# Appendix Bachelor degree programme Chemical Engineering

## Appendix I Learning outcomes of the Bachelor's degree programme (Article 3.1.1)

**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 their 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 of the degree programme (Article 3.7.4)

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 in appendix IV.

# Appendix III  Course units in the propaedeutic phase

- **List of course units; Article 4.1.1**
- **Compulsory order of examinations; Article 9.3**

Practicals are defined as lab practicals

| **Course unit name** | **ECTS** | **Practical** | **Entry requirements** |
|---|---|---|---|
| Maths for Chemistry and Engineering | 5 | | |
| Molecules: Structure, Reactivity, and Function | 5 | x | |
| Concepts of Chemistry and Engineering | 5 | x | |
| Transport Phenomena | 5 | | |
| Organic Chemistry 1 | 5 | | |
| Practical Synthesis and Analysis 1 | 5 | x | |
| Biochemistry & Biotechnology | 5 | x | |
| Sustainability Projects | 5 | | |
| Physical Chemistry 1 | 5 | | |
| Inorganic Chemistry | 5 | | |
| Spectroscopy | 5 | | |
| Linear Algebra & Multivariable Calculus for Chemistry | 5 | | |

# Appendix IV Course units in the post-propaedeutic phase

- **List of course units; Article 7.1.1**
- **Compulsory order of examinations; Article 9.3**

| Course unit | ECTS | Practical | Entry requirements |
|---|---|---|---|
| Industrial Organic Chemistry and Catalysis | 5 | | Organic Chemistry 1 |
| Single-Phase Reactors | 5 | | |
| Physical Transport Phenomena 2 | 5 | | |
| Industrial Organic Chemistry and Catalysis Practical | 5 | x | Practical synthesis and analysis 1 |
| Computational Methods in Science and Technology | 5 | | |
| Technical Thermodynamics | 5 | | |
| Macromolecular Chemistry | 5 | | |
| Green Chemistry: Technological, Societal and Ethical Aspects | 5 | | |
| Practical Macromolecular Chemistry | 5 | x | |
| Product Technology | 5 | | |
| Separation Processes | 5 | | |
| Process Control & Dynamics | 5 | | |
| General Process Equipment | 5 | | Single phase reactors |
| Chemical Process Development and Design | 5 | | |
| Special Process Equipment | 5 | | |
| Multiphase Reactors | 5 | | |
| Process Design | 10 | | |
| 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 | After period 1b: passed 130 ECTS of the Bachelor's degree programme of Chemical Engineering<br>(If the Project is done in period 1a the student should have passed 130 ECTS of the Bachelor's degree programme of Chemical Engineering after period 2a of the previous year)<br>The student should submit a study program one month before starting the project. |

**Electives**

| Course unit | ECTS | Practical | Entry requirements |
|---|---|---|---|
| Electrochemical Technology | 5 | x | |
| Medicinal Chemistry I | 5 | | |
| Physical Properties of Materials 1 | 5 | | |
| Structural probes for solid materials | 5 | x | |

# Appendix V Admission to the post-propaedeutic phase (Article 6.1.1)

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 following degree programmes:
- BSc Chemistry

# Appendix VI Contact hours propaedeutic and post-propaedeutic phase (Article 3.6)

| **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 VII Additional Requirements Open degree Programmes (Art. 7.3)

In exceptional circumstances students wishing to pursue an open degree programme may file a request with the Board of Examiners of Physics and Applied Physics. The Board of Examiners will evaluate whether the proposed curriculum meets the learning outcomes of the degree programme.

# Appendix VIII Transitional provisions (article 12.1)

## For cohort 2021-2022 and earlier

| **Course** | **May be replaced with** | **Reason** |
|---|---|---|
| Physical transport phenomena 1 | Transport Phenomena (y1) | Course is similar to a large extent and fulfills similar learning objectives |
| Linear Algebra for CE | Linear Algebra & multivariable calc (y1) | Course is similar to a large extent and fulfills similar learning objectives |