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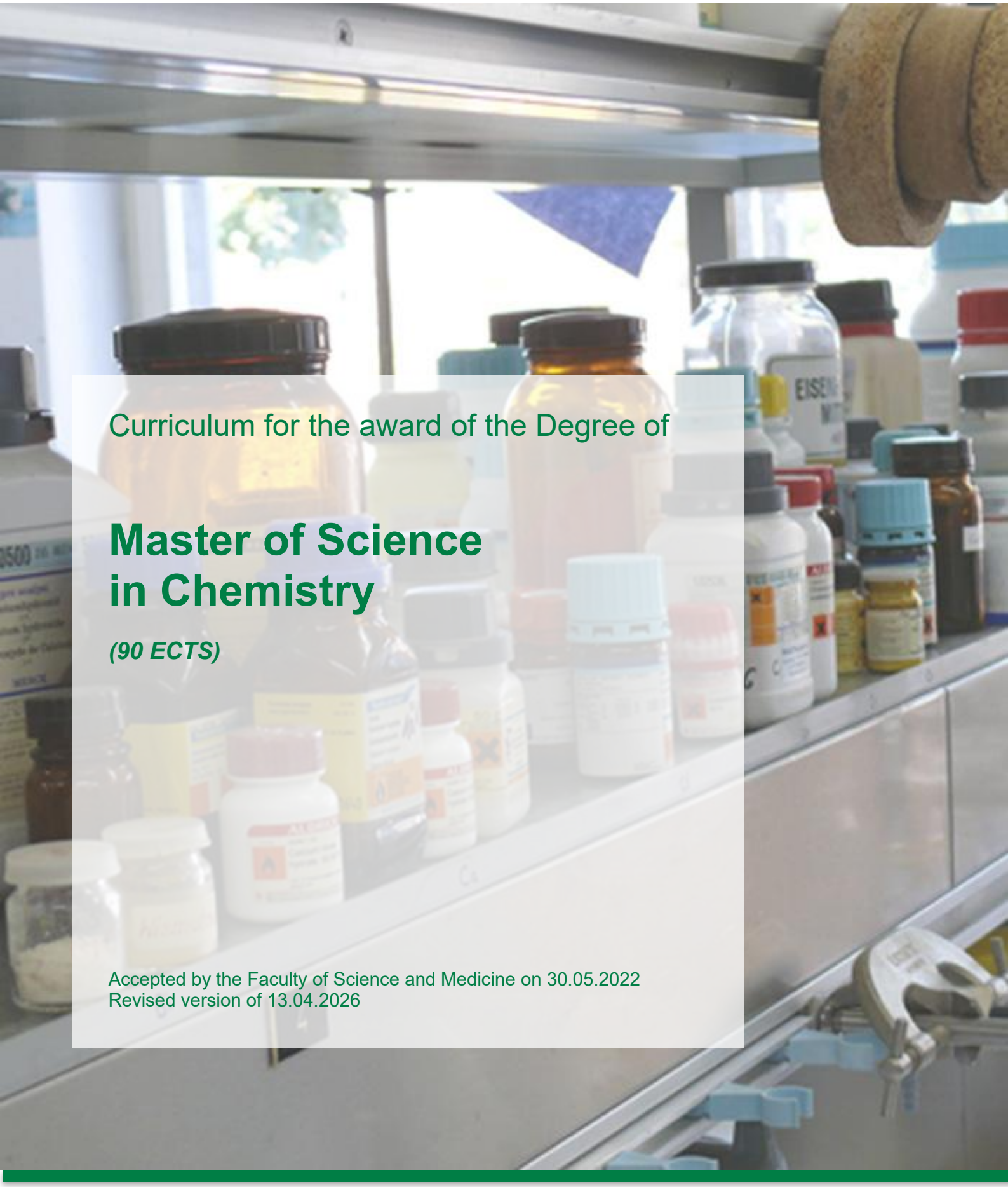

Curriculum for the award of the Degree of

Master of Science in Chemistry

(90 ECTS)

Accepted by the Faculty of Science and Medicine on 30.05.2022
Revised version of 13.04.2026

