university) level
B Biology	wia or wib + na+sk+bio
B Pharmacy	wia or wib + na+sk
B Life Science and Technology	wib+na+sk
B Biomedical Engineering	wib+na+sk
B Computing Science	wib
B Artificial Intelligence	wia or wib
B Physics	wib+na
B Chemistry	wib+na+sk
B Astronomy	wib+na
B Mathematics	wib
B Chemical Engineering	wib+na+sk
B Industrial Engineering and Management Science	wib
B Applied Physics	wib+na
B Applied Mathematics	wib

wia = Mathematics A; wib = Mathematics B; na = Physics; sk = Chemistry; bio = Biology

2. In addition, candidates are required to be competent in English:

	Overall	Reading	Listening	Speaking	Writing
IELTS (Academic)	6.5	6.5	6.5	6.5	6.5
TOEFL IBT (internet-based test)	90	21	21	21	24
Cambridge English	CAE of CPE Certificate with a minimum score of 180				
English language test - UG Language Centre		B2	B2	B2	C1

Applicants with a Dutch VWO or equivalent diploma are exempt from an English language test as are native English speakers.

3. The Admissions Board Bachelor programmes FSE will determine whether deficiencies have been compensated satisfactorily.

C. Foreign qualifications (EEA)

1. Any certificate that grants access to a university in a European country will also grant access to Dutch universities.

2. In the entrance examination, as referred to in art. 7.28, paragraph 3 of the Act, per country and educational institution specific training conditions are mentioned. These are standardized. The entrance examination is, in accordance with the Admissions Board Bachelor's programmes FSE, carried out by the Admissions Office. If for a specific diploma no standardisation has taken place then the requirements as formulated for candidates with a HBO (university of applied science) propaedeutic certificate will apply to these candidates in the entrance examination as defined in Article 7.28.3 of the Act (see A).

3. In addition, candidates are required to be competent in English:

	Overall	**Reading**	**Listening**	**Speaking**	**Writing**
IELTS (Academic)	6.5	6.5	6.5	6.5	6.5
TOEFL IBT (internet-based test)	90	21	21	21	24
Cambridge English	CAE of CPE Certificate with a minimum score of 180				
English language test - UG Language Centre		B2	B2	B2	C1

Applicants with a Dutch VWO or equivalent diploma are exempt from an English language test as are native English speakers.

4. The Admissions Board Bachelor's programmes FSE will determine whether deficiencies have been compensated satisfactorily.

D. Foreign qualifications (non-EEA)

1. A non-European certificate that according to NUFFIC and/or NARIC standards is equivalent to a Dutch VWO certificate will grant access to university in the Netherlands.

2. In the entrance examination, as referred to in art. 7.28, paragraph 3 of the Act, per country and educational institution specific training conditions are mentioned. These are standardized. The entrance examination is, in accordance with the Admissions Board Bachelor's programmes FSE, carried out by the Admissions Office. If for a specific diploma no standardisation has taken place then the requirements as formulated for candidates with a HBO (university of applied science) propaedeutic certificate will apply to these candidates in the entrance examination as defined in Article 7.28.3 of the Act (see A).

3. In addition, candidates are required to be competent in English:

	Overall	Reading	Listening	Speaking	Writing
IELTS (Academic)	6.5	6.5	6.5	6.5	6.5
TOEFL IBT (internet-based test)	90	21	21	21	24
Cambridge English	CAE of CPE Certificate with a minimum score of 180				
English language test - UG Language Centre		B2	B2	B2	C1

Applicants with a Dutch VWO or equivalent diploma are exempt from an English language test as are native English speakers.

4. The Admissions Board Bachelor's programmes FSE will determine whether deficiencies have been compensated satisfactorily.

E. Entrance examination (Colloquium Doctum)

1. The following requirements apply to the entrance examination as defined in Article 7.29 of the Act:

Degree programme	Nature and Health VWO level	or	Nature and Technology VWO level
B Biology	en, wia or b, sk, bio, na		en, wib, na, sk, bio
B Pharmacy	en, wia or b, sk, bio, na		en, wib, na, sk
B Life Science and Technology	en, wib, sk, bio, na		en, wib, na, sk
B Biomedical Engineering	en, wib, sk, bio, na		en, wib, na, sk
B Computing Science	en, wib, sk, bio		en, wib, na, sk
B Artificial Intelligence	en, wia or b, sk, bio		en, wib, na, sk
B Physics	en, wib, sk, bio, na		en, wib, na, sk
B Chemistry	en, wib, sk, bio, na		en, wib, na, sk
B Astronomy	en, wib, sk, bio, na		en, wib, na, sk
B Mathematics	en, wib, sk, bio		en, wib, na, sk
B Chemical Engineering	en, wib, sk, bio, na		en, wib, na, sk
B Industrial Engineering and Management Science	en, wib, sk, bio		en, wib, na, sk
B Applied Physics	en, wib, sk, bio, na		en, wib, na, sk
B Applied Mathematics	en, wib, sk, bio		en, wib, na, sk

en = English; wia = Mathematics A; wib = Mathematics B; na = Physics; sk = Chemistry; bio = Biology

2. In addition, candidates are required to be competent in English:

	Overall	Reading	Listening	Speaking	Writing
IELTS (Academic)	6.5	6.5	6.5	6.5	6.5
TOEFL IBT (internet-based test)	90	21	21	21	24
Cambridge English	CAE of CPE Certificate with a minimum score of 180				
English language test - UG Language Centre		B2	B2	B2	C1

Applicants with a Dutch VWO or equivalent diploma are exempt from an English language test as are native English speakers.

