Appendix Bachelor degree programme Chemical Engineering

Appendix I Learning outcomes of the degree programme (Article 1.3.a)

A. Generic learning outcomes – Knowledge

A1. Bachelor's graduates have general knowledge of the foundations and history of mathematics, natural sciences and technology, in particular those of their own discipline.
A2. Bachelor's graduates have mastered the basic concepts of their own discipline to a certain extent and are familiar with the interrelationships of these concepts within their own discipline as well as with other disciplines.
A3. Bachelor's graduates have in-depth knowledge of several current topics within their own discipline.
A4. Bachelor's graduates are familiar with the quantitative character of the fields of mathematics and natural sciences and have an understanding of the methods used in these fields, and particularly within their own discipline, including computer-aided methods.
A5. Bachelor's graduates have sufficient knowledge and understanding of mathematics and natural sciences to successfully complete a follow-up Master's degree programme in their own discipline.
A6. Bachelor's graduates are aware of the societal, ethical and social aspects involved in the fields of mathematics and natural sciences.

B. Generic learning outcomes – Skills

B1. (Research) Bachelor's graduates are able to draw up a research question, design, plan and conduct research and report on it independently with a certain degree of supervision. Bachelor's graduates are able to evaluate the value and limitations of their research and assess its applicability outside their own field.
B2. (Designing) Bachelor's graduates are able to translate a problem, in particular a design problem, into a plan of approach and – taking into account the requirements of the client and/or technical preconditions – find a solution.
B3. (Gathering information) Bachelor's graduates are able to gather relevant information using modern means of communication and to critically interpret this information.
B4. (Collaborating) Bachelor's graduates are able to collaborate in teams (including multidisciplinary teams) on technical-scientific problems.
B5. (Communicating) Bachelor's graduates are able to communicate orally and in writing in academic and professional contexts, with both colleagues and others. They are familiar with the relevant means of communication.
B6. (Reflecting) Bachelor's graduates are able to assess their own actions and those of others in a natural sciences context, bearing in mind the social/societal and ethical aspects.
B7. (Learning skills) Bachelor's graduates are able to apply learning skills that enable them to pursue a follow-up degree and acquire knowledge in new fields with a high level of autonomy.
B8. Additional subject-specific skills are listed in D.

C. Degree programme-specific learning outcomes – Basic Knowledge

The Bachelor's graduate in Chemical Engineering has:

C1. knowledge of the most important fields of i) process technology: physical transport phenomena, chemical reactor engineering, separation methods, and process design, ii) product technology: materials science, design methodology, and processing, and iii) basic aspects of chemistry: inorganic, organic, analytical, physical, and polymer chemistry and biochemistry.
C2. skilled in the use of standard laboratory procedures and in the use of equipment for synthetic and analytical work, necessary background knowledge of Mathematics and Physics,
C3. understanding of the position and role of the discipline within science and society, and also in the international character of the discipline.

The Bachelor's graduate has become familiar with the following key elements of Chemical Engineering:

C4. Important aspects of chemical terminology, nomenclature and conventions.
C5. Numerical and computational skills, including error analysis, understanding of the proper order of magnitude and correct use of units.
C6. The most important types of chemical reactions and their characteristics.
C7. The principles and procedures that are used in the chemical analysis and in the characterization of chemical compounds.
C8. The design of industrial processes, taking into account flow and transfer of matter and energy.
C9. The principles of Thermodynamics and phase diagrams.
C10. Kinetics of various chemical reactions.
C11. Dimensional analysis and its application in various (technological) problems.
C12. Basic knowledge of fluid dynamics and heat and mass transfer and their application in various part of process technology.
C13. Knowledge of equipment that is used in many chemical processes.
C14. The principles of separation methods and their application in industry.
C15. Basic knowledge of industrial chemistry and reactor engineering.
C16. Materials Science with emphasis on structure-property relationships and their application in various areas of Product Technology (production, analysis, etc.).
C17. The principles of production, structure and properties of polymers and the use of these in various types of chemical products.
C18. Basic knowledge of Product Technology.
C19. Thinking in systems that are relevant for industrial chemistry and technology.
C20. The properties of chemicals and the environmental and safety aspects of using them.

