Assessment plan bachelor's degree programme Chemical Engineering 2022-2023

Introduction

This assessment plan is a systematic description of the type of assessment used in the various modules of the bachelor's degree programme Chemical Engineering. This assessment plan fits within the assessment policy of the Faculty of Science and Engineering[1], and the protocol used by the Board of Examiners of the degree programme[2].

The assessment plan is based on:

- the learning outcomes of the degree programme (appendix 1);
- the Teaching and Examination regulations of the degree programme;
- the description of the various modules of the degree programme in the digital course catalogue *Ocasys*, including:
    - Objective of the module;
    - Course content;
    - Lecturers and examiners;
    - Assessment method used;
    - Lecture format.

The assessment plan contains two parts:

1. An overview of the examiners and assessment types used for all modules in the bachelor's degree programme Chemical Engineering.

   The following types of assessments are distinguished in this scheme:
    - Written examination (WE)
    - Multiple choice (MC)
    - Interim Test (IT)
    - Oral examination (OE)
    - Assignment (AST)
    - Report (R)
    - Assessment of Practical work, including laboratory and computer work (PR)
    - Presentation (P)
    - Mandatory Attendance (Att)

2. Matrices describing the relation between the various modules of the bachelor's degree programme Chemical Engineering and the learning outcomes of the degree programme.

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[1] FSE Quality Assurance Manual 2018-2019

[2] Quality Assurance Guide for the Board of Examiners 2015

Part 1: Examiners and assessment types of modules in the degree programme

(examiner in bold is first examiner)

Course unit	Examiners	Assessment type
Core programme		
First Year		
Maths for Chemistry and Engineering (**CH**)	**S.S. Faraji** / T. K. Gebretekle	WE, IT
Molecules: Structure, Reactivity and Function (**CH**)	**E. Otten**/ C. Mayer	WE, IT, PR, AST
Concepts of Chemistry and Engineering (**CE**)	**N.N.H.M. Eisink** /N.H. Katsonis	WE, PR
Organic Chemistry 1 (**CH**)	**M.D. Witte /** T. Kudernac	WE, IT
Transport phenomena (**CE**)	**F.Picchioni /** P.Raffa	WE, IT
Practical Course: Synthesis and Analysis (**CH**)	**A.J. Minnaard** / W.R. Browne	R, PR
Sustainability projects	**P. Karka** / H. Heeres	R, P, AST
Biochemistry and biotechnology (**CH**)	**J. Broos** /C. Mayer	WE
Physical Chemistry 1 (**CH)**	**K.M. Tych /** W.R. Browne	WE, IT, PR
Linear Algebra and multivariable calculus	**P. Lamprou** / P.Tibboel	WE, IT, AST
Inorganic Chemistry (**CH**)	**E. Otten** / J.E.M.N. Klein	WE
Spectroscopy (**CH**)	**W.R. Browne** / M. Tromp	WE, IT
Second year		
Single-Phase Reactors	**J. Xie /** H.J. Heeres	WE, R
Industrial organic chemistry and catalysis	**P.J. Deuss** / P. Raffa	WE, AST
Industrial organic chemistry and catalysis Practical	**P. Raffa** / N.N.H.M. Eisink	R, PR
Computational Methods in Science and Technology	**W.P. Krijnen** / F. Wubs	R, AST
Technical Thermodynamics	**V. Kyriakou** / J.G.M.Winkelman	WE
Macromolecular Chemistry (**CH**)	**K.U. Loos** / D. Maniar	WE, P
Green Chemistry: Technological, Societal and Ethical Aspects	**M.J. van den Nieuwenhof-Schilstra** / P.P. Pescarmona	WE, P, AST
Practical Macromolecular Chemistry (**CH**)	**W.R. Browne** / N.N.H.M. Eisink	R, PR
Separation Processes	**J.G.M.Winkelman**/ P.P. Pescarmona	WE
Product Technology	**R.K.Bose** / F.Picchioni	WE, AST
General Process Equipment	**J.G.M. Winkelman** / C.L. Tucker	R, P, PR, AST
Physical Transport Phenomena 2	**J. Yue** / F.Picchioni	WE
Third Year		
General Process Equipment	See above	
Process control and dynamics	**C.L. Tucker** / F.Picchioni	WE, AST
Physical Transport Phenomena 2	See above	
Special Process Equipment	**J.G.M. Winkelman** / F.Picchioni	R, P
Chemical Process Development and Design	**G.F. Versteeg /** J.G.M.Winkelman	R
Multiphase Reactors	**G.F. Versteeg** /H.J.Heeres	WE
Process Design	**J.G.M. Winkelman** / F.Picchioni	R, P, AST
Bachelor Research Project	See list of examiners	R, P, PR
Electives from other programmes		
Medicinal Chemistry I (**CH**)	See Assessment plan CH	
Structural Probes and Solid Materials (**CH**)	See Assessment plan CH	
Physical Properties of Materials 1 (**CH**)	See Assessment plan CH	
Electrochemical Technology (**CH**)	See Assessment plan CH	

Examiners with UTQ for individual projects:

Acuautla Meneses, M.I.
Bose, R.K.
Deuss, P.J.
Duchateau, R.*
Duin, M. van*
Euverink, G.J.W.
Heeres, H.J.
Jurak, E.
Kamperman, M.M.G.
Karka, P .*
Koning, C.E.*
Kottapalli, A.G.P.*
Kyriakou, V.*
Maarel, M.J.E.C. van der
Miedema, H.* (BSc)
Pescarmona, P.P.
Picchioni, F.
Protesescu, L.*
Raffa, P.
Tucker, C.L.*
Versteeg, G.F.*
Winkelman, J.G.M.
Xie, J.X.*
Yue, J.

