

**Assessment plan for the curriculum of the
Bachelor's degree programme
in
Biomedical Engineering
Curriculum 2024/2025**

Programme director: Prof. dr. ir. Erik van de Giessen

Date advice Board of Examiners: 11 June 2024

Date approval Faculty Board:

1. Vision on assessment

1. Assessment should evaluate the students ability to apply knowledge, make judgments, and communicate in a professional way (both written and oral) with the aim to increase the quality of medical care and to decrease the cost and manpower, necessary for providing health care nowadays.
2. Assessment should enable qualification of a student to work in med-tech companies and (non-) academic hospitals
3. Assessment should enable qualification of a student to work in academic institutions to perform scientific research to new technologies that will contribute to more efficient health care and high quality of life
4. *Assessment as learning*: Assessment is part of the learning process to provide students feedback in their learning process.
 - a. Assessment involves both feedback and summative assessment.
 - b. Assessment is contextualized: this means that students receive feedback or are tested in practical context-rich assignments as much as possible.
 - c. Learning and developing competencies is often team-based. Peers as well as teachers and/or professional from the field are needed as a mirror, to conduct a discussion, develop new insights and to ask critical questions.
 - d. Problem solving and coping with problem solving tasks is seen as the core of the learning process.
5. Assessment should enable the evaluation of learning outcomes.

2. Assessment guidelines

1. Summative and formative assessment should be balanced in order to avoid “assessment steers learning” and to stimulate internal motivation.
2. Formative assessment is primarily intended to provide feedback about the learning process and progress.
3. Written and oral deliverables should receive extensive feedback from the available staff. In case staff is unable to deliver this feedback, the use of such deliverables should be reconsidered.
4. Group projects/assignments allow for self-reflection and for intergroup summative assessment. Both of these enrich the academic learning process.

3. Learning outcomes of the degree programme

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.

4. Overview of assessment methods, test moments for course units, and examiners

Year	Period	Course	EC	Assessment method(s) *	Does (part of the) assessment have a formative function?	Test moment(s)	First examiner	Second examiner
1	1a	Calculus 1 (for BME)	5	AST, IT, WE	AST	final exam, assignments	dr. W.P. (Wim) Krijnen	dr.ir. R. (Roel) Luppens
1	1a	Principles of Design Engineering	5	PR, P, R	PR, P	report, presentation	dr. Ir. C.C. (Charissa) Roossien	dr. Ir. R. (René) Fluit
1	1b	Anatomy and Physiology	5	AST, P, WE/MC	PR	final exam, presentation	dr. T.G. (Theo) van Kooten	C. (Cyril) Luman, MSc. and dr. T.M. (Tim) Valk
1	1b	Biomechanics	5	AST, WE	AST	continuous, final exam, presentation, assignment	dr. A. (Andrea) Giuntoli	dr. P.K. (Prashant) Sharma
1	1b	Material Science	5	AST, WC	AST	final exam, assignment	dr. P.K. (Prashant) Sharma	dr. P. (Patrick) van Rijn
1	2a	Molecules of Life for BME	5	AST, WE	AST	final exam and assignment	dr. M.M. (Michael) Lerch	dr. C. (Clemens) Mayer
1	2a	Physics Lab for BME	3	PR, R, WE	PR	continuous PR, final exam	dr. M. (Mattia) Fontana	dr. J. (Jelmer) Sjollema
1	2a	Ethics 1: Philosophy of Science and Scientific Integrity	2	AST, MC, P	AST, P	final exam, presentation	dr. G. (Gorazd) Andrejc	prof. dr. C. (Christoph) Jedan
1	2a	Statistics 1 for BME	5	AST, P, WE/MC	AST, P	continuous assignments, final exam, presentation	dr. B.W. (Brandon) Peterson	dr. J. (Jelmer) Sjollema
1	2b	Biomaterials 1	5	AST, P, MC	P, AST	final exam, presentation	dr. P. (Patrick) van Rijn	dr. P.K. (Prashant) Sharma
1	2b	Linear Algebra for BME	5	AST, WE	AST	final exam	dr. P.M.J. (Pieter) Tibboel **	prof. dr. S. (Stephan) Trenn
1	2b	Microbiology	5	AST, PR, R, WE	AST, PR	final exam, assignment continuous	dr. B.W. (Brandon) Peterson	dr. ir. G. (Girbe) Buist
1	2b	Safe Microbiological Techniques	5	PR	PR	practical test	dr. B.W. (Brandon) Peterson	dr. ir. G. (Girbe) Buist
2	1a	Mathematical Tools for BME	5	IT, WE	IT	mid-term, final exam	prof. dr. C. (Cagri) Karakurt	dr. P.M.J. (Pieter) Tibboel
2	1a	Python and Numerical Methods	5	AST	AST	continuous	dr. J. (Jelle) Aalbers	dr. J.W.A. (Jan-Willem) Brijan
2	1b	Designing Biomedical Products 2	4	PR, P, R	PR, P, GA	continuous, report, presentation	dr. Ir. R. (René) Fluit	dr. Ir. C.C. (Charissa) Roossien
2	1b	Ethics 2: Biomedical Ethics	1	MC	-	final exam	dr. G. (Gorazd) Andrejc	prof. dr. C. (Christoph) Jedan
2	1b	Electricity and Magnetism	5	P, WE/MC	P	tutorial quiz, final exam, presentation	dr. M. (Myroslav) Kavatsyuk	prof. dr. N. (Nasser) Kalantar-Nayestanaki
2	1b	Thermodynamics	5	MC/WE	-	final exam	dr. W.L.J. (Wouter) Hinrichs	prof. dr. H.W. (Henderik Willem) Frijlink
2	2a	Physics and Technology of Medical Imaging	5	MC	-	final exam	dr. M.J.W. (Marcel) Greuter	Ir. A.L.J. (Arjen) van Hulzen
2	2a	Waves and Optics for BME	5	AST, MC, P, PR, R	AST, P, LT	continuous assignment, final exam	dr. ing. S. (Somayeh) Asadi	prof. dr. W.H. (Wouter) Roos
2	2b	Biological Physics	5	R, WE	-	final exam, report	prof. dr. P.C.A. (Patrick) van der Wel	prof. dr. W.H. (Wouter) Roos
2	2b	Biomedical Image Processing	5	MC, R	-	final exam, report	dr. ir. P.M.A. (Peter) van Ooijen	dr. J.B.C. (Jan Bernard) Marsman
2	2b	Imaging Laboratory 1	5	PR, OR, R	PR	final exam, reports mid and end of the course	dr. M.J.W. (Marcel) Greuter	dr. A.T.M. (Antoon) Willemsen