D. Degree programme-specific learning outcomes- Skills

The Bachelor's graduate in Chemical Engineering has developed the skills and competences mentioned below.

Chemical Engineering-related cognitive skills and competences

The Bachelor's graduate is:

D1. able to demonstrate and use his/her knowledge and understanding of essential facts, concepts, principles and theories related to the topics, as defined in B, for the (re)design of new chemical processes/products.
D2. able to apply knowledge and understanding to solve basic qualitative and quantitative problems,
D3. skilled in evaluating, interpreting and combining chemical and process/product technological information and data,
D4. able to recognize and implement 'good laboratory practice',
D5. familiar with project work,
D6. able to adopt a professional attitude regarding environmental and safety aspects and possible ethical implications in the context of research, education and industry.
D7. able to work at different levels of abstraction and detail, including system design level,
D8. able to see, where necessary, the importance of other disciplines (interdisciplinary) and their contribution in the design process.

Chemical Engineering-related practical skills

The Bachelor's graduate is:

D9. skilled in the use of standard laboratory procedures and in the use of equipment for synthetic and analytical work,
D10. able to verify chemical properties, to observe and measure events or changes, and to systematically archive and document data,
D11. able to interpret data, obtained from observations and measurements, and relate it to the right theories,
D12. able to assess the risks of laboratory procedures and the use of chemicals,
D13. skilled in the safe handling of chemicals, taking into account physical and chemical properties, including the various specific risks of use, and is also able to act adequately in emergency situations in the laboratory,
D14. able to use IT skills appropriate to the chosen specialization.

Appendix II Majors and Minors in the degree programme (Article 2.1.3)

The degree programme has the following Major(s):
A propaedeutic phase appendix III and a post propaedeutic phase appendix IV.

The degree programme has the following Minor(s):
Students can choose an elective for 5 ECTS, see table for course units.

Appendix III Course units in the propaedeutic phase

- **List of course units; Article 3.1.1**
- **Compulsory order of examinations; Article 8.2**

Practicals are defined as lab practicals

Course unit name	**ECTS**	**Practical**	**Entry requirements**
Calculus for Chemistry and Chemical Engineering	5		
Molecules: Structure, Reactivity, and Function	5	x	
General Chemistry	5		
Organic Chemistry 1	5		
Practical Synthesis and Analysis 1	5	x	
Physical Chemistry 1	5		
Biochemistry	5		
Practical Biochemistry	5	x	
Spectroscopy	5		
Introduction to Process and Product Technology	5		
Inorganic Chemistry	5		
Sustainability Symposium	5		

Appendix IV Course units in the post-propaedeutic phase

- **List of course units; Article 6.1.1**
- **Compulsory order of examinations; Article 8.2**

Course unit	ECTS	Practical	Entry requirements
Technical Thermodynamics	5		
Industrial Organic Chemistry and Catalysis	5		Organic Chemistry 1
Computational Methods in Science and Technology	5		
Single-Phase Reactors	5		
Linear Algebra & Multivariable Calculus for Chemistry	5		
Product Technology	5		
Separation Processes	5		
Science, Ethics, Technology, and Society	5		
Physical Transport Phenomena 1	5		
Macromolecular Chemistry for Chemical Engineering	5		
Practical Macromolecular Chemistry for Chemical Engineering	5	x	Having obtained a minimum grade of "5" for the course Macromolecular Chemistry for Chemical Engineering
General Process Equipment	5		
Multiphase Reactors	5		
Physical Transport Phenomena 2	5		
Control Engineering	5		
Special Process Equipment	5		
Process Design	10		
Chemical Process Development and Design	5		
Electives: courses from bachelor programmes, which must be individually approved by the BoE.	5		See programme-specific appendices of the Teaching and Examination Regulations.
Bachelor Project	15	x	Passed 150 ECTS of the Bachelor's degree programme of Chemical Engineering

Electives

Course unit	ECTS	Practical	Entry requirements
Medicinal Chemistry I	5		
Materials Science and Engineering	5		
Physical Properties of Materials 1	5		
Programming in C/C++ (part I)	5		
Statistics	5		
Structural probes for solid materials	5	x	