* Examiners without UTQ, should be accompanied by a certified examiner

An examiner for the Bachelor Research Project of the bachelor Chemistry can act as a second supervisor for the Bachelor Research Project of the bachelor Chemical Engineering.

Part 2: Relation between the learning outcomes and the curriculum

(for the learning outcomes see Appendix 1)

Core Programme

Learning outcomes	A1	A2	A3	A4	A5	A6	B1	B2	B3	B4	B5	B6	B7	1.1	1.2	1.3	2.1	2.2	2.3	2.4	2.5	2.6	2.7	2.8	2.9	2.10	2.11	2.12	2.13	2.14
Maths for Chemistry and Engineering	+	+		+	+								+		+			+												
Molecules: Structure, Reactivity and Function	+	+			+								+	+			+	+		+	+	+			+	+	+	+	+	
Concepts of Chemistry and Engineering		+		+	+									+		+	+	+	+											
Organic Chemistry 1	+	+			+								+	+			+	+												
Transport phenomena	+	+												+	+			+												
Practical Course: Synthesis and Analysis		+			+		+				+			+			+		+	+		+			+	+	+	+	+	+
Sustainable projects		+	+				+		+	+	+		+			+	+				+									+
Biochemistry	+	+			+								+	+			+	+	+											+
Physical Chemistry 1	+	+		+	+								+	+	+		+	+	+											+
Linear Algebra and multivariable calculus	+	+		+	+								+				+			+										
Inorganic Chemistry	+	+			+								+	+			+	+												
Spectroscopy	+	+		+	+								+	+	+		+	+												+
Single-Phase Reactors	+	+		+	+									+	+				+			+								
Industrial organic chemistry and catalysis	+	+			+			+					+	+			+	+												
Industrial organic chemistry and catalysis Practical					+		+				+						+		+	+		+			+	+	+	+	+	+
Computational Methods in Science and Technology		+		+	+									+	+	+														
Technical Thermodynamics		+			+									+	+				+											
Macromolecular Chemistry	+	+			+					+	+			+	+	+		+	+											
Chemical Engineering & Society: Ethical and Professional Aspects	+	+				+			+	+	+	+				+														
Practical Macromolecular Chemistry		+			+				+		+			+	+			+	+	+	+	+	+			+	+	+	+	+
Separation Processes		+			+									+	+				+											
Product Technology	+	+	+		+			+	+					+	+		+	+	+	+		+								

Learning outcomes	A1	A2	A3	A4	A5	A6	B1	B2	B3	B4	B5	B6	B7	1.1	1.2	1.3	2.1	2.2	2.3	2.4	2.5	2.6	2.7	2.8	2.9	2.10	2.11	2.12	2.13	2.14

General Process Equipment	+	+		+	+									+	+				+	+			+		+					
Process Control & Dynamics		+		+	+									+				+												+
Physical Transport Phenomena 2		+			+									+	+				+											
Special Process Equipment	+	+	+	+	+			+	+	+	+			+	+			+	+	+		+	+		+					
Chemical Process Development and Design		+		+				+	+	+	+				+			+		+			+	+	+					
Multiphase Reactors		+			+									+	+				+											
Bachelor Research Project		+	+	+	+		+	+	+	+	+			+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+

Appendix 1: Learning outcomes of the degree programme

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 (see Appendix I for further specification) 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 Appendix 1.2.

Appendix 1.1: Degree programme-specific learning outcomes – Basic Knowledge

The Bachelor's graduate in Chemical Engineering has:

1.1. 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.

1.2. Necessary background knowledge of Mathematics and Physics,

1.3. 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:

a. Important aspects of chemical terminology, nomenclature and conventions.

b. Numerical and computational skills, including error analysis, understanding of the proper order of magnitude and correct use of units.

c. The most important types of chemical reactions and their characteristics.

d. The principles and procedures that are used in the chemical analysis and in the characterization of chemical compounds.

e. The design of industrial processes, taking into account flow and transfer of matter and energy.

f. The principles of Thermodynamics and phase diagrams.

g. Kinetics of various chemical reactions.

h. Dimensional analysis and its application in various (technological) problems.

i. Basic knowledge of fluid dynamics and heat and mass transfer and their application in various parts of process technology.

j. Knowledge of equipment that is used in many chemical processes.

k. The principles of separation methods and their application in industry.

l. Basic knowledge of industrial chemistry and reactor engineering.

m. Materials Science with emphasis on structure-property relationships and their application in various areas of Product Technology (production, analysis, etc.).

n. The principles of production, structure and properties of polymers and the use of these in various types of chemical products.

o. Basic knowledge of Product Technology.

p. Thinking in systems that are relevant for industrial chemistry and technology.

q. The properties of chemicals and the environmental and safety aspects of using them.

Appendix 1.2: 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:

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

Chemical Engineering-related practical skills
The Bachelor's graduate is:

2.9 skilled in the use of standard laboratory procedures and in the use of equipment for synthetic and analytical work,
2.10 able to verify chemical properties, to observe and measure events or changes, and to systematically archive and document data,
2.11 able to interpret data, obtained from observations and measurements, and relate it to the right theories,
2.12 able to assess the risks of laboratory procedures and the use of chemicals,
2.13 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,
2.14 able to use IT skills appropriate to the chosen specialization.