Appendix Master degree programme Chemical Engineering

Appendix I Learning outcomes of the degree programme (art. 3.1)

The objectives of the master's degree programme Chemical Engineering are:

- to prepare students for an independent professional career; in this context this means being able to carry out fundamental or applied scientific research, as well as applying state of the art scientific variety of new practical situations,
- to make students develop skills, knowledge and insight in a specialization area of the field of study, with a focus on insight in and approach to scientific problems,
- to make students develop the ability to clearly and concisely communicate the acquired knowledge to others.

The objectives of the programme result in the following learning outcomes

A. General academic skills for the master's degree programme Chemical Engineering

The graduate

A1. is able to keep up with and make use of professional literature in relevant subfields,
A2. is able to make himself/herself familiar with a subfield of the own discipline within a reasonable time span,
A3. is able to formulate a research plan based on a global problem description in a subfield of the own discipline,
A4. is able to analyze, interpret using state of the art information, and draw conclusions from research results,
A5. is able to operate effectively in a position in which knowledge and research skills within the field of the own discipline are required,
A6. is able to perform in a multidisciplinary team, transfer knowledge to others, give oral presentations, write a report or internationally accessible scientific article, and take part in a scientific discussion,
A7. is able to design, conduct and evaluate experiments and the necessary checks and balances independently,
A8. is able to relate their own results and conclusions to results already available in the literature,
A9. has sufficient understanding of the role of the own discipline in society to come to a well-considered choice and practice of profession,
A10. has an understanding of the role of their own discipline in a sustainable society.

B. Specific academic knowledge and skills for the master's degree programme Chemical Engineering.

Engineering knowledge and skills: the graduate has acquired specific knowledge and skills in the area of fundamental and applied engineering sciences. More specifically, the graduate:

B1. is able to design a realistic process including specifying the sub-steps, like drawing flow charts, describing equipment and process flows, and calculating the behavior of process equipment; as well as to provide alternatives for these separate steps,
B2. has an understanding of: (i) process-product relations, (ii) ways to minimize byproduct and waste streams, (iii) manufacturing routes for classes of molecules and products.

Academic knowledge and skills in the product and process technology: the graduate is able to design chemical products and the related process based on a multidisciplinary approach (chemical and technological aspects). More specifically, the graduate:

B3. has knowledge on product formulation, specifications, catalytic systems, analytical methods, interactions between components and relevant physical and mechanical methods for the manufacture of chemical or biotechnological products within one of the 'product sectors' bio-based products, industrial catalysis or polymeric products.

B4. is able to design a realistic product and associated process, either focussing on the product within one of the 'product sectors' bio-based products, industrial catalysis or polymeric products, or focussing on the process through advanced process technology. This includes an analysis and design of all sub-steps, including specification of product properties, product flow diagrams, a description of the process and processing equipment, as well as providing alternatives for these steps.

Appendix II Specializations of the degree programme (art. 3.6)

The degree programme has the following specializations:

- Advanced Process Technology
- Bio-based Products and Processes
- Industrial Catalysis
- Polymeric Products
- Renewable Energy

Appendix III Content of degree programme (art. 3.8)

Practicals are defined as lab practicals

Course unit	Code	EC	Prac.	Entry requirements
Research project	WMCE901-45	45	x	Passed 25 ECTS of the compulsory courses of the Master's degree programme of Chemical Engineering, completion of Scientific Integrity and Safety, submitting study programme
Internship	WMCE014-20	20*	x	Passed 25 ECTS of the compulsory courses of the Master's degree programme of Chemical Engineering, completion of Scientific Integrity and Safety, submitting study programme
Scientific Integrity and Safety	WMCE020-00	-		
Processes and Products for a Sustainable Carbon Cycle	WMCE021-05	5		
Catalysis for Engineers	WMCE002-05	5		
Interfacial Engineering	WMCE003-05	5		
Electrochemical Systems and Engineering (ME)	WMME029-05	5		
Polymer Products	WMCE005-05	5		

Advanced Product Engineering	WMCE007-05	5		
One of the specializations in Sustainable Product and Process Technology (packages of 3 electives each) can be chosen: ● Advanced Process Technology ● Bio-based Products ● Industrial Catalysis ● Polymeric Products ● Renewable Energy		15		
Electives**		10		