Appendix V Entry requirements

(Article 10.2.1)

A. Deficient VWO-diploma

1. The following requirements apply to the entrance examination as defined in Article 7.28.3 of the Act:

Bacheloropleiding *Bachelor's degree programme*	**N+T**	**N+G**	**E+M**	**C+M**
Biologie *Biology*	Biologie	Natuurkunde	Wiskunde A of B Natuurkunde Scheikunde Biologie	Wiskunde A of B Natuurkunde Scheikunde Biologie
Farmacie *Pharmacy*	V	Natuurkunde	Natuurkunde Scheikunde	Wiskunde A of B Natuurkunde Scheikunde
Life Science and Technology **Scheikunde** *Chemistry* **Scheikundige Technologie** *Chemical Engineering*	V	Wiskunde B Natuurkunde	Wiskunde B Natuurkunde Scheikunde	Wiskunde B Natuurkunde Scheikunde
Informatica *Computing Science* **Technische Bedrijfskunde** *Industrial Engineering and Management* **(Technische) Wiskunde** *(Applied) Mathematics*	V	Wiskunde B	Wiskunde B	Wiskunde B
Kunstmatige Intelligentie *Artificial Intelligence*	V	V	V	Wiskunde A of B
(Technische) Natuurkunde *(Applied) Physics* **Sterrenkunde** *Astronomy*	V	Wiskunde B Natuurkunde	Wiskunde B Natuurkunde	Wiskunde B Natuurkunde

2. The Admissions Board of the bachelor programmes of the FSE. will determine whether deficiencies have been compensated satisfactorily.

B. HBO (university of applied science) propaedeutic certificate, other universities

1. The following requirements apply to the entrance examination as defined in Article 7.28.3 of the Act:

Bachelor's degree programme	**Subjects at VWO (pre-university) level**	Requirement: Dutch as a Second Language (programme II) for non-native speakers of Dutch
B Biology	wia or wib + na+sk+bio	Yes
B Pharmacy	wia or wib + na+sk	Yes
B Life Science and Technology	wib+na+sk	Yes
B Computing Science	wib	
B Artificial Intelligence	wia or wib	
B Physics	wib+na	
B Chemistry	wib+na+sk	
B Astronomy	wib+na	
B Mathematics	wib	
B Chemical Engineering	wib+na+sk	
B Industrial Engineering and Management Science	wib	
B Applied Physics	wib+na	
B Applied Mathematics	wib	

wia = Mathematics A; wib = Mathematics B; na = Physics; sk = Chemistry; bio = Biology

2. In addition, candidates are required to be competent in English:

IELTS (Academic)	6.5 - no less than 6.0 on each section
TOEFL IBT (internet-based test)	92 - no less than 21 on each section
TOEFL CBT (computer-based test)	237 - no less than 21 on each section
TOEFL PBT (paper-based test)	580 - no less than 55 on each section
Cambridge English	CAE or CPE Certificate
English language test - University of Groningen Language Centre	Minimum section scores C2 or C1 (one B2 allowed)

3. The Admissions Board of the bachelor's programmes of the FSE will determine whether deficiencies have been compensated satisfactorily.

C. Foreign qualifications (EEA)

1. Any certificate that grants access to a university in a European country will also grant access to Dutch universities.

2. In the entrance examination, as referred to in art. 7.28, paragraph 3 of the Act, per country and educational institution specific training conditions are mentioned. These are standardized. The entrance examination is, in accordance with the Admissions Board Bachelor's programmes FSE, carried out by the Admissions Office. If for a specific diploma no standardisation has taken place then the requirements as formulated for candidates with a HBO (university of applied science) propaedeutic certificate will apply to these candidates in the entrance examination as defined in Article 7.28.3 of the Act (see A).

3. In addition, candidates are required to be competent in English:

IELTS (Academic)	6.5 - no less than 6.0 on each section
TOEFL IBT (internet-based test)	92 - no less than 21 on each section
TOEFL CBT (computer-based test)	237 - no less than 21 on each section
TOEFL PBT (paper-based test)	580 - no less than 55 on each section
Cambridge English	CAE or CPE Certificate
English language test - University of Groningen Language Centre	Minimum section scores C2 or C1 (one B2 allowed)

4. The Admissions Board of the bachelor programmes of the FSE will determine whether deficiencies have been compensated satisfactorily.

