Appendices to the Teaching and Examination Regulations for the Master's degree programme in Mechanical Engineering (2025-2026)

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Appendix I Learning outcomes of the degree programme (Article 3.1)

After the completion of a master's degree programme in Mechanical Engineering, the graduate is expected to attain the following learning outcomes.

On knowledge and understanding
The graduate**:**

1.1. Has knowledge of the underlying concepts of mechanical engineering, including the necessary physics, mathematics and computer science, at a level that permits admission to a higher level post-graduate programme.
1.2. Is familiar with the quantitative character of mechanical engineering and with the relevant research methods.
1.3. Has operational knowledge and design skills in the field of mechanical engineering.
1.4. Has a thorough understanding of:
   a. advanced instrumentation (for Advanced Instrumentation track).
   b. smart processes, engineering materials and products (for Smart Factories track).
   c. process design for energy systems (for Smart and Green Energy Systems track).
1.5. Has knowledge in the field of business and management.

On the synthesis and application of knowledge and understanding
The graduate:

2.1. Is able to carry out research in order to understand phenomena that are usable in developing mechanical engineering applications.
2.2. Is able to analyse a (new) complex applied problem, and develop a structured and well-planned approach to search for a solution.
2.3. Is able to apply their mechanical engineering knowledge and skills in their own and related subject areas.
2.4. Is able to seek new applications for mechanical engineering concepts.
2.5. Is able to use advanced instrumentation and/or advanced programming tools.
2.6. Is able to apply mechanical engineering concepts in an industrial environment or in an international mechanical engineering research environment.
2.7. Is able to collaborate in a (multi-disciplinary) international research and design team.

On reasoning and judgement
The graduate:

3.1. Is able to obtain relevant information using modern information channels, and interprets this information critically for specific use in mechanical engineering research.
3.2. Judges their and others' actions within a scientific context, taking societal and ethical aspects into account.
3.3. Is able to draw conclusions on the basis of limited or incomplete information, and realizes and formulates the limitations of such conclusions.

On communication skills
The graduate:

4.1. Is able to communicate clearly, verbally and in writing, on their subject and relevant applications, at different levels understandable to experts and non-experts using relevant communication tools.

On learning skills
The graduate:

5.1. Is able to address issues inside as well as outside their main subject area, therefore and thereby gaining new knowledge and skills.
5.2. Is able to familiarize themselves with recent advances in science and engineering and use them in mechanical engineering applications.

Appendix II Tracks/specializations of the degree programme (Article 3.6)

The degree programme has three tracks:

1. Advanced Instrumentation
2. Smart Factories, with two specializations:
    a. Materials for Mechanical Engineering
    b. Robotics, Mechatronics & Smart Systems
3. Smart and Green Energy Systems

Appendix III Content of the degree programme (Article 3.8)

Advanced Instrumentation Track:

Course unit name	**Course code**	**EC TS**	**Entry requirements**
Basic Detection Techniques	WMAS002-05	5	
Introduction to Data Science	WMME027-05	5	
Computational Solid Mechanics	WMME028-05	5	
Advanced Instrumentation and Extreme Environments	WMME006-05	5	
Analysis and Control of Smart Systems	WMIE015-05	5	
Systems Engineering	WMIE021-05	5	
Advanced Mechanical Measurement	WMME035-05	5	
Elective courses		25	
Master Design Project Mechanical Engineering	WMME901-20	20	- 45 ECTS of first year courses of the ME master programme - Completed the Scientific Integrity module (WMME004-00)
Master Research Project Mechanical Engineering	WMME902-40	40	- 45 ECTS of first year courses of the ME master programme - Completed the Scientific Integrity module (WMME004-00)

Smart Factories Track:

Course unit name	Course code	ECTS	Entry requirements
Introduction to Data Science	WMME027-05	5	
Multibody and Non-Linear Dynamics	WMME009-05	5	
Advanced Processing for Complex Materials	WMME007-05	5	
Computational Solid Mechanics	WMME028-05	5	
Analysis and Control of Smart Systems	WMIE015-05	5	
Systems Engineering	WMIE021-05	5	
Advanced Mechanical Measurement	WMME035-05	5	
Elective courses		25	
Master Design Project Mechanical Engineering	WMME901-20	20	- 45 ECTS of first year courses of the ME master programme - Completed the Scientific Integrity module (WMME004-00)
Master Research Project Mechanical Engineering	WMME902-40	40	- 45 ECTS of first year courses of the ME master programme - Completed the Scientific Integrity module (WMME004-00)

Smart and Green Energy Systems Track:

Course unit name	Course code	ECTS	Entry requirements
Electrochemical Systems & Engineering	WMME029-05	5	
Introduction to Data Science	WMME027-05	5	
Computational Solid Mechanics	WMME028-05	5	
Thermodynamics of Energy Conversion	WMME018-05	5	
Advanced Process and Energy Technologies	WMCE012-05	5	
Advanced Mechanical Measurement	WMME035-05	5	
Systems Engineering	WMIE021-05	5	
Elective courses		25	
Master Design Project Mechanical Engineering	WMME901-20	20	- 45 ECTS of first year courses of the ME master programme - Completed the Scientific Integrity module (WMME004-00)
Master Research Project Mechanical Engineering	WMME902-40	40	- 45 ECTS of first year courses of the ME master programme - Completed the Scientific Integrity module (WMME004-00)

The assessment method of the courses can be found in the assessment plan of the degree programme and on ocasys.rug.nl.
The teaching method of the courses can be found on ocasys.rug.nl.

Appendix IV Electives (Article 3.9.1)

Electives for Advanced Instrumentation Track

Course unit name	Course code	ECTS
Advanced Vibration	WMME030-05	5
Multibody and Non-Linear Dynamics	WMME009-05	5
Robotics for IEM	WMIE005-05	5
Space Mission Technology	WBAS003-05*	5
Finite Element Methods and Applications	WMMA051-05	5
Fitting Dynamical Models to Data	WMIE007-05	5
Multiscale Contact Mechanics and Tribology	WMIE011-05	5
Applied Optics	WMME010-05	5
Engineering Design Integration	WMEE029-05	5
Nonlinear Control Systems	WMSC003-05	5
Product Design by the Finite Element Method	WMIE003-05	5
Data-driven Optimization	WMME011-05	5
Medical Imaging Instrumentation	WMME014-05	5
Opto-Mechatronics	WMME015-05	5

* The Bachelor's course WBAS003-05 Space Mission Technology has been deemed of appropriate level for ME Master's students and may therefore be taken as an elective.

Electives for Smart Factories Track

Each specialization has its own set of specialization specific electives. 15 ECTS (out of 25 ECTS) of electives needs to be chosen from the list of electives from one specialization. The remaining 10 ECTS can be chosen from any of the electives within the track.

Electives for the specialization Materials for Mechanical Engineering

Course unit name	Course code	ECTS
Advanced Vibration	WMME030-05	5
Surface Engineering and Coating Technology	WMIE013-05	5
Multiscale Contact Mechanics and Tribology	WMIE011-05	5
Smart Materials for Engineering	WMME021-05	5
Composites and Metamaterials	WMME031-05	5
Fracture of Materials	WMME023-05	5

Electives for the specialization Robotics, Mechatronics & Smart Systems

Course unit name	Course code	ECTS
Advanced Vibration	WMME030-05	5
Bio-signal Processing for Human Machine Interaction	WMBE026-05	5
Robotics for IEM	WMIE005-05	5
Fitting Dynamical Models to Data	WMIE007-05	5
MEMS, NEMS and Nanofabrication	WMIE010-05	5
Engineering Design Integration	WMEE029-05	5
Smart Materials for Engineering	WMME021-05	5
Nonlinear Control Systems	WMSC003-05	5
TinyML: Machine Learning for Embedded Devices	WMME034-05	5
Data-driven Optimization	WMME011-05	5
Opto-Mechatronics	WMME015-05	5

General track electives (not specialization related)

Course unit name	Course code	ECTS
Product Design by the Finite Element Method	WMIE003-05	5
CFD for Engineers	WMCE013-05	5

Electives for Smart and Green Energy Systems Track

Course unit name	Course code	ECTS
Advanced Vibration	WMME030-05	5
Multibody and Non-Linear Dynamics	WMME009-05	5
Finite Element Methods and Applications	WMMA051-05	5
Microfluidics	WMME020-05	5
Photovoltaics Science and Energy	WMCH011-05	5
Surface Engineering and Coating Technology	WMIE013-05	5
Engineering Design Integration	WMEE029-05	5
Hydrogen, Fuels and Electrolysers	WMME019-05	5
Sustainable Electric Energy Storage	WMCH029-05	5
Fuel Cell Systems	WMEE015-05	5
CFD for Engineers	WMCE013-05	5
Sustainable Industrial Practice	WMIE027-05	5

The assessment method of the courses can be found in the assessment plan of the degree programme and on ocasys.rug.nl.
The teaching methods and entry requirements of the courses can be found on ocasys.rug.nl.

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

A student is allowed to start with either the Design Project or the Research Project if at least 45 ECTS of first year courses and the Scientific Integrity module have been passed.

Appendix VI Admission to the degree programme (Articles 2.1A1+2.1B.1)

Holders of the following Bachelor's degrees from research universities in the Netherlands will be admitted to the Master's degree programme:

1. BSc Mechanical Engineering
2. BSc Aerospace Engineering

Holders of the following Bachelor's degrees from the University of Groningen are considered to have sufficient knowledge and skills and will be admitted to the Master's degree programme in Mechanical Engineering on that basis:

1. BSc Industrial Engineering and Management, Production Technology and Logistics specialization including the Mechanical Engineering specialisation package.
   This packages comprises of the following courses:
   a. Dynamics and Vibrations (WBIE054-05)
   b. Numerical Methods (for IEM) (WBIE049-05)
   c. Solid Mechanics (WBIE055-05 or WBPH015-05)
   d. Materials Science and Engineering (WBPH071-05)
   e. Mechatronics (WBIE011-05)
   f. Principles of Measurement Systems (WBPH029-05) or Technical Thermodynamics (WBIE031-05 or WBCE014-05)
2. BSc Applied Physics, including the following courses:
   a. Computer Aided Design and Manufacturing (WBIE033-05)
   b. Solid Mechanics (WBIE055-05 or WBPH015-05)
3. BSc Physics, including the following courses:
   a. Computer Aided Design and Manufacturing (WBIE033-05)
   b. Solid Mechanics (WBIE055-05 or WBPH015-05)
   c. Control Engineering (WBIE034-05 or WMBE024-05)
   d. Numerical Methods (for IEM) (WBIE049-05)
4. BSc Astronomy, including the minor in Instrumentation and the following courses:
   a. Computer Aided Design and Manufacturing (WBIE033-05)
   b. Solid Mechanics (WBIE055-05 or WBPH015-05)
5. BSc Applied Mathematics, including the following courses:
   a. Computer Aided Design and Manufacturing (WBIE033-05)
   b. Solid Mechanics (WBIE055-05 or WBPH015-05)
   c. Mechatronics (WBIE011-05)
   d. Materials Science and Engineering (WBPH071-05),
   e. Technical Thermodynamics (WBIE031-05 or WBCE014-05)
6. BSc Biomedical Engineering, including the following courses:
   a. Computer Aided Design and Manufacturing (WBIE033-05)
   b. Solid Mechanics (WBIE055-05 or WBPH015-05)
   c. Mechatronics (WBIE011-05) or Control Engineering (WBIE034-05 or WBME024-05)

   Additionally for the Smart and Green Energy Systems track:
   d. Fluid Dynamics (WBIE004-05) or Physical Transport Phenomena (WBIE061-05)

Appendix VII Pre-master programmes

1. FSE offers Pre-Master's programmes of *60 EC, 45 EC or 30 EC,* and individually determined Pre-Master's programmes. The overview below shows:
   - which NVAO-accredited HBO diploma grants access to the MSc Mechanical Engineering;
   - The content and student workload for these fixed programmes.

   a. Bachelor Mechanical Engineering/Werktuigbouwkunde (croho 34280)
   b. Bachelor Electrical Engineering/Elektrotechniek (croho 34267)

Premaster for the Advanced Instrumentation or Smart Factories track

Semester	Course Title	Course Code	ECTS
1a	Calculus 1 (for IEM) (WBIE003-05)	WBIE059-10	5
1a	Numerical Methods (for IEM))	WBIE049-05	5
1b	Solid Mechanics (for IEM)	WBIE055-05	5
1b	Linear Algebra (for IEM)	WBIE009-05	5
1b	Materials Science and Engineering	WBPH071-05	5
2a	Calculus 2 (for IEM)	WBIE017-05	5
2a	Signals and Systems	WBIE030-05	5
2b	Literature Thesis ME	WBIE056-05	5
2b	Control Engineering	WBIE034-05	5
Total			45

Premaster for the Smart and Green Energy Systems track

Semester	Course Title	Course Code	ECTS
1a	Calculus 1 (for IEM) (WBIE003-05)	WBIE059-10	5
1a	Numerical Methods (for IEM))	WBIE049-05	5
1b	Solid Mechanics (for IEM)	WBIE055-05	5
1b	Linear Algebra (for IEM)	WBIE009-05	5
2a	Technical Thermodynamics (IEM)	WBIE031-05	5
2a	Calculus 2 (for IEM)	WBIE017-05	5
2a	Signals and Systems	WBIE030-05	5
2b	Literature Thesis ME	WBIE056-05	5
2b	Physical Transport Phenomena	WBIE061-05	5
Total			45

   - Starting date 1 September

2. For HBO programmes not listed above, the Board of Admissions decides:
   a. The content and the student workload of a tailor-made Pre-Master's programme.
      or
   b. Admission is not accepted.

The starting dates of the tailor-made programmes can be either 1 September or 1 February, depending on the selection of courses.

Appendix VIII Transitional provisions (Article 7.1)

The transitional arrangement is an arrangement that students can use if they wish to replace a course that is part of their Teaching and Examination Regulations, but either no longer exists or has been changed to a different course in a later set of Teaching and Examination Regulations. In some cases, an arrangement can consist of multiple courses. If a transition is not in the list of transitional arrangements, students will need permission of the Board of Examiners first.

Discontinued course units				**Substitute course units**				
Course unit code	*Course unit name*	*ECTS*	*Final exam period*	*Course unit code*	*Course unit name*	*ECTS*	*Explanation*	*Equivalent Yes/No*
WMIE029-05	Engineering Design Integration	5	2024-2025	WMEE029-05	Engineering Design Integration	5	Course will fall under the responsibility of the EES programme from this academic year onwards.	Yes

Appendix IX Additional requirements open degree programmes (Article 5.6)

Open degree programme

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.