3. The Admissions Board Bachelor's programmes FSE will determine whether deficiencies have been compensated satisfactorily.

Appendix VI Clustering of Bachelor's degree programmes Article 5.3.4, Article 5.6.1

Degree programme CROHO code	Name of degree programme	Clustered with CROHO code	Name of degree programme
56286	B Life Science and Technology	56860 56157 56226	B Biology B Pharmacy B Biomedical Engineering
56860	B Biology	56286 56157 56226	B Life Science and Technology B Pharmacy B Biomedical Engineering
56157	B Pharmacy	56860 56286 56226	B Biology B Life Science and Technology B Biomedical Engineering
56226	B Biomedical Engineering	56860 56286 56157	B Biology B Life Science and Technology B Pharmacy
56980	B Mathematics	56965 50206 56962 50205	B Applied Mathematics B Physics B Applied Physics B Astronomy
56965	B Applied Mathematics	56980 50206 56962 50205	B Mathematics B Physics B Applied Physics B Astronomy
50206	B Physics	56962 50205 56965 56980	B Applied Physics B Astronomy B Applied Mathematics B Mathematics
56962	B Applied Physics	50206 50205 56965 56980	B Physics B Astronomy B Applied Mathematics B Mathematics
50205	B Astronomy	56962 56965 50206 56980	B Applied Physics B Applied Mathematics B Physics B Mathematics
56857	B Chemistry	56960	B Chemical Engineering
56960	B Chemical	56857	B Chemistry

	Engineering		

Appendix VII Admission to the post-propaedeutic phase Article 5.1.1

The following candidates will be admitted to the post-propaedeutic phase:

Students who have been issued a positive study advice from the degree programme Biomedical Engineering at the University of Groningen.

The Board of Examiners decides over students from other degree programmes.

Appendix VIII Contact hours propaedeutic phase Article 2.3

Degree programme year 1	
Structure contact hours	**Contact hours per year**
Lectures	110
Tutorials	60
Practicals	120
Supervision during an internship	N/A
Examinations	30
Career services	8 (mentor sessions)

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Appendix IX University Minors of the faculty of Science and Engineering (Article 8.5.1)

1. Neurosciences Minor (taught in English):
   - Neuroscience (15 ECTS)
   - Behavioural Neuroscience (15 ECTS)

   Future Planet Innovation (taught in English): (not offered in the academic year 2019-2020)
   - *Global Challenges (10 ECTS)*
   - *Sustainability in perspective (5 ECTS)*
   - *Sustainable contributions to society (15 ECTS)*

   Astronomy through Space and Time Minor (taught in English):
   - The Evolving Universe (5 ECTS)
   - Cosmic Origins (5 ECTS)
   - Astrobiology (5 ECTS)

   Einstein's physics: Space-time and parallel worlds (taught in English):
   - Einstein's Universe (5 ECTS)
   - Quantum World (5 ECTS)
   - Building blocks of matter (5 ECTS)

2. The Programme Committee for the Bachelor's degree programmes in Biology also has authority in the field of the Minor "Neurosciences" and/or its course units.

   The Programme Committee for the Master's degree programme in Energy and Environmental Sciences also has authority in the field of the Minor "Future Planet Innovation" and/or its course units.

   The Programme Committee for the Bachelor's degree programme in Astronomy also has authority in the field of the Minor "Astronomy through Space and Time" and/or its course units.

   The Programme Committee for the Bachelor's degree programmes in Physics and Applied Physics also has authority in the field of the Minor "Einstein's physics: Space-time and parallel worlds" and/or its course units.

3. The Board of Examiners for the Bachelor's degree programmes in Biology and Life Science and Technology and the Master's degree programmes in Biology, Biomolecular Sciences, Ecology and Evolution, Marine Biology also has authority in the field of the Neurosciences Minor and/or its course units.

   The Board of Examiners for the Master's degree programme in Energy and Environmental Sciences also has authority in the field of the "Future Planet Innovation" Minor and/or its course units.

   The Board of Examiners for the Bachelor's degree programme in Astronomy also has authority in the field of the Astronomy through Space and Time Minor and/or its course units.

   The Board of Examiners for the Bachelor's degree programmes in Physics and Applied Physics also has authority in the field of the Physics Minor "Einstein's physics: Space-time and parallel worlds" and/or its course units.

Commented [IK1]: In de gaten houden wat hiermee gebeurt – komt dit wel of niet terug in 2020-2021

4. These Teaching and Examination Regulations also apply in their entirety to the Minors in “Neurosciences”, “Future Planet Innovation”, “Astronomy through Space and Time” and “Einstein's physics: Space-time and parallel worlds” and/or their course units.

Appendix X Transitional arrangement:

Non-applicable for the year 2020-2021