FACULTE DES SCIENCES ET DE MÉDECINE
MATHEMATISCH-NATURWISSENSCHAFTLICHE UND MEDIZINISCHE FAKULTÄT

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1 General Remarks

This curriculum describes all the regulations concerning the course of studies in chemistry at the University of Fribourg. It is based on the regulations of the Faculty of Science and Medicine as defined in the ***Règlement pour l'obtention des Bachelor of Science et des Master of Science de la Faculté des sciences et de médecine***, which entered into force on 30 May 2022 (hereafter called the *Regulation* for short). In case of discrepancies of translation, the French version will be considered authoritative.

The Regulation of 30 May 2022 for the award of the Bachelor of Science and Master of Science degrees establishes a limit on the duration of Bachelor's and Master's studies, as well as of the minor study program (see articles 11, 13 and 14) (https://www.unifr.ch/scimed/fr/rules/regulations).

1.1 Academic Titles and Programme of Study

The Faculty of Science and Medicine of the University of Fribourg awards the following official academic titles to students who have successfully completed their respective course of studies:

- **Bachelor of Science in Chemistry**, subsequently called **BSc**.
- **Master of Science in Chemistry**, subsequently called **MSc**.

The **programme of study of the BSc** in Chemistry represents a university course of studies, comprising a basic scientific education in chemistry by its method- and problem-oriented nature. It enables one to enter a wide professional area. At the same time it provides the basis for life-long learning, an indispensable requirement for professional success. In addition, the BSc in Chemistry forms the basis for advanced studies leading to the MSc in Chemistry. Every person who is in possession of a federal general qualification for university entrance (*maturité fédérale* / *Eidgenössisches Maturitätszeugnis*) or any equivalent document (cf. Art. 7 of the Regulation) will be admitted to the BSc degree programme.

The **programme of study of the MSc** in Chemistry represents a scientific course of studies, allowing one to specialize in a specific subject. The MSc in Chemistry gives access to various professional activities in research, education, industry, commerce, and administration. The MSc is furthermore the entry requirement for the scientific work and deepened scientific education leading to a doctorate. When accompanied by a subsidiary subject (biology, geography, informatics, mathematics, or physics), the MSc allows one to enter a complementary didactics programme leading to a qualification as a high-school teacher [*Diplôme d'enseignement pour les écoles de maturité (DEEM)* / *Lehrdiplom für Maturitätsschulen (LDM*)].

Candidates in possession of a BSc in Chemistry of the University of Fribourg or any other Swiss university are admitted to the MSc in Chemistry (Art. 8 of the Regulation). Candidates in possession of a BSc degree in a different subject or equivalent degrees (e.g. after graduating from an engineering school) can also be admitted to the MSc study program based on a decision of the Faculty of Science and Medicine to be made in each individual case. Provisional admission can be granted and depends on the fulfilment of additional requirements set by the Faculty (cf. Section 2.5).

1.2 Course Structure

The degree courses leading to the BSc and MSc respectively are subdivided into **teaching units (UE)** comprising lectures, exercise classes, laboratories, seminars, student projects, etc. To each UE, a number of **ECTS credits** *(European Credit Transfer System)* are assigned. The BSc degree course requires 180 ECTS credits (or 6 semesters of full-time studies), and the MSc degree additional 90 ECTS credits (or 3 semesters of full-time studies).

The MSc degree programme consists of a one-year taught programme comprising lectures, lab work, and seminars, and the **MSc project** lasting 4-6 months leading to the **MSc thesis**.

The purpose of the different forms of UE is as follows:

- **Lectures** give an introduction to the scientific methods in chemistry and advance thinking in a scientific way. They help acquiring the required knowledge and understanding the fundamental concepts, and introduce the formalisms used in data processing.
- **Lab work** complements the lectures and provides essential help for working with and understanding a lecture's content. They give students the opportunity to practise and apply the acquired principles, techniques, and models.
- **Research report** is preparing the students for acquiring knowledge in a specific field and disseminating the learned in a written form.
- The preparation of the **Master thesis,** under the supervision of an experienced researcher, is the actual starting point of scientific research.