* Assessment method: Written exam (WE), Multiple-choice exam (MC), Oral exam (OR), Report (R), Interim Test (IT), Assignment (AST), Practical work (PR), Presentation (P).

** Will be replaced with another coordinator at the start of the academic year

Overview continued.

Year	Period	Course	EC	Assessment method(s) *	Does (part of the) assessment have a formative function?*	Test moment(s)	First examiner	Second examiner
2	2b	Lab course Biomaterials	5	OR, PR, R	PR	continuous	dr. P. (Patrick) van Rijn	dr. P.K. (Prashant) Sharma
2	2b	Surface characterization	5	P, WE	P or AST	final exam and presentation	prof. dr. R. (Romana) Schirhagl	dr. J. (Jelmer) Sjollema
2	2b	Transport in Biological Systems	5	AST, WE	AST	final exam and assignment	dr. Ir. R (René) Fluit	dr. ir. P.D. (Pablo) Druetta
3	1a	Applied Medical Visualization	5	MC, R	-	continuous , final exam, presentation	dr. ir. P.M.A. (Peter) van Ooijen	dr. L.V. (Sanne) van Dijk
3	1a	Biofabrication	5	MC, P, WE	P	final exam, presentation	dr. P.K. (Prashant) Sharma	dr. J. (Joep) Kraeima
3	1a	Biomedical Instrumentation	5	WE, P	-	final exam	prof. dr. R. (Romana) Schirhagl	prof. dr. ir. N.M. (Natasha) Maurits
3	1a	Designing Biomedical Products 3	5	PR, R, P	ASM, P, GA	continuous, report, presentation, assignment	dr. Ir. C.C. (Charissa) Roossien	dr. Ir. R (René) Fluit
3	1a	Microscopy and Imaging		WE, P	P	final exam and presentation	prof. dr. R. (Romana) Schirhagl	dr. B.W. (Brandon) Peterson
3	1a	Polymeric Materials for Biomedical Applications	5	R, WE	PR	final exam, report	prof. dr. M.M.G. (Marleen) Kamperman	dr. D. (Dina) Maniar
3	1b	Research course Biomedical Engineering	9	PR, P, R	PR, P, R	final presentation	dr. M.A. (Mohammed Ali) Shahbazi	prof. dr. H.A. (Hélder) Santos
3	1b	Ethics 3: Research Ethics	1	MC, AST	-	final exam	dr. G. (Gorazd) Andrejc	prof. dr. C. (Christoph) Jedan
3	2a	Biomedical Sensors	5	WE	P, GA	continuous , final exam, presentation	prof. dr. A.G.P. (Ajay) Kottapalli	dr. E. (Elisabeth) Wilhelm
3	2a	Electronics	5	AST, PR, WE	-	final exam	prof. dr. G. (George) Palasantzas	prof. dr. ir. B.J. (Bart) Kooi
3	2a	Imaging Laboratory 2	5	AST, OR, R	AST	final exam, reports mid and end of the course	dr. M.J.W. (Marcel) Greuter	dr. A.T.M. (Antoon) Willemsen
3	2a	Physicochemical Concepts in Bionanotechnology	5	IT, WE, P	AST, GA	final exam and assignment	dr. J. (Jelmer) Sjollema	dr. P.K. (Prashant) Sharma
3	2a	Tissue Engineering and Regenerative Medicine	5	MC, WE, P	P	final exam and presentation	dr. A.M. (Sandra) Smink	dr. T.G. (Theo) van Kooten
3	2b	Bachelor's Project Biomedical Engineering	15	PR, P, R	PR, P	final report and final presentation	prof. dr. ir. E. (Erik) van der Giessen	<i>Examiners for the project are chosen with the subject</i>