D. Foreign qualifications (non-EEA)

1. A non-European certificate that according to NUFFIC and/or NARIC standards is equivalent to a Dutch VWO certificate will grant access to university in the Netherlands.

2. In the entrance examination, as referred to in art. 7.28, paragraph 3 of the Act, per country and educational institution specific training conditions are mentioned. These are standardized. The entrance examination is, in accordance with the Admissions Board Bachelor's programmes FSE, carried out by the Admissions Office. If for a specific diploma no standardisation has taken place then the requirements as formulated for candidates with a HBO (university of applied science) propaedeutic certificate will apply to these candidates in the entrance examination as defined in Article 7.28.3 of the Act (see A).

3. In addition, candidates are required to be competent in English:

IELTS (Academic)	6.5 - no less than 6.0 on each section
TOEFL IBT (internet-based test)	92 - no less than 21 on each section
TOEFL CBT (computer-based test)	237 - no less than 21 on each section
TOEFL PBT (paper-based test)	580 - no less than 55 on each section
Cambridge English	CAE or CPE Certificate

English language test - University of Groningen Language Centre	Minimum section scores C2 or C1 (one B2 allowed)

4. The Admissions Board of the bachelor programmes of the FSE will determine whether deficiencies have been compensated satisfactorily.

E. Entrance examination (Colloquium Doctum)

1. The following requirements apply to the entrance examination as defined in Article 7.29 of the Act:

Degree programme	**Nature and Health VWO level**	**or**	**Nature and Technology VWO level**
B Biology	en, wia or b, sk, bio, na		en, wib, na, sk, bio
B Pharmacy	en, wia or b, sk, bio, na		en, wib, na, sk
B Life Science and Technology	en, wib, sk, bio, na		en, wib, na, sk
B Computing Science	en, wib, sk, bio		en, wib, na, sk
B Artificial Intelligence	en, wia or b, sk, bio		en, wib, na, sk
B Physics	en, wib, sk, bio, na		en, wib, na, sk
B Chemistry	en, wib, sk, bio, na		en, wib, na, sk
B Astronomy	en, wib, sk, bio, na		en, wib, na, sk
B Mathematics	en, wib, sk, bio		en, wib, na, sk
B Chemical Engineering	en, wib, sk, bio, na		en, wib, na, sk
B Industrial Engineering and Management Science	en, wib, sk, bio		en, wib, na, sk
B Applied Physics	en, wib, sk, bio, na		en, wib, na, sk
B Applied Mathematics	en, wib, sk, bio		en, wib, na, sk

en = English; wia = Mathematics A; wib = Mathematics B; na = Physics; sk = Chemistry; bio = Biology

2. In addition, candidates are required to be competent in English:

IELTS (Academic)	6.5 - no less than 6.0 on each section
TOEFL IBT (internet-based test)	92 - no less than 21 on each section
TOEFL CBT (computer-based test)	237 - no less than 21 on each section
TOEFL PBT (paper-based test)	580 - no less than 55 on each section
Cambridge English	CAE or CPE Certificate
English language test - University of Groningen Language Centre	Minimum section scores C2 or C1 (one B2 allowed)

3. The Admissions Board of the bachelor programmes of the FSE will determine whether deficiencies have been compensated satisfactorily.

Appendix VI Clustering of Bachelor's degree programmes Article 4.3.4, Article 4.6.1

Degree programme CROHO code	Name of degree programme	Clustered with CROHO code	Name of degree programme
56286	B Life Science and Technology	56860 56157	B Biology B Pharmacy
56860	B Biology	56286 56157	B Life Science and Technology B Pharmacy
56157	B Pharmacy	56860 56286	B Biology B Life Science and Technology
56980	B Mathematics	56965 50206 56962 50205	B Applied Mathematics B Physics B Applied Physics B Astronomy
56965	B Applied Mathematics	56980 50206 56962 50205	B Mathematics B Physics B Applied Physics B Astronomy
50206	B Physics	56962 50205 56965 56980	B Applied Physics B Astronomy B Applied Mathematics B Mathematics
56962	B Applied Physics	50206 50205 56965 56980	B Physics B Astronomy B Applied Mathematics B Mathematics
50205	B Astronomy	56962 56965 50206 56980	B Applied Physics B Applied Mathematics B Physics B Mathematics
56857	B Chemistry	56960	B Chemical Engineering
56960	B Chemical Engineering	56857	B Chemistry