1.3 Acquired skills

The aim of the studies leading to the award of a MSc in Chemistry is to deepen knowledge and perfect competence in the chosen field and at the same time develop skills in scientific English. Thus, at the end of the course, a student will have shown that he/she can apply their knowledge to accomplish a research project and will have learned how to work independently or how to integrate into an interdisciplinary research team. The award of the degree requires creative and self-critical talents as well as the ability to communicate ideas and work both in English and their native language.

1.4 Assessment of Course Units (UE) and Acquisition of ECTS Credits

Acquisition of ECTS credits occurs in three steps: assessment of the UE, grouping of UE into validation package, and awarding the respective credits.

Lab work is assessed following the criteria given at the beginning of the course. Admission to the exam corresponding to a lecture course can be subject to meeting the requirements of the corresponding lab work section. **Assessment** of lectures is made by an oral and/or written exam, whose type and duration are regulated in an appendix to this curriculum. Exams take place during the official exam periods (sessions) in spring, summer, and autumn. Students register on-line in the student web portal MyUniFR within the stipulated delays for each exam according to the on-line procedure (https://my.unifr.ch). The marks range from 6 (highest mark) to 1 (lowest mark). An exam marked below 4 can be repeated once at the next exam session at the earliest.

Validation packages comprise multiple, separately assessed UE. Art. 24 and 27 of the Regulation determines the number of these packages whereas this curriculum determines their content.

The conditions for validation of ECTS credits are described in Art. 25 of the Regulation.

After the validation, upon request, the Dean's office issues transcripts of records in which exam results and credits awarded are acknowledged (Art. 28 and 30 of the Regulation), provided the exam fee has been paid.

1.5 Teaching Languages

Each course of the BSc is taught in either German or French. Students can decide, in which of the two languages they want to express themselves. Occasionally, courses may be taught in English.

MSc courses are taught in English, German or French. For exams and written work (project reports, MSc thesis, etc.) students can choose between English, German or French.

1.6 Ethics and Science

Scientific ethics are an integral part of the curriculum at the Faculty of Science and Medicine and applies to all fields of study.
They are based on fundamental principles such as honesty, rigor, responsibility, and respect for people, data, and the environment.
In all written and oral work completed during their studies, students are required to follow citation and referencing principles, avoid any form of plagiarism or data falsification, and ensure the authenticity of their personal contributions.
The Faculty works to raise students' awareness of the ethical issues specific to scientific practices, in order to promote a responsible approach that aligns with the values of the academic community and society. The use of artificial intelligence (AI) is governed by the departments.

In this context, the Faculty has established two compulsory courses that must be completed during the course of study in order to validate the degree. These courses are listed below:
Detailed descriptions can be found at: https://www.unifr.ch/scimed/en/integrity

1. **Basic orientation and research in the library (part 1)**

The aim is to learn about the specific objectives and methods of documentary research.

This course must be completed during the first semester of study. The results will be viewable only after completion of this course and submission of the signed 'Declaration of Scientific Integrity' form.

2. **Systematic research and document management (part 2)**

The aim is to prepare and carry out documentary research in a systematic and comprehensive manner.

This training must be completed before or during the Bachelor's or Master's degree. It is compulsory in order to validate the Bachelor's or Master's degree.

1.7 Regulations and Additional Information

Detailed information about studying Chemistry can be found in the documents referenced on the web page http://www.unifr.ch/scimed/en/plans which can also be obtained from the Office of the Department of Chemistry, chemin du Musée 9, CH-1700 Fribourg.

2 Master of Science (MSc)

[Version 2024, validation packages: PV-SCH.0000064, PV-SCH.0000065]

The programme of study of the MSc in Chemistry spans one and a half years, corresponding to 90 ECTS credits. The courses (UE) of the MSc correspond to 60 ECTS credits in total. They consist of 5 compulsory modules (42 ECTS) and of 2 elective modules (18 ECTS) to be chosen among the 5 thematic modules.

