Faculty of Science and Technology

UNIVERSITEIT TWENTE.

Programme-specific supplement to the programme section of the student charter including education and examination regulations of the Bachelor's degree programme in Biomedical Engineering

(art. 7.13 and 7.59 WHW)

Contents

Preamble

1. The regulations in this supplement apply to the full-time Bachelor's degree programme in UT (CROHO: 56226).

2. Together with the general section (TNW21.679/jg), this programme-specific supplement forms the programme section of the student charter including the education and examination regulations of the Biomedical Engineering bachelor's programme of the Faculty of Science and Technology of the University of Twente.

3. The 'Biomedical Engineering Examination Board Rules' sets out the rules regarding the performance of its duties and powers, which the Biomedical Engineering Examination Board has established in accordance with Article 7.12b of the Act.

4. In case of ambiguities, the Dutch version of the programme-specific supplement Bachelor Biomedical Technology is leading.

Date: 21 July 2021
Reference: TNW/21.688

Article 1 Definitions

(based on the General section of the Education and Examination Regulations for Bachelor's degree programmes 2021-2022)

1. Module: total of 15 ECTS of one or more study units
2. Module component: component of a module (equivalent to study component) that is concluded with one or more tests. Where in this document reference is made to a subject area, this also refers to module component.
3. Study unit: part of a study programme that is concluded with an exam and for which ECTS are awarded.
4. Study component: part of a study unit that is concluded with one or more tests.

Within the Biomedical Engineering course, the term 'module' is used in everyday language for all study units worth 15 ECTS and 12 ECTS. We call the underlying components 'module components'. The mathematics curriculum has individual study units worth 2 to 4 ECTS.

Article 2 Subsequent Master's degree

The bachelor's and master's programmes in Biomedical Engineering are integrated. Successful completion of the bachelor's exam grants access to, among other things, the master's programme in Biomedical Engineering of the Faculty of Applied Sciences of the University of Twente.

Article 3 Programme aims and attainment targets

Biomedical Engineering is an interdisciplinary field in which engineering, medicine and natural sciences are brought together. A Biomedical Engineer applies scientific and engineering concepts and methods to obtain scientific knowledge and to solve medical problems. The aim is to:

1. Generate new knowledge of and insight into living systems through innovation and the application of experimental, analytical and design techniques.
2. Design and develop new devices, algorithms, processes and systems that contribute to biomedical engineering in healthcare.
3. Apply goal-oriented strategies and contextual insight to resolve problems in healthcare.
4. Implement solutions in healthcare based on excellent communication and collaboration with other disciplines.

A Biomedical Engineer must have the following competencies:

1. Competence in the discipline of Biomedical Technology
2. Competence in research
3. Competence in design
4. A scientific approach
5. Basic intellectual skills
6. Competence in collaboration and communication
7. Takes the temporal and societal context into account.

These competencies are required for the completion of both Biomedical Engineering degree programmes i.e. Bachelor of Science and Master of Science. However, the testable objectives specified below are specific to the bachelor's level. For each attainment target, a (k), (s) and/or an (a) indicates whether it concerns the acquisition of knowledge, skills and/or attitude respectively.

A Bachelor of Biomedical Engineering

1. Is competent in Biomedical Engineering

A Biomedical Engineer is familiar with existing scientific knowledge and has the competence to expand their knowledge through study.

1a. Understands the knowledge base of the relevant fields of biomedical engineering (theories, methods, techniques). These fields include core concepts of Physics, Chemistry, Mechanical Engineering, Electrical Engineering, Mathematics, Biology and Medical Sciences (Medicine). [ks]
1b. Understands the structure of Biomedical Engineering and the relationship between sub-areas. [ks]
1c. Has knowledge of and some skill in the processes of establishing the truth, theorizing and modelling within Biomedical Engineering. [ks]
1d. Has knowledge of and some skill in how texts, data, problems, results are interpreted within Biomedical Engineering. [ks]
1e. Has knowledge of and some skills in how experiments, data collection and simulations are performed within Biomedical Engineering [ks]
1f. Has knowledge of and some skill in decision-making within Biomedical Engineering. [ks]

1g Is aware of the presuppositions of standard methods and of their importance. [ksa]
1h. Under supervision, is able to identify gaps in their knowledge and to revise and expand their knowledge through study. [ks]

2. Is competent in research

A Biomedical Engineer has the competence to acquire new scientific knowledge through research. In this context, research means developing new knowledge and new insights in a purposeful and methodical manner.