*The Internship is 20 ECTS and can be extended, before the start of the project, to 25 or 30 ECTS (at the expense of one or two elective course).
** To be chosen from the courses in the specializations or from the list in Appendix IV

Specializations

Students who wish to follow an open program must submit their program for approval including confirmation of the program's coherence and sufficient coverage of the *Eindtermen* of the Masters Chemistry Engineering program.
Students who wish to follow an open program must contact the Programme Director within the first 6 months of their MSc registration, to prepare an application for their program which has to be submitted for approval to the Board of Examiners.
The Board of Examiners will grant the request for an open degree programme where the proposed program:
- covers the Learning Outcomes of the Masters Chemical Engineering program sufficiently
- shows a clear overall coherence.

Advanced Process Technology	**Code**	**ECTS**	**Prac.**	**Entry requirements**
Advanced Process and Energy Technologies	WMCE012-05	5		
Advanced Polymer Processing	WMCE006-05	5		
One of these two courses has to be chosen:				
Product focused Process Design	WMCE011-05	5		
Microfluidics (ME)	WMME020-05	5		

Bio-based Products and Processes	**Code**	**ECTS**	**Prac.**	**Entry requirements**
Food Pharma Products	WMIE008-05	5		
Product Focused Process Design	WMCE011-05	5		
One of these two courses has to be chosen:				
Design of Industrial Catalysts	WMCE009-05	5		
Biocatalysis for Engineers	WMCE015-05	5		

Industrial Catalysis	**Code**	**ECTS**	**Prac.**	**Entry requirements**
Design of Industrial Catalysts	WMCE009-05	5		
Homogeneous Catalysis	WMCE010-05	5		
One of these two courses has to be chosen:				

Biocatalysis for Engineers	WMCE015-05	5		
Engineered Nanomaterials for Industry	WMCE016-05	5		

Polymeric Products	**Code**	**ECTS**	**Prac.**	**Entry requirements**
Circular Polymers	WMCE017-05	5		
Food Pharma Products	WMIE008-05	5		
Advanced Polymer Processing	WMCE006-05	5		

Renewable Energy	**Code**	**ECTS**	**Prac.**	**Entry requirements**
Sustainable Electrical Energy Storage	WMCH029-05	5		
Advanced Process and Energy Technologies	WMCE012-05	5		
One of these three courses has to be chosen:				
Hydrogen, Fuels and Electrolysers (ME)	WMME019-05	5		
Photovoltaics Science and Energy	WMCH011-05	5		
Design of Industrial Catalysts	WMCE009-05	5		

Appendix IV Electives (art. 3.9.1)

Course unit	**Code**	**ECTS**	**Prac.**	**Entry requirements**
Biomaterials 2	WMBE001-05	5		
Advanced Processing for Complex Materials (ME)	WMME007-05	5		
Bioinspired Designer Materials	WMCH009-05	5		
Properties of Functional Materials	WMPH051-05	5		
Analysis and Control of Smart Systems	WMIE015-05	5		
Characterisation of Materials (PH)	WMPH021-05	5		
Compressible Flows	WMCE008-05	5		
Sustainable Energy Supply (FEB)	EBM202A05	5		
CFD for Engineers	WMCE013-05	5		
Management of Product Innovation (FEB)	EBB652B05	5		
Sustainable Industrial Practice (IEM)	WMIE027-05	5		
Advanced LCA for Sustainability (IEM)	WMIE034-05	5		
Electives on individual approval of the Board of Examiners			See course unit	

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

Entry requirements are mentioned in tables appendices III and IV.

Appendix VI Admission to the degree programme (art. 2.1A.1 + art. 2.1B.1)

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 Chemical Engineering on that basis:
- BSc Chemical Engineering

Students with a background in Chemical Engineering or related bachelor's degree programme and interested in pursuing a master's degree programme in Chemical Engineering are encouraged to apply through the Admissions Office of the Faculty of Science and Engineering. The Board of Admissions of Chemistry and Chemical Engineering will then assess the application and decides whether the applicant has sufficient background to register for the programme, possibly after following a bridging premaster's programme.

Appendix VII Transitional provisions (art. 7.1)

For cohort 2023-2024 and earlier

Course	May be replaced with	Info
Bio-based Products(WMCE001-05)	Processes and Products for a Sustainable Carbon Cycle (WMCE021-05)	Name Change

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

N/A