Curriculum for the

Master Study
Green Chemistry

at the TU Wien,

at the University of Natural Resources and Applied Life Sciences

Vienna, and

at the University of Vienna

Valid from October 1, 2022

Inhaltsverzeichnis

1. Basis and Scope 3

2. Qualification Profile 3

3. Duration and Scope 4

4. Admission to the Master Study 4

5. Structure of the Study 5

6. Courses 8

7. Examination Regulations 8

8. Studyability and Mobility 9

9. Master Thesis 9

10. Academic Degree 10

11. Quality Management 10

12. Effective date 11

13. Transitional Provisions 11

A. Module Descriptions 13

B. Course Types 26

C. Semester Recommendation for Courses 28

D. Semester Recommendation for Students Entering at a Slant 29

E. Examination Subjects with the Assigned Modules and Courses 30

1. Basis and Scope

The present curriculum defines and regulates the English scientific master study *Green Chemistry* established jointly at the TU Wien (TUW), the University of Natural Resources and Life Sciences Vienna (BOKU) and University of Vienna (UniWien). It is based on the University Act 2002 – UG (BGBl. I Nr. 120/2002 in the currently valid version) – and the *Legal Regulations for Studies of the Statutes* of the participating universities (TU Wien, University of Natural Resources and Life Sciences Vienna, University of Vienna) as well as the Regulation of the Rectorates according to § 54e Abs. 3 UG for the jointly established master study *Green Chemistry* in the currently valid version.

2. Qualification Profile

The English-language master degree program *Green Chemistry* provides an in-depth, scientifically and methodologically high-quality education geared towards enduring knowledge, which enables graduates both to continue their studