Appendices to the Teaching and Examination Regulations for the Master's degree programme(s) in Mechanical Engineering (2024-2025)

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 his/her mechanical engineering knowledge and skills in his/her 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 his/her 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 his/her 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 his/her main subject area, therefore and thereby gaining new knowledge and skills.
5.2. Is able to familiarize him/herself 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	ECTS	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	
Experimental Design	WMME012-05	5	
Course in Business, Management and Society	Various	5	
Elective courses		25	
Master Design Project Mechanical Engineering	WMME901-20	20	Passed 45 ECTS of first year courses of the ME master programme
Master Research Project Mechanical Engineering	WMME902-40	40	Passed 45 ECTS of first year courses of the ME master programme

Smart Factories Track:

Course unit name	Course code	ECTS	Entry requirements
Introduction to Data Science	WMME027-05	5	
Robotics for IEM	WMIE005-05	5	
Advanced Processing for Complex Materials	WMME007-05	5	
Computational Solid Mechanics	WMME028-05	5	
Analysis and Control of Smart Systems	WMIE015-05	5	
Experimental Design	WMME012-05	5	
Course in Business, Management and Society	Various	5	
Elective courses		25	
Master Design Project Mechanical Engineering	WMME901-20	20	Passed 45 ECTS of first year courses of the ME master programme
Master Research Project Mechanical Engineering	WMME902-40	40	Passed 45 ECTS of first year courses of the ME master programme

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	
Experimental Design	WMME012-05	5	
Course in Business, Management and Society	Various	5	
Elective courses		25	
Master Design Project Mechanical Engineering	WMME901-20	20	Passed 45 ECTS of first year courses of the ME master programme
Master Research Project Mechanical Engineering	WMME902-40	40	Passed 45 ECTS of first year courses of the ME master programme

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.

Courses in Business, Management and Society

Course unit name	Course code	ECTS
Technology Based Entrepreneurship	WMIE006-05	5
Global Change	WMEE008-05	5
Sustainable Industrial Practice	WMIE027-05	5
Sustainable Society	WMEE020-05	5
Technology and the Ethics of Research	WMBE018-05	5

Joint project options for obtaining a master's degree in a closely related programme:

Course unit name	Course code	ECTS	Entry requirements
Master Research Project IEM-ME*	WMIE903-55	55	- Passed 45 ECTS of first year courses of both the IEM and ME master programmes; - Passed Research Methodology (IEM).
Master Design Project IEM**	WMIE901-25	25	- Passed 45 ECTS of first year courses of both the IEM and ME master programmes; - Passed Research Methodology (IEM).
Master's Research Project ME-EES***	WMEE909-50	50	- Passed 45 ECTS of first year courses of the ME master programme

* The joint Master Research Project IEM-ME is available only to students enrolled in both the ME and IEM master programmes. This joint project replaces, and cannot be combined with, the regular Research Projects in both programmes.
** The IEM Design Project is available to students enrolled in both the ME and IEM master programmes. This project may substitute, or be followed in addition to, the Master Design Project ME.
*** The joint Master Research Project ME-EES is available only to students enrolled in both the ME and EES master programmes. This joint project replaces, and cannot be combined with, the regular ME Research Projects. For the entry requirements of EES, check the EES TER appendices.

Appendix IV Electives (Article 3.9.1)

Electives for Advanced Instrumentation Track

Course unit name	Course code	ECTS
Advanced Mechanical Dynamic Measurement	WMME035-05	5
Multibody and Nonlinear Dynamics	WMME009-05	5
Robotics for IEM	WMIE005-05	5
Space Mission Technology	WBAS003-05	5
Advanced Detection Techniques	WMME005-05	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
Advanced Vibration	WMME030-05	5
Applied Optics	WMME010-05	5
Engineering Design Integration	WMIE029-05	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
Systems Engineering	WMIE021-05	5

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 Mechanical Dynamic Measurement	WMME035-05	5
Multibody and Non-Linear Dynamics	WMME009-05	5
Finite Element Methods and Applications	WMMA051-05	5
Multiscale Contact Mechanics and Tribology	WMIE011-05	5
Surface Engineering and Coating Technology	WMIE013-05	5
Advanced Polymer Processing	WMCE006-05	5
Advanced Vibration	WMME030-05	5
Smart Materials for Engineering	WMME021-05	5
Composites and Metamaterials	WMME031-05	5
Fracture of Materials	WMME023-05	5

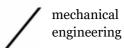Electives for the specialization Robotics, Mechatronics & Smart Systems

Course unit name	Course code	ECTS
Advanced Mechanical Dynamic Measurement	WMME035-05	5
Bio-signal Processing for Human Machine Interaction	WMBE026-05	5
Multibody and Non-Linear Dynamics	WMME009-05	5
Fitting Dynamical Models to Data	WMIE007-05	5
MEMS, NEMS and Nanofabrication	WMIE010-05	5
Advanced Vibration	WMME030-05	5
Nonlinear Control Systems	WMSC003-05	5
TinyML: Machine Learning for Embedded Devices	WMME034-05	5
Smart Materials for Engineering	WMME021-05	5
Data-driven Optimization	WMME011-05	5
Opto-Mechatronics	WMME015-05	5
Systems Engineering	WMIE021-05	5

General track electives (not specialization related)

Course unit name	Course code	ECTS
Basic Detection Techniques	WMAS002-05	5
Engineering Design Integration	WMIE029-05	5
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
Interfacial Engineering	WMCE003-05	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
Advanced Vibration	WMME030-05	5
Engineering Design Integration	WMIE029-05	5
Hydrogen, Fuels and Electrolysers	WMME019-05	5
Sustainable Electric Energy Storage	WMCH029-05	5
Capita Selecta in Ocean Energy	WMME033-05	5
Fuel Cell Systems	WMEE015-05	5
CFD for Engineers	WMCE013-05	5
Systems Engineering	WMIE021-05	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 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:
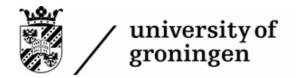1. BSc Mechanical Engineering
2. BSc Aerospace Engineering

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:
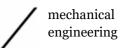1. BSc Industrial Engineering and Management, Production Technology and Logistics specialization including the Mechanical Engineering specialisation package.
   This packages comprises of the following courses:
   a. Dynamics and Vibrations (WBIE054-05)
   b. Numerical Methods (for IEM) (WBIE049-05)
   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 (WBIE011-05 or WBME024-05)
   d. Numerical Methods (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)

Appendix VII 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*
WMAS025-05	Space Mission Technology (for ME)	5	2023-2024	WBAS003-05	Space Mission Technology	5	Administrative course code change	Yes
WMMA020-05	Modeling and Control of Complex Nonlinear Engineering Systems	5	2023-2024	WMSC003-05	Nonlinear Control Systems	5	Name change of the course	Yes

Appendix VIII 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.