Courses organized by other programmes

1	1a	Mammalian Cell Biology	5	MC, WE, AST	AST	final exam, assignment continuous	prof. Dr. G. (Geert) van den Bogaart	dr. R. (Rifka) Vlijm
2	1a	Dynamics and Vibrations	5	WE	-	final exam	prof. dr. M. (Maryam) GhandchiTehrani	prof. dr. ir. E. van der Giessen
2	2a	Signals & Systems	5	IT, WE	-	final exam	dr. S. (Saeed) Ahmed	prof. dr. ir. J.M.A. (Jacqueline) Scherpen

BME course not given in 2024-2025 (will return in curriculum in 2025-2026)

3	1b	Cell Biology and Immunology	5	R, WE	-	final exam and report	dr. T.G. (Theo) van Kooten	dr. J. (Jelmer) Sjollema
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* Assessment method: Written exam (WE), Multiple-choice exam (MC), Oral exam (OR), Report (R), Interim Test (IT), Assignment (AST), Practical work (PR), Presentation (P).

5. Relationship between course units and details of the learning outcomes

Relationship between course units and learning outcomes of the programme, given per year, divided into periods. An X in the table indicate that the learning outcome is explicitly assessed in the course. Courses indicated in *Italic* are compulsory elective courses or deepening minor courses.

[illegible]

Year 2	Period	1a			1b				2a			2b					
	Courses	Mathematical Tools for BME	Python and Numerical Methods	Dynamics and Vibrations	Designing Biomedical Products 2	Electricity and Magnetism	Ethics 2: Biomedical Ethics	Thermodynamics	Physics and Technology of Medical Imaging	Signals and Systems	Waves and Optics for BME	Biological Physics	Image Processing	Imaging Laboratory 1	Lab course Biomaterials	Surface characterization	Transport in Biological Systems
Learning outcomes																	
A. Knowledge																	
A1: math, biology, physics, (bio)chem, anatomy, physiology, engineering		X		X		X		X	X	X	X	X				X	X
A2: models and methods used in these fields, including computer-aided methods			X	X	X				X	X		X	X				
A3: learning methods necessary to follow developments. Prepare for lifelong learning and Masters.		X			X			X			X				X		
B. Application of knowledge																	
B1: apply knowledge for design of new solutions to biomedical problems					X			X								X	
B2: perform measurements on biological systems and are able to interpret the data			X					X			X					X	
B3: critically formulate the relevant questions, choose or propose appropriate methods, procedures and/or systems.					X					X	X		X	X	X		
C. Decision making																	
C1: key aspects of professional, ethical and societal responsibilities							X										
C2: reflect on professional, ethical and social responsibilities							X										
D. Communication																	
D1: understanding of functioning methods of multidisciplinary teams					X						X						
D2: familiar with the established methods/tools of communication and their limitations																	
D3: effectively, clearly and unambiguously communicate their findings/results in a multidisciplinary setting					X	X					X				X	X	

Year 3	Period	1 a (minor)					1b			2a					2b
Courses	<i>Applied Medical Visualization</i>	<i>Biofabrication</i>	<i>Biomedical Instrumentation</i>	<i>Designing Biomedical Products 3</i>	<i>Microscopy and Imaging</i>	<i>Polymeric Materials for Biomedical Applications</i>	<i>(Cell Biology and Immunology) *</i>	<i>Ethics 3: Research Ethics</i>	<i>Research course Biomedical Engineering</i>	<i>Electronics</i>	<i>Tissue Engineering and Regenerative Medicine</i>	<i>Biomedical Sensors</i>	<i>Imaging Laboratory 2</i>	<i>Physicochemical Concepts in Bionanotechnology</i>	<i>Bachelor's Project Biomedical Engineering</i>
Learning outcomes															
A. Knowledge															
A1: math, biology, physics, (bio)chem, anatomy, physiology, engineering						X	X					X		X	X
A2: models and methods used in these fields, including computer-aided methods	X		X							X		X	X	X	X
A3: learning methods necessary to follow developments. Prepare for lifelong learning and Masters.									X	X					X
B. Application of knowledge															
B1: apply knowledge for design of new solutions to biomedical problems			X	X		X					X				
B2: perform measurements on biological systems and are able to interpret the data			X												
B3: critically formulate the relevant questions, choose or propose appropriate methods, procedures and/or systems.	X	X		X					X						
C. Decision making															
C1: key aspects of professional, ethical and societal responsibilities				X				X							X
C2: reflect on professional, ethical and social responsibilities							X	X							X
D. Communication															
D1: understanding of functioning methods of multidisciplinary teams				X					X		X	X			X
D2: familiar with the established methods/tools of communication and their limitations				X											
D3: effectively, clearly and unambiguously communicate their findings/results in a multidisciplinary setting		X		X			X		X						X

* Cell Biology and Immunology course will return in the curriculum of 2025-2026.

6. Project examiners list

Below the project examiners are listed with their expertise. These examiners are no courses examiners (see paragraph 1), but are involved as a teacher in the bachelor's or master's programme, or are previous course coordinators of bachelor's or master's programme courses, are mentor in the master's programme, are an examiner/lecturer from another programme, or are experts in their files and have been supervising project in previous years.

A Bachelor's research project will always have 2 examiners, of which one has to be a BME examiner. A BME examiner is always a course examiner involved in one of the Biomedical Engineering programmes. The BME examiner of a project has the responsibility to check the Biomedical Engineering content of the project application.

Project examiner	Department/Expertise
dr. M.I. (Monica) Acuautila Menese	UG - Mechatronic engineering, Piezoelectric materials, Micro/Nano Electro Mechanical Systems (MEMS/NEMS), Flexible electronics, Sensors (piezoelectric, gas)
dr. ir. G. (Gloria) Araiza Illan	UG - Human-robot interaction, haptics
dr. ir. P. (Paul) Baron	UMCG - MRI Physics researcher
prof. dr. ir. D. (Deniz) Baskent	UMCG - dB-SPL Lab, Department of Otorhinolaryngology
prof. dr. R.M.F. (Rolf) Berger	UMCG - Pediatrics
dr. F. (Frans) Bianchi	UG - Biochemistry & Molecular Biology
prof. dr. H.J.G. (Henk) Bilo	UMCG - Internist
prof. dr. G.H. (Truuske) de Bock	UMCG - Oncological Epidemiology
dr. R.P.H. (Reinoud) Bokkers	UMCG - Intervention radiologist
dr. R.J.H. (Ronald) Borra	UMCG - Imaging/MRI
prof. dr. S. (Stefan) Both	UMCG - Radiology Oncology
prof. dr. R. (Raffaella) Carloni	UG - Robotics Lab
dr. B. (Bart) Cornelissen	UMCG - Basic and translational Research and Imaging methodology Development
dr. B. (Branislava) Curcic-Blake	UMCG - Neuroimaging
dr. K. (Kevin) Damman	UMCG - Cardiology
prof. dr. P. (Pim) van Dijk	UMCG - Audiology, Tinnitus, Biophysics of Hearing
dr. P.R. (Peter) van Dijk	UMCG - Endocrinologist
prof. dr. P.U. (Pieter) Dijkstra	UMCG - Rehabilitation
dr. J.M. (Menno) Douwes	UMCG - Pediatric cardiology
dr. M. (Michiel) Erasmus	UMCG - Cardiothoracic surgery, ex vivo lung and heart perfusion, mechanical heart support, lung surgery and mediastinal surgery
dr. F. (Federica) Fontanella	UMCG - AI in prenatal echography
dr. E.P.C. (Etienne) Gaudrain	UG - Auditory research: Auditory Scene Analysis in Cochlear-Implant users
dr. C. (Christian) Greve	UMCG - Movement science/Beatrixoord
dr. J.M. (Juha) Hijmans	UMCG - Rehabilitation
dr. R.F. Hoffmann	UMCG - cholesteatoma care, cochlear implantation, bone conduction implantation, stapes surgery, tinnitus
dr. M. (Mike) Hogervorst	UMCG - Trauma surgery and spinal surgery
dr. W.M.H. (Willem) Hoogaars	UMCG - (Advanced) Microscopy, Molecular biochemistry, Cell Biology
dr. A. (Anouk) van der Hoorn	UMCG - Radiology, Nuclear Medicine & Medical Imaging
prof. J.H.P. (Han) Houdijk	UMCG - Clinical Movement Sciences
dr. C.V. (Christian) Hulzebos	UMCG - Pediatrics, neonatology
prof. dr. P.C. (Paul) Jutte	UMCG - Orthopedics
dr. Z. (Zeinab) Kamal	UMCG - 3 D lab (Orthopaedic Biomechanics)
dr. ir. E.W. (Erik) Korevaar	UMCG - Medical Physicist Radiation oncology
dr. A.O. (Anastasiia) Krushynska	UG - Mechanics, Mechanical Engineering, Acoustics

Project examiners continued.

Project examiner	Department/Expertise
dr. R. (Roald) Lambrechts	UMCG - Molecular and Cellular Biology
prof. dr. C.J.C. (Claudine) Lamoth	UMCG - Movement Analysis and Smart Technology in Aging
prof. dr. H.G.D. (Henri) Leuvenink	UMCG - Groningen Institute for Organ Transplantation
dr. P. (Peter) van Luijk	UMCG - Damage and Repair in Cancer Development and Cancer Treatment (DARE)
dr. J.B.C. (Jan-Bernard) Marsman	UMCG - Neuroimaging (Advanced fMRI analysis, Combined Eye tracking and fMRI; Eye tracking; Data analysis; Statistics)
prof. dr. ir. N.M. (Natasha) Maurits	UMCG - Neuroengineering
prof. dr. H.C. (Henny) van der Mei	UMCG - BME
dr. V.E. (Vincent) de Meijer	UMCG - HPB and Liver Transplant Surgeon
prof. dr. S. (Sarthak) Misra	UMCG - BME/UT Twente - Surgical Robotics Lab
dr. C. (Cyril) Moers	UMCG -Tansplantation, Organ preservation
dr. T. (Taraneh) Mokabber	UG - Biomaterials Materials Science
dr. A. (Alessio) Murgia	UMCG - Rehabilitation, Neurosciences, BME
prof. dr. W.N. (Maarten) Nijsten	UMCG - Critical Care
prof. dr. P. (Peter) Olinga	UG - Translational Biopharmaceutics
dr. A.R. (Rob) den Otter	UMCG - Neurosciences, Rehabilitation
dr. P. (Pietro) Pisciotta	UMCG - Medical Physicist
dr. R.N. (Nils) Planken	UMC Amsterdam - Cardiovascular imaging
dr. S.J. (Sonja) Pyott	UMCG - Peripheral auditory system, Hearing loss and tinnitus, Neuroscience
dr. L. (Laurens) Reinke	UMCG - WIOO - Simulation Center UMCG
prof. H.A. (Hélder) Santos	UMCG - Biomedical Engineering
dr. R.C.L. (Richte) Schuurmann	UMCG - Surgery
dr. A. (Alina) Sigaeva	UMCG - Free radicals regulation and cell communication
dr. J. (Joyce) van Sluis	UMCG - Imaging (PET)
prof. dr. C.K. (Corry) van der Sluis	UMCG - Rehabilitation Medicine
dr. H. (Hans) Timmerman	UMCG - Anesthesiology
prof. dr. ir. C. (Charalampos) Tsoumpas	Engineering, Biomedical, Nuclear Science & Technology, Radiology, Nuclear Medicine & Medical Imaging
dr. H.C. (Hugo) van der Veen	UMCG - Orthopedic surgery
dr. R.J.K. (Riemer) Vegter	UMCG - Human Movement Science
prof. dr. J.P.P.M. (Jean-Paul) de Vries	UMCG - (Vascular) surgery
dr. R. Wijsman	UMCG - Radiotherapist Oncology
dr. T.P. (Tineke) Willems	UMCG - Cardiovascular Centre
dr. M.K. (Gosia) Włodarczyk-Biegun	UG - Polymer Science
dr. P.J. (Pieter) van der Zaag	UG - Microscopy, Nanoscience & Nanotechnology, Radiology, Nuclear Medicine & Medical Imaging
prof. dr. I.S. (Inge) Zuhorn	UMCG - Nanoscience & Nanotechnology