The compulsory *Research module* MO-SCH.04901 consists of 2 laboratory projects – to be carried out in two research groups of the Department of Chemistry, each project being the equivalent of 3 full-time weeks.

All modules have to be chosen within the programme of the Department of Chemistry of the University of Fribourg (one module can be taken at the EIF, see below). The study advisor can allow exceptions.

The MSc degree programme is completed by a 6-month master research project of 30 ECTS credits in total, which includes writing a master thesis and its oral defence.

UE of the MSc can only be assessed and recognized after successful completion of the BSc.

2.1 Course Units of the MSc

1st and 2nd Semester (Autumn and/or Spring)

Code	Course Unit	tot. h.	ECTS
	Compulsory		
MO-SCH.00074	*Inorganic chemistry module, consisting of:*		
SCH.04021	Inorganic chemistry I (lectures)	28	3
SCH.04022	Inorganic chemistry II (lectures)	28	3
MO-SCH.04141	*Organic chemistry module, consisting of:*		
SCH.04144	Advanced Organic chemistry I (lectures)	28	3
SCH.04145	Advanced Organic chemistry II (lectures)	28	3
SCH.04143	Selected topics in organic chemistry (lectures)	28	3
MO-SCH.00075	*Physical chemistry module, consisting of:*		
SCH.04851	Physical chemistry I (lecture)	28	3
SCH.04852	Physical chemistry II (lecture)	28	3
SCH.04821	Quantum chemistry and AI for chemistry	28	3
MO-SCH.04320	*Materials chemistry module, consisting of:*		
SCH.04321	Materials chemistry I (lecture)	28	3
SCH.04322	Materials chemistry II (lecture)	28	3
MO-SCH.04901	*Research module, consisting of:*		
SCH.04902	Laboratory project I (practical course)[1]	112	6
SCH.04903	Laboratory project II (practical course) [1]	112	6
			42

[1] To be carried out in two different research groups

	Elective at the Chemistry Department [1]		
MO-SCH.04251	*Analytical chemistry module, consisting of:*		
SCH.04251	Analytical chemistry I (lectures)	28	3
SCH.04252	Analytical chemistry II (lectures)	28	3
SCH.04254	Analytical Chemistry III (lectures)	28	3
MO-SCH.04703	*Advanced inorganic chemistry module, consisting of:*		
SCH.04701	Nanomaterials (lecture)	28	3
SCH.04705	Crystallography and crystal growth and technology (lecture)	28	3
SCH.04707	Metals in materials and life (lecture)	28	3
MO-SCH.04013	*Advanced organic chemistry module, consisting of:*		
SCH.04011	Bioorganic chemistry (lectures)	28	3
SCH.04012	Physical organic chemistry (lectures)	28	3
SCH.04213	Synthesis of complex molecules (lectures)	28	3
MO-SCH.00077	*Polymers module, consisting of:*		
SCH.04824	Polymer Engineering (lectures)	28	3
SCH.04825	Advanced polymer chemistry (lecture and exercices)	42	4.5
SCH.04806	Selected topics in polymer science (seminar)	14	1.5
			18

3rd Semester

Code	Course Unit	tot. h.	ECTS
	Compulsory[2]		
SCH.05014	Master project / Thesis	–	30
			30

2.2 Content of the UE of the MSc

Lectures

All modules comprise thematically focused lectures and seminars given by several professors. Some lectures may be presented by teachers from the Fribourg engineering school and professors from Neuchâtel and Berne. The following thematic is covered:

- Inorganic chemistry module (In depth presentation of subjects from inorganic chemistry);
- Organic chemistry module (In depth presentation of subjects from organic chemistry);
- Physical chemistry module (In depth presentation of subjects from organic chemistry).
- Materials chemistry module (In depth presentation of subjects from materials chemistry);
- Research module (Individual research work);
- Analytical chemistry (2D NMR interpretation, mass spectroscopy, chromatography, sample preparation, analytics in industry, validation);
- Advanced inorganic chemistry (Nanoparticles, properties and applications; Solid state chemistry, soft matter, oxide materials, superconductors, surface coating; typical methods for solid state analysis);
- Advanced organic chemistry module (Asymmetric synthesis of complex molecules, chemistry in biology and medicine, mechanistic investigations of organic reactions).
- Polymers (Polymer synthesis, analysis and properties; biopolymers, hybrid materials);

Lab work

Lab work is an integral part of chemistry. Students are exposed to the research performed in the Department of Chemistry of the University of Fribourg and in the Adolphe Merkle Institute and exercise themselves in a field closely related to a lecture thematic.

[1] Grouped units constitute a master module, which can only be chosen as a whole. Students who followed the industrial chemistry course during their bachelor studies may choose the optional "Industrial chemistry" module at the University of Applied Sciences Fribourg.

[2] The Master Thesis cannot be started before the validation of the entire Research Module (MO-SCH.04901).

2.3 MSc Exams and Assessment

Assessment criteria for courses are specified in the appendix to the curriculum in Chemistry. All of the 1st year UE of the MSc, i.e., the sum of the 5 compulsory + 2 elective modules, form the **first validation package**, enabling one to obtain 60 ECTS credits.

2.4 Master Project / Thesis and Assessment

The master thesis (SCH.05014) forms the **second validation package**. As a matter of principle, work on the master thesis can only be started after at least half of the modules of the first validation package have been evaluated and after the validation of the entire Research Module (MO-SCH.04901).

The master project, a thesis of 30 ECTS credits and duration of 4-6 months, introduces the students to scientific research. Normally, students will work on it during the third semester, and it represents the summit of the course of studies. It is a research work of a considerable volume under the supervision of an experienced researcher. During the master project and thesis, students can test their interest and ability to do research. They produce a thesis in the form of a scientific report and give an oral presentation of 30 minutes.

The master thesis is assessed by two examiners with a mark ranging from 6 (best mark) to 1 (worst mark). One of the examiners establishes a written report. A pass is accorded if the mark is at least 4. A failed master thesis can be repeated once on a different subject.

The successful completion of the two validation packages awards the right to the title **Master of Science in Chemistry, University of Fribourg (MSc)**.

2.5 Regulations of Admission to the Master Programme

2.5.1 Admission Procedure

Admission to the Master's programme may be granted provided the following two conditions have been met by the applicant:

- Satisfying the University admission requirements as defined in the *Règlement concernant l'admission à l'Université de Fribourg* (https://www.unifr.ch/apps/legal/fr/document/274904),
- The student possesses a Bachelor of Science in Chemistry from the University of Fribourg or an academic degree judged equivalent by the Faculty of Science and Medicine.

For candidates with degrees that are not judged equivalent by the Faculty of Science and Medicine, the Commission for Students' Requests will decide on eligibility (*Commission des requêtes des étudiant-e-s*, Dean's Office, Faculty of Science and Medicine, ch. du Musée 8, CH-1700 Fribourg, Switzerland).

Based on the candidate's academic qualification, the Commission for Students' Requests can accept the application on the condition that additional requirements are fulfilled, provided they are of a minor scope and can be completed simultaneously with the Master studies. Otherwise, access is denied or applicants can be admitted to a "pre-master programme" and can begin the Master programme only after having fulfilled the requirements initially set for the pre-master. Final acceptance to the Master programme for a qualifying student depends on the successful completion of the additional requirements.

2.5.2 Standard Transfers

Particular admission transfers to the master are regularly used, especially by candidates in possession of a Bachelor HES in Chemistry. Detailed descriptions of these standard transfers represent an appendix to this curriculum and can be obtained from the Dean's Office of the Faculty of Science and Medicine or the Office of the Department of Chemistry.

3. Additional Module Programmes

One module of 9 ECTS credits, the “Industrial Chemistry”, can be chosen from the Master program of the HES Fribourg, provided that the courses in “Industrial Chemistry” have been followed during the Bachelor studies.

3.1 Content of the Teaching Units of the MSc

For the description of the content and the learning outcomes, please refer to the student web portal MyUniFR (https://my.unifr.ch).

3.2 Exams of MSc and Validation

The chosen module will be examined under the responsibility of the corresponding department which offers it. Refer to the appendix specific to the domain.