2a. Is able to reformulate poorly structured research problems. In doing so, they also involve the system limits. Can defend this new interpretation before the parties involved. [ksa]
2b. Is perceptive and possesses the creativity and the ability to discover certain connections and new perspectives in seemingly trivial situations. [ksa]
2c. Under supervision, is able to draw up and execute a research plan. [ks]
2d. Can work at different levels of abstraction. [ks]
2e. Recognises the importance of other disciplines (interdisciplinarity), where necessary. [ka]
2f. Is aware of the changeability of the research process as a result of external circumstances or advancing insights. [ka]
2g Is able to assess the usability of research conducted in the field of Biomedical Engineering. [ks]
2h. Under supervision, is able to contribute to the development of scientific knowledge in one or more fields of Biomedical Engineering. [ks]

3. Is competent in design

Many Biomedical Engineers will design as well as research. In this context, designing is a synthetic activity aimed at the realisation of new or modified artefacts or systems with the intention to create value in accordance with predefined requirements and desires (e.g. mobility, health).

3a. Is able to reformulate poorly structured design problems. In doing so, they also involve the system limits. Is able to defend this new interpretation before the parties involved. [ksa]
3b. Possesses creativity and synthetic skills with regard to design problems. [ksa]
3c. Is able to produce and execute a draft plan (under supervision). [ks]
3d. Can work at different levels of abstraction, including system level. [ks]
3e. Recognises the importance of other disciplines (interdisciplinarity), where necessary. [ks]
3f. Is aware of the changeability of the design process as a result of external circumstances or advancing insights. [ka]
3g Can integrate existing knowledge into a design. [ks]
3h. Possesses the ability to make design decisions and justify and evaluate them systematically. [ks]

4. Has a scientific approach

A Biomedical Engineer has a systematic approach, characterised by the development and use of theories, models and coherent interpretations, has a critical attitude and has insight into the nature of science and technology.

4a. Is curious and has a lifelong learning attitude. [ka]
4b. Has a systematic approach, characterized by the development and use of theories, models and coherent interpretations. [ksa]
4c. Has the knowledge and skills to use, justify and assess the value of models for research and design (model in the broadest sense: from mathematical model to scale model). Can modify models for their own use. [ks]
4d. Has insight into the nature of science and technology (purpose, methods, differences and similarities between scientific fields, nature of laws, theories, explanations, role of the experiment, objectivity, etc.). [k]
4e. Has insight into the scientific practice (research system, relation with clients, publication system, importance of integrity, etc.). [k] k.
4f. Is able to adequately document the results of research and design with a view of contributing to the development of knowledge in the field of Biomedical Engineering and beyond. [ksa]
4g Can obtain scientific literature in an academic way and is able to understand and interpret it. [ksa]

5. Possesses basic intellectual skills

A Biomedical Engineer is competent in reasoning, reflection and forming a judgement. These are skills which are learned or sharpened in the context of a specific discipline and which are generically applicable henceforth.

5a. Is able to reflect critically on their own thinking, decision making and acting and adjust these on the basis of this reflection. [ks]
5b. Can reason logically, both within the field of study and beyond, e.g. 'why' and 'what-if' reasoning. [ks]
5c. Can recognize modes of reasoning (induction, deduction, analogy, etc.) within the field of study. [ks]
5d. Is able to ask adequate questions and has a critical yet constructive attitude towards analysing and solving simple problems in the field of health care. [ks]
5e. Can form a reasoned judgement, even in the case of incomplete or irrelevant data. [ks]
5f. Can take a position on a scientific argument in biomedical engineering. [ksa]
5g Possesses basic numerical skills and an understanding of orders of magnitude. [ks]

6. Is competent in collaboration and communication

A Biomedical Engineer has the competence to work with and for others. This not only requires adequate interaction, a sense of responsibility and leadership, but also good communication with colleagues and non-colleagues. He or she is also able to participate in a scientific or public debate.

6a. Is able to communicate in writing with colleagues and non-colleagues about the results of learning, thinking and decision making. [ks]
6b. Is able to verbally communicate with colleagues and non-colleagues about the results of learning, thinking and decision making. [ks]
6c. As above (verbally and in writing), but in English.
6d. Is able to follow debates about both the field and its place in society. [ks]
6e. Displays professional behaviour. This includes: reliability, involvement, and independence. Respects the opinions of others. [ksa]
6f. Is able to perform project-based work: is pragmatic and has a sense of responsibility; is able to deal with limited sources; is able to deal with risks; is able to compromise. [ksa]
6g. Is able to work as part of a multidisciplinary team. [ks]
6h. Has insight into and can deal with team roles and social dynamics. [ks]

7. Takes the temporal and societal context into account.

Science and technology do not exist in isolation and always have a temporal and social context. Beliefs and methods have their origin; the decisions being made have social consequences over time. A Biomedical Engineer understands this and possesses the ability to integrate these insights into their scientific work.

