Appendices

to

Teaching and Examination Regulations

2021-2022

Appendices master's degree programme

Biomedical Engineering

Appendix I. Learning outcomes of the degree programme (art. 3.1)

A graduate with a Master of Science in BME is able to:

1. *Analyse the problem and define aim*

A Biomedical Engineer is able to analyse biomedical problems of a complex nature by choosing the appropriate level of abstraction and by critically examining existing theories, models or interpretations based on the assessment of the scientific value of current research within Biomedical Engineering. The Biomedical Engineer thereby creates a cause-effect model, distinguishes the problems that are fundamental and solvable and defines the aim which has the highest priority.

2. *Create a Design, Research & Development proposal*

A Biomedical Engineer is able to design different strategies to obtain the defined aim, and has the skills in, and the affinity with the design, use and validation of models to allow the Biomedical Engineer to consciously choose the most efficient and effective Design, Research & Development plan.

3. *Execute the Design, Research & Development plan*

A Biomedical Engineer is able to execute a Design, Research & Development plan and to adapt it when external circumstances or advancing insight requires it. Depending on the project the focus may be more on the scientific approach to increase knowledge and understanding (research), on prototyping and product improvement (development) or on the design of new devices or systems, although all three aspects are essential in the Design, Research & Development cycle of innovative products.

4. *Analyse and interpret the data*

A Biomedical Engineer is able to ask adequate questions and has a critical, yet constructive attitude towards analysing and solving complex real-life biomedical problems. The Biomedical Engineer is able to form a well-reasoned opinion in the case of incomplete or irrelevant data; is able to analyse and interpret the results of Design, Research & Development in terms of statistics, limitations and the relation to existing literature and devices aiming to contribute to the advancement of knowledge in his or her field of Biomedical Engineering and beyond it.

5. *Communicate results*

A Biomedical Engineer, as an interdisciplinary specialist, is able to communicate orally and in writing about Design, Research & Development with colleagues, non-colleagues and other involved parties including health care providers and patients. In addition, the Biomedical Engineer is able to debate about both Biomedical Engineering and the place of Biomedical Engineering in society.

6. *Embed the results in scientific and social context*

A Biomedical Engineer is able to analyse and to discuss the social consequences (economic, social, cultural) of new developments in Biomedical Engineering with colleagues and non-colleagues; has insight into (debates about) scientific practice and is able to analyse and to discuss the ethical and the normative aspects of the consequences and assumptions of the scientific practice with colleagues and non-colleagues and is able to integrate these ethical and normative aspects in its own work.

7. *Demonstrate a professional attitude*

A Biomedical Engineer is able to incorporate the knowledge, skills and competences described above and demonstrates a professional attitude by showing a high level of independence, responsibility and commitment. In addition, the Biomedical Engineer shows social skills as well as the ability to improve after feedback.

Appendix II. Tracks of the degree programme (art. 3.5)

The degree programme is divided into the following tracks:

Medical Imaging
Biomaterials Science and Engineering
Medical Device Design

Appendix III. Content of the degree programme (art. 3.7)

Course details, teaching method, mode of assessment, and entry requirements of all courses are described in Ocasys.

1. Course elements of the track Medical Imaging

Course elements year 1

Course element	ECTS
Radiation Physics	5
Introduction to MATLAB programming for BME	5
Conventional Imaging Techniques and Ultrasound	5
Medical Physics in Radiation Oncology	5
Computed Tomography	5
Image Processing	5
Statistical Methods in BME	5
Biomedical Instrumentation 2	5
Multidisciplinary Project	5
Internship [1]	15
Seminars (4) [1]	-

[1] As described in the Guidelines on the Student Portal

Course elements year 2

Course element	ECTS
Applied Medical Visualization	5
MRI	5
Microscopy and Imaging	5
Physics in Nuclear Medicine	5
Medical Device Commercialization [1]	5
Technology and the Ethics of Research [2]	5
Master's Project [3, 4]	30
Seminars (4) [3]	-

[1] Workshop included in Medical Device Commercialization: 3D- Lab.
[2] Workshops included in Technology and the Ethics of Research 2: Scientific writing, Letter and CV writing.
[3] As described in the Guidelines on the Student portal.
[4] Included in the Master's project are: Writing a project proposal, poster presentation winter symposium, oral presentation summer symposium.

2. Course elements of the track Biomaterials Science and Engineering

Course elements year 1

Course element	ECTS
Interface Biology	5
Biomaterials 2	5
Introduction to MATLAB programming for BME	5
Biofilms	5
Engineering and Biotribology	5
Surface Characterisation	5
Statistical Methods for BME	5
Biomedical Instrumentation 2	5
Multidisciplinary Project	5
Internship [1]	15
Seminars (4) [1]	-

[1] As described in the Guidelines on the Student Portal

Course elements year 2

Course element	ECTS
Microscopy and Imaging	5
Recent Development in Biomaterials	5
Integrated Lab Course in Biomaterials	5
Colloid and Interface Science	5
Medical Device Commercialization [1]	5
Technology and the Ethics of Research [2]	5
Master's Project [3, 4]	30
Seminars (4) [3]	-

[1] Workshop included in Medical Device Commercialization: 3D- Lab.
[2] Workshops included in Technology and the Ethics of Research 2: Scientific writing, Letter and CV writing.
[3] As described in the Guidelines on the Student portal.
[4] Included in the Master's project are: Writing a project proposal, poster presentation winter symposium, oral presentation summer symposium.

3. Course elements of the track Medical Device Design

Course elements year 1

Course element	ECTS
Biomaterials 2	5
Introduction to MATLAB programming for BME	5
Control Engineering (for BME)	5
Prosthetics and Orthotics	5
Engineering and Biotribology	5
Mechatronics	5
Statistical Methods for BME	5
Biomedical Instrumentation 2	5
Multidisciplinary Project	5
Internship [1]	15
Seminars (4) [1]	-

[1] As described in the Guidelines on the Student Portal

Course elements year 2

Course element	ECTS
Interface Biology or Bio-signal processing for human machine interaction	5
Product Design by Finite Elements Method	5
Robotics	5
MEMS/NEMS and Nanofabrication	5
Medical Device Commercialization [1]	5
Technology and the Ethics of Research [2]	5
Master's Project [3, 4]	30
Seminars (4) [3]	-

[1] Workshop included in Medical Device Commercialization: 3D- Lab.
[2] Workshops included in Technology and the Ethics of Research 2: Scientific writing, Letter and CV writing.
[3] As described in the Guidelines on the Student portal.
[4] Included in the Master's project are: Writing a project proposal, poster presentation winter symposium, oral presentation summer symposium.

4. Course elements of the track CEMACUBE

Students of CEMACUBE registered at the University of Groningen will follow courses in year 1 or year 2 of the programme. The other year will be carried out a one of the partner universities. In year 1 CEMACUBE students will follow an adjusted set of year 1 courses, taken from each track:

Course elements year 1

Course element	ECTS
Biomaterials 2	5
Introduction to MATLAB programming for BME	5
Conventional Imaging Techniques and Ultrasound	5
Image Processing	5
Engineering and Biotribology	5
MEMS/NEMS and Nanofabrication	5
Statistical Methods for BME	5
Biomedical Instrumentation 2	5
Multidisciplinary Project	5
Internship [1]	15
Seminars (4) [1]	-

[1] As described in the Guidelines on the Student Portal

Course elements year 2

For year 2 the CEMACUBE student will follow the courses of one of the tracks mentioned in Appendix 3.

Appendix IV. Electives (art. 3.8.1)

Courses selected by students
Upon request of the student, the Board of Examiners may approve courses that are not mentioned in Appendix III. The request procedure must be started at least 6 weeks before the course enrolment deadline. The procedure starts when the Board of Examiners receives a request form with a detailed course description and a clear argumentation containing the relevance of the selected course for the student's curriculum.

The Board of Examiners will decide on an individual basis if permission is granted. The student will be informed about the Board's decision, within 6 weeks by email.

Appendix V Entry requirements and compulsory order of examinations (art. 4.4)

Course unit	ECTS	Entry requirements
Master's project	30	Internship (15 ECTS) and at least 30 ECTS of the course programme needs to be finalised 4 weeks before the start of the project.

Appendix VI Admission to the degree programme (art. 2.1A.1 + art. 2.1B.1)

Admission to the Master's degree programme

1. Holders of the following University of Groningen Bachelor's degrees are considered to have sufficient knowledge and skills and will be directly admitted to the Master's degree programme:
    a. Holders of a Bachelor's degree in Life Science and Technology with a major Biomedical Engineering from the University of Groningen
    b. Holders of a Bachelor's degree in Physics with the track Life and Health from the University of Groningen.
    c. Holders of a Bachelor's degree in Physics with the track Biological & Medical Physics from the University of Groningen.
    d. Holders of a Bachelor's degree in Physics with the courses Molecular Biophysics, Modelling Life, Cellular Chemistry.

2. Holders of a Dutch University Bachelor's degree in Biomedical Engineering are considered to have sufficient knowledge and skills and will be directly admitted to the Master's degree programme.

3. Holders of a University of Groningen Bachelor's degree in Human Movement Sciences may be admitted individually, under the condition of successfully finishing a 45 ECTS premaster programme first.

4. Holders of a non-university Bachelor's degree in Electrical Engineering (majors: mechatronics, electronics) or Mechanical engineering may be admitted individually, under the condition of successfully finishing a premaster programme first. A premaster programme will have up to 60 ECTS.

5. Holders of a non-university Bachelor's degree, who have a prior degree other than a VWO diploma including a final examination in English, will have to prove that they have English proficiency at VWO level by one of the accepted language tests.

Appendix VII Transitional provisions (art. 7.1)

N/A

Appendix VIII Additional Requirements Open degree Programmes

(Art. 5.6)

In exceptional circumstances students wishing to pursue an open degree programme may file a request with the Board of Examiners. The Board of Examiners will evaluate whether the proposed curriculum meets the learning outcomes of the degree programme and can determine further conditions in their Rules and Regulations.

Appendix IX. Application and decision deadlines for admission

(art. 2.6.1 art. 2.6.3)

Programmes starting on 1 September 2021

Deadline of Application	EU/EEA students	non-EU/EEA students
Biomedical Engineering	1 May 2021	1 May 2021

Deadline of decision	EU/EEA students	non-EU/EEA students
Biomedical Engineering	1 June 2021	1 June 2021