university of groningen / faculty of science and engineering

# Teaching and Examination Regulations 2020-2021 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. 3.6)

Course details, mode of assessment, entry requirements and examination 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 |
| Technology and the Ethics of Research | 5 |
| Master's Project [1, 2] | 35 |
| Seminars (4) [1] | - |

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

[2] Included in the Master's project preparation are: workshop Scientific writing, workshop Letter and CV writing, workshop 3D-lab, Winter symposium and 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 |
| Technology and the Ethics of Research | 5 |
| Master's Project [1, 2] | 35 |
| Seminars (4) [1] | - |

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

[2] Included in the Master's project preparation are: workshop Scientific writing, workshop Letter and CV writing, workshop 3D-lab, Winter symposium and 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 | 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 | 5 |
| Product Design by Finite Elements Method | 5 |
| Robotics | 5 |
| MEMS/NEMS and Nanofabrication | 5 |
| Technology and the Ethics of Research | 5 |
| Master's Project [1, 2] | 35 |
| Seminars (4) [1] | - |

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

[2] Included in the Master's project preparation are: workshop Scientific writing, workshop Letter and CV writing, workshop 3D-lab, Winter symposium and 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 as mentioned in Appendix 3.

# Appendix IV. Electives (art. 3.7)

### Courses selected by students

Upon request of the student, the Board of Examiners may approve a course that is not mentioned in Appendix III. The request procedure must be started at least 6 weeks before the start of the course, and starts when the Board of Examiners receives a new programme proposal, supplemented with argumentation for the request and a detailed course description. The argumentation should contain the relevance of the selected course for the student's individual 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 VI Admission to the degree programme and different tracks/specializations (art. 2.1.1 + art. 2.2 + art. 2.3)

**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, usually by passing a language test.

# Appendix VIII. Application and decision deadlines for admission

(art. 2.6.1, art. 2.6.3)

| Deadline of Application | EU/EEA students | non-EU/EEA students |
|---|---|---|
| Biomedical Engineering | 1 May 2020 | 1 May 2020 |

| Deadline of decision | EU/EEA students | non-EU/EEA students |
|---|---|---|
| Biomedical Engineering | 1 June 01, 2020 | 1 June 2020 |