7a. Understands relevant (internal and external) developments in the history of Biomedical Engineering. This also includes integrating the interaction between the internal (ideas) development and the external (social) development. [ks]
7b. Is able to analyse the societal (economic, social, cultural) consequences of new developments in the field of Biomedical Engineering and to discuss these with colleagues and non-colleagues. [ks]
7c. Is able to analyse the ethical and normative aspects of the consequences and assumptions of scientific thinking and acting, discuss these with colleagues and non-colleagues (in both research and design). [ks]
7d. Has an eye for the different roles of professionals in society. [ks]

Article 4 Admission to the study programme

There are no additional provisions regarding admission to the programme, as laid down in section 2 of the general part of the Education and Examination Regulations (OER) for bachelor's programmes and Article 2.3 'Entrance examination or special entrance examination certificate'.

Article 5 Language

1. The bachelor's study programme in Biomedical Engineering is a Dutch-taught programme. The provisions of Article 3.3 of the General section apply in this respect.

2. From the third year onwards, the modules may be taught in English.

3. Parts of bachelor years 1 and 2 may be taught in English if the lecturer is not a Dutch speaker.

4. Study materials are in Dutch or English.

5. Some of the lecturers for certain study units are English speaking. In those cases, the student must speak English and may be asked to submit written work in English.

Article 6 Design of the programme

1. The curriculum for the bachelor's programme is designed according to the definitions set out in Article 1 of this document. For the full bachelor curriculum, please refer to Article 7.

2. Each module has two to five theoretical subject areas, which are applied in an overarching project. Students work together in project groups and are supervised by a tutor, which results in the end product of the project. As students progress during the bachelor's programme, a higher degree of independent project work is expected.

3. The project forms the common thread in every study unit bearing more than 10 ECTS. The study components within the study unit help solve the assignment within the project. Examples of final products include written reports, final presentations, posters, debate, and joint or individual oral. Written partial and final tests usually apply for the supporting subject areas. Students are required to follow a study unit in its entirety.

4. The most common teaching methods are project work, lectures, tutorials, practicals, assignments and self-study.

5. More information about the content of the study units can be found in the Course Catalogue in Osiris. Detailed information about the learning objectives for each module component can be found in the module manual following registration for the module concerned.

Article 7 The Bachelor's examination

The programmes below apply in academic year 2021-2022.
The B1 programme has a study load of 60 ECTS. The components of the B1 programme are:

Module	Quarter	Contents	ECT	Weight	Minimum	Total ECTS
Engineerable humans, constructing with molecules, M1	1	Project General chemistry Biochemistry Anatomy Methodology & statistics	3.00 3.00 2.00 1.50 1.50	27% 27% 18% 14% 14%	5.5 5.5 5.5 5.5 5.5	11
Introduction to Mathematics + calculus 1A	1		4.00	100%	5.5	4
Microscopic detection of cancer, M2	2	Project Geometric optics Cell biology	5.00 4.00 3.00	49% 29% 22%	5.5 5.5 5.5	12
Calculus 1B	2		3.00	100%	5.5	3
Measuring is knowing, basic principles of medical sensors, M3	3	Project Medical sensors and measuring systems Anatomy and Physiology Optical measuring of tissue	2.50 5.00 2.50 2.00	21% 41% 21% 17%	5.5 5.5 5.5 5.5	12
Linear Algebra	3		3.00	100%	5.5	3
Implant Design M4	4	Project Mechanics Hard materials Imaging	4.5 5 1.5 1	37% 41% 13% 9%	5.5 5.5 5.5 5.5	12
Calculus 2	4		3	100%	5.5	3

The B2 programme has a study load of 60 ECTS. The components of the B2 programme are:

Module	Quarter	Contents	ECT	Weight	Minimum	Total ECTS
Creating biological tissues, M5	1	Project structure analysis Applied cell biology	6.5 2.5 4	52% 21% 27%	5.5 5.5 5.5	13
Vector Calculus	1		2	100%	5.5	2
Transport phenomena in biological systems, M6	2	Project ITP BTP Physical ch. Reaction Kinetics MADS	4.80 2.00 2.00 3.00 2,00 1.20	33% 13% 13% 20% 13% 8%	5.5 5.5 5.5 5.5 5.5 5.5	15
Measuring is missing, M7	3	Project Ultrasound CT Physical optics Anatomy and phys. Signals and syst.	2.50 2.00 2.00 3.00 2.00 3.50	17% 13% 13% 20% 13% 24%	5.5 5.5 5.5 5.5 5.5 5.5	15
Brain in balance, M8	4	Project Mechanics Biomedical reg. Neurophysiology Medical electronics	4.05 1.95 3.00 3.00 3.00	27% 13% 20% 20% 20%	5.5 5.5 5.5 5.5 5.5	15

In the third year, three BME modules are given from the three disciplinary lines in bachelor education. Students choose at least one BME module appropriate to the research direction of their bachelor assignment. This module, together with the bachelor assignment, forms the graduation phase (i.e. 30 ECTS in total).

The remaining 30 ECTS in the 3rd year can be achieved as follows:

- 3rd year BME modules;
- High Tech Human Touch modules as set out on the central minors website;
- Minors from other programmes as set out on the central minors website;
- Electives at another university in the Netherlands or abroad.

The following restriction applies to UT modules not offered by the BME programme:

- Only entire modules can be chosen. The overlap with subject matter already dealt with does not exceed 50% of the module. If the overlap concerns the Mathematics curricular course, the student must do an alternative course component;
- The possible modules are visible in the minor selection tool and have been approved by the programme and the Examination Board.

The following assessment criteria apply for non-UT modules:

- The modules and/or courses must be of an academic level;
- The choice must be accompanied by a written motivation via the web form “Request Examination Board”;
- The overlap with subject matter already dealt with does not exceed 50%.
- The choice and motivation for non-UT education are assessed against the above criteria by the Examination Board.

The modules offered by BME for the B3 programme are:

Module	Quarter	Contents	ECTS	Weight	Minimum	Total
Biorobotics, M9	1	Project Control of robotic systems Robot Kinematics Biomedical Signal Analysis	6.50 3.00 2.50 3.00	43% 20% 17% 20%	5.5 5.5 5.5 5.5	15
Imaging & Diagnostics, M10	2	Project Molecular spectroscopy for imaging Magnetic resonance imaging Tissue imaging	3.00 3.00 6.00 3.00	20% 20% 40% 20%	5.5 5.5 5.5 5.5	15
Bioengineering Technologies BMT M11	3	Project Cell-material interactions Bio-organic chemistry Polymer chemistry &	5.50 3.50 3.00 3.00	40% 24% 18% 18%	5.5 5.5 5.5 5.5	15
Bachelor's	4	Bachelor's assignment	15.0	100%	6	15

Article 8 Sequence of study units

1. Before the start of a study unit, the student must meet the prerequisites and/or subject-specific requirements for that study unit.

2. At the start of a minor, the student must have obtained at least 75 ECTS and at least the four first-year modules must have been completed in full. The remaining 15 ECTS may include the module components which, pursuant to Art 4a (2), remain valid.

3. To be eligible to start the exam component of the bachelor assignment, a student must meet the following requirements:
   - The student has passed all exam components of the B1 program (60 ECTS).
   - The student has not yet completed a maximum of two modules (30 ECTS) from the B2 and B3 programme.
   - Before starting the bachelor's assignment, the student must have completed the module given by the research direction in which the assignment is carried out.

4. At the student's request, the Examination Board may grant an exemption from the conditions stipulated in sections 1 to 2 of this article if strict application of the provisions therein would result in an unjustifiable delay in study progress.

Article 9 Compensation and validity period of test results

1. For all subject areas of the module, there are 2 standard opportunities per year for the student to participate, even if the 2nd standard instance falls outside the quarter dates.

2. If a module has not been completed with a pass, the following rules apply to the validity period of test results for all modules from the BME bachelor's programme:
   a. All partial results have unlimited validity, provided that:
      - The weighted average of the subject areas is at least 5.0 (NB: the project is not a subject area);
      - The project has been successfully completed.

   Missing grades or items are counted as a 1.0. An internal assessment requirement applies for certain subjects. If you do not meet the internal assessment requirement, but have participated in all compulsory components, the sub-grades will be included in your weighted average. The module is only passed, and ECTS are only awarded, once all components of the module have been completed.
   b. Partial results that do not meet the above requirements will expire at the end of the academic year.

   c. In all other cases, the student can submit a request to the Examination Board to extend the validity of test results.

3. A compensated five for a TOM module is a final grade for a subject area of less than 5.5, but at least 4.5, while the unrounded weighted final grade for the module is 5.5 or higher and, according to the rules of the module in question, the module has not been passed. The compensated five can only be applied if there is only one failed subject within the module that meets the previous rule. Students can only make use of this scheme once per bachelor year, for one module.

4. During the module assessment meeting (grade meeting), the examiners (the lecturers and the module coordinator) may determine, in individual cases, whether a student may compensate the module within the current academic year. The marks obtained within the module and possible circumstances are taken into account.

Article 10 (Binding) Education Recommendation

1. At the end of their first year of registration for the degree programme, every student is given a definitive written recommendation about the continuation of their studies within the degree programme, subject to Article 6.4 of the General section of the OER (Discontinuation of the educational programme). This recommendation is based on the student's study results and can be a positive or negative recommendation, with due observance of Articles 6.4 and 6.5 of the General section of the OER.

2. Positive definitive education recommendation as referred to in Article 6.3 (1) of the General section of the OER can be issued to students who:
    - Has successfully completed at least 75%, 45 ECTS, of the study load in the first year of study. This includes results from module components that are valid for longer than the current academic year (see Article 8 (2a)).
    - Have completed at least 3 of the 4 mathematics components from the first year of the bachelor's program with a pass (≥ 5.5). These mathematics components cannot be compensated in the same way as subject areas.

3. A negative definitive education recommendation as referred to in Article 6.3 (1) of the General part of the OER can be issued to students who do not meet the requirements stated in paragraph 2 of this article (10).

Article 11 Quality assurance

The quality of education is systematically monitored according to the Plan-Do-Check-Act (PDCA) cycle. The quality assurance system is described in the BMT/BME Quality Assurance Manual[1] and consists of two parts:

1. The organisation of the faculty with all actors who play a role in the management, organisation, development and execution of the study programme. Through a clear division of tasks and responsibilities and mutual coordination, the actors jointly ensure a high-quality study programme.

2. The evaluation system that monitors the quality of the study programme and provides the actors with information on the quality and is therefore aimed at educational development and continuous quality improvement. Furthermore, the evaluation system also provides information for external accountability about the study programme to bodies within the university (such as the Faculty Council, the dean, the University Council and the Executive Board) and outside the university (the Ministry, the Education Inspectorate, review committees and accreditation bodies).

A complaints procedure for students forms part of the quality assurance provisions.

Article 12 Transition arrangement

1. If the study programme included in article 7 of this supplement is amended or if one of the articles in the general section or in this programme-specific supplement is amended, the programme will draw up and publish a transitional arrangement.

1. The conditions for such transitional arrangements are stipulated in article 8.4 of the general section.

2. The transitional arrangements are published on the website of the Biomedical Technology programme.

[1] The Quality Assurance Manual can be found on the OKC's Canvas page.

Article 13 Safety

Working in a laboratory is subject to certain safety requirements. Students are obligated to inform themselves of these rules[2] and comply with them. To be allowed to work in a laboratory, the student must actually be registered as a student at the UT.

Article 14 Student counselling

1. The programme director will appoint a student adviser. The student adviser's job is, on the one hand, to advise and guide individual students regarding all aspects of their studies and, on the other hand, to inform the programme director regarding the students' study progress.

2. The student advisor actively maintains contact with students with a study speed lower than 75% of the nominal speed of 60 ECTS per year.

3. During the first, second and third years of study, the student adviser monitors the progress made by the students assigned to them and offers them solicited and unsolicited advice.

4. The student adviser provides solicited and unsolicited advice to the examination board regarding decisions that affect individual students; in doing so, the student adviser and the examination board will treat any information provided to them by the students confidentially.

Article 15 Amendments

In the event of amendments to the programme supplement, the provisions of articles 8.3 and 8.4 of the general section shall apply.

Article 16 Entry into force

This programme-specific supplement will enter into force on 1 September 2021 and replaces the regulations of 26 October 2020.

Adopted by the TNW Faculty Board after having obtained advice from the BME Programme Committee, with the approval of the TNW Faculty Council with Articles 8 and 10 and the approval of the BME Programme Committee with Articles 3, 7, 11, 13 and 13.

Enschede, 21 July 2021

[2] See the "Health & Safety and Environmental Regulations" ("Arbo- en Milieureglement") at http://www.tnw.utwente.nl/intra/diensten/amh/ and the TNW laboratory practice group information at http://www.tnw.utwente.nl/onderwijs_overig/practica/.