Appendix VII Admission to the post-propaedeutic phase Article 5.1.1

The following candidates will be admitted to the post-propaedeutic phase:

Students who have been issued a positive study advice from the degree programme in question
Students who have been issued a positive study advice from one of the degree programmes:
- BSc Chemistry

Appendix VIII Contact hours propaedeutic phase Article 2.3

Degree programme year 1	
Structure contact hours	**Number of contact hours per year**
Lectures	264
Tutorial/ practicals/ pc practicals	188/ 330/ 90
Tutoring	8
Supervision during an internship	-
Examinations	52

Appendix IX University Minors of the faculty of Science and Engineering (Article 7.5.1)

1. Neurosciences Minor (taught in English):
   - Neuroscience (15 ECTS)
   - Behavioural Neuroscience (15 ECTS)

   Future Planet Innovation (taught in English):
   - Global Challenges (10 ECTS)
   - Sustainability in perspective (5 ECTS)
   - Sustainable contributions to society (15 ECTS)

   Astronomy through Space and Time Minor (taught in English):
   - The Evolving Universe (5 ECTS)
   - Cosmic Origins (5 ECTS)
   - Astrobiology (5 ECTS)

   Einstein's physics: Space-time and parallel worlds (taught in English):
   - Einstein’s Universe (5 ECTS)
   - Quantum World (5 ECTS)
   - Building blocks of matter (5 ECTS)

2. The Programme Committee for the Bachelor’s degree programmes in Biology and Life Science and Technology also has authority in the field of the Minor “Neurosciences” and/or its course units.

The Programme Committee for the Master's degree programme in Energy and Environmental Sciences also has authority in the field of the Minor "Future Planet Innovation" and/or its course units.

The Programme Committee for the Bachelor's degree programme in Astronomy also has authority in the field of the Minor "Astronomy through Space and Time" and/or its course units.

The Programme Committee for the Bachelor's degree programmes in Physics and Applied Physics also has authority in the field of the Minor "Einstein's physics: Space-time and parallel worlds" and/or its course units.

3. The Board of Examiners for the Bachelor's degree programmes in Biology and Life Science and Technology and the Master's degree programmes in Biology, Ecology and Evolution, Marine Biology and Molecular Biology and Biotechnology also has authority in the field of the Neurosciences Minor and/or its course units.

   The Board of Examiners for the Master's degree programme in Energy and Environmental Sciences also has authority in the field of the "Future Planet Innovation" Minor and/or its course units.

   The Board of Examiners for the Bachelor's degree programme in Astronomy also has authority in the field of the Astronomy through Space and Time Minor and/or its course units.

   The Board of Examiners for the Bachelor's degree programmes in Physics and Applied Physics also has authority in the field of the Physics Minor "Einstein's physics: Space-time and parallel worlds" and/or its course units.

4. These Teaching and Examination Regulations also apply in their entirety to the Minors in Neurosciences, Future Planet Innovation, Astronomy through Space and Time and Einstein's physics: Space-time and parallel worlds and/or their course units.

Appendix X Transitional arrangement (article 12.1)

Transitional arrangement for the Bachelor's/Master's in Chemical Engineering

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*
CHPC-10	First year Symposium for Chemical Engineers	5	Period 1b 2018/19	WPCH17002	Sustainability Symposium	5		Yes
CHOC2-11	Organic Chemistry 2 (for Chemical Engineers)	5	Period 1a 2019-2020	WBCH18002	Industrial Organic Chemistry and Catalysis	5		Yes

* It is also possible to substitute equivalent course units in the other direction. This can apply to students with a large backlog who want to fall under the new TER.