Appendices
to
Teaching and Examination Regulations
2024-2025
Master degree programme
in
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/specializations (art. 3.6)

The degree programme is divided into the following tracks:

Biomaterials Science and Engineering
Medical Device Design
Medical Imaging

Appendix III. Content of the degree programme (art. 3.8)

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

1. Course elements of the track Biomaterials Science and Engineering

Course elements year 1

Course code	Course name	ECTS
WMBE011-05	Biofilms	5
WMBE001-05	Biomaterials 2	5
WMBE019-05	Biomedical Instrumentation 2	5
WMBE014-05	Engineering and Biotribology	5
WMBE004-05	Interface Biology	5
WMBE31-05	Medical Device Innovation and Translation 1	5
WMBE030-05	Nanomedicines for Biomedical Applications	5
WMBE021-05	Statistical Methods for BME	5
WMBE022-15	Internship [1]	15
	Elective (1)	5
	Seminars (4) [1]	-

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

Course elements year 2

Course code	Course name	ECTS
WMBE037-05	3D Bioprinting for Tissue Engineering	5
WMBE003-05	Integrated Lab Course Biomaterials	5
WMBE032-05	Medical Device Innovation and Translation 2	5
WMBE006-05	Microscopy and Imaging	5
WMBE009-05	Recent Developments in Biomaterials	5
WMBE018-05	Technology and the Ethics of Research [1]	5
WMBE901-35	Master's Project [2, 3]	30
	Seminars (4) [2]	-

[1] Workshops included in Technology and the Ethics of Research: Scientific writing, Letter and CV writing.
[2] As described in the Guidelines on the Student portal.
[3] Included in the Master's project are: Writing a project proposal, poster presentation start symposium, oral presentation end symposium.

2. Course elements of the track Medical Device Design

Course elements year 1

Course code	Course name	ECTS
WMBE019-05	Biomedical Instrumentation 2	5
WMBE024-05	Control Engineering for BME	5
WMBE014-05	Engineering and Biotribology	5
WBIE011-05	Mechatronics	5
WMBE31-05	Medical Device Innovation and Translation 1	5
WMBE029-05	Product Design by FEM (for BME)	5
WMBE016-05	Prosthetics and Orthotics	5
WMBE021-05	Statistical Methods for BME	5
WMBE022-15	Internship [1]	15
	Elective (1)	5
	Seminars (4) [1]	-

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

Course elements year 2

Course code	Course name	ECTS
WMBE001-05	Biomaterials 2	5
WMBE026-05	Bio-signal processing for human machine interaction	5
WMBE032-05	Medical Device Innovation and Translation 2	5
WMIE010-05	MEMS, NEMS and Nanofabrication	5
WMIE005-05	Robotics for IEM	5
WMBE018-05	Technology and the Ethics of Research [1]	5
WMBE901-35	Master's Project [2, 3]	30
	Seminars (4) [2]	-

[1] Workshops included in Technology and the Ethics of Research: Scientific writing, Letter and CV writing.
[2] As described in the Guidelines on the Student portal.
[3] Included in the Master's project are: Writing a project proposal, poster presentation start symposium, oral presentation end symposium.

3. Course elements of the track Medical Imaging

Course elements year 1

Course code	Course name	ECTS
WMBE019-05	Biomedical Instrumentation 2	5
WMBE013-05	Computed Tomography	5
WMBE002-05	Conventional Imaging Techniques and Ultrasound	5
WMBE035-05	MATLAB Concepts for Image and Data Analysis	5
WMBE31-05	Medical Device Innovation and Translation 1	5
WMBE007-05	MRI	5
WMBE008-05	Physics in Nuclear Medicine	5
WMBE033-05	Radiation Physics	5
WMBE021-05	Statistical Methods for BME	5
WMBE022-15	Internship [1]	15
	Seminars (4) [1]	-

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

Course elements year 2

Course code	Course name	ECTS
WMBE034-10	Capitum Selectum Medical Imaging Principles and Applications	10
WMBE032-05	Medical Device Innovation and Translation 2	5
WMBE015-05	Medical Physics for Radiation Oncology	5
WMBE006-05	Microscopy and Imaging	5
WMBE018-05	Technology and the Ethics of Research [1]	5
WMBE901-35	Master's Project [2, 3]	30
	Seminars (4) [2]	-

[1] Workshops included in Technology and the Ethics of Research: Scientific writing, Letter and CV writing.
[2] As described in the Guidelines on the Student portal.
[3] Included in the Master's project are: Writing a project proposal, poster presentation start symposium, oral presentation end symposium.

Appendix IV. Electives (art. 3.9.1)

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

1. Track Biomaterials Science and Engineering

During year 1, one of the below mentioned courses need to be chosen.

Course code	Course name	ECTS
WMBE035-05	MATLAB Concepts for Image and Data Analysis	5
WMBE029-05	Product Design by FEM (for BME)	5

2. Track Medical Device Design

During year 1, one of the below mentioned courses need to be chosen.

Course code	Course name	ECTS
WMBE004-05	Interface Biology	5
WMBE035-05	MATLAB Concepts for Image and Data Analysis	5

Courses selected by students
Upon request of the student, the Board of Examiners may approve courses that are not mentioned in Appendix III or IV. The request procedure must start 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 (art. 4.4)

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

Course code	Course unit	ECTS	Entry requirements
WMBE022-15	Internship	15	A minimum of 15 ECTS finalized courses from the curriculum of the Master's programme Biomedical Engineering needs to be finalised four weeks before the start of the Internship.
WMBE901-30	Master's project	30	The Internship (15 ECTS) and at least 30 ECTS of the courses from the curriculum of the Master's programme Biomedical Engineering needs to be finalised four weeks before the start of the Master's 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 (old curriculum, start date prior to 2020).

b. Holders of a Bachelor's degree in Physics with the track Biological & Medical Physics from the University of Groningen.

c. Holders of a Bachelor's degree in (Applied) Physics with the courses:

WBPH023-05	Molecular Biophysics
WBBY024-05	Modelling Life
WBCH021-05	Cellular Chemistry

d. Holders of a Bachelor's degree in Life Science and Technology from the University of Groningen (start 2020 or later), with the following Biomedical Engineering bachelor courses:

WBBE045-05	Applied Medical Visualization
WBBE055-05	Mathematical Tools (for BME)
WBBE058-05	Microscopy and Imaging
WBBE024-05	Anatomy and Physiology
WBBE010-08	Research Course BME
WBBE046-02	Ethics 3: Research Ethics
WBBE057-05	Physics and Technology of Medical Imaging
WBIE030-05	Signals and Systems
WBBE040-05	Waves and Optics for BME
WBBE901-15	Bachelor's project in Biomedical Engineering

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)

Course unit	From 2024-2025 onwards replaced by
WMBE020-05 Multidisciplinary Project	WMBE31-05 Medical Device Innovation and Translation 1
WMBE010-05 Applied Medical Visualization	WBBE045-05 Applied Medical Visualization + an individual deepening assignment
WMBE012-05 Colloid and Interface Science	WMBE029-05 3D Bioprinting for Tissue Engineering
WMBE005-05 Introduction to MATLAB Programming for BME	WMBE035-05 MATLAB Concepts for Image and Data Analysis
WMBE023-05 Medical Device Commercialization	WMBE032-05 Medical Device Innovation and Translation 2
WMBE028-05 Quantitative Image Analysis	Last chance exam WMBE028-05 Quantitative Image Analysis in 2024-2025
WMBE017-05 Surface Characterization	WMBE030-05 Nanomedicines for Biomedical Applications
WMPH013-05 Radiation Physics	WMBE033-05 Radiation Physics

Master's project
Students who started the Master's programme before 2020 have two options:

1. To do a Master's project of 35 ECTS (WMBE901-35)
   or
2. To do a Master's project of 30 ECTS (WMBE901-30) and the course WMBE023-05 Medical Device Commercialization or WMBE032-05 (before September 2024) Medical Device Innovation and Translation 2 (after September 2024).

Appendix VIII Additional Requirements Open degree Programmes (Art. 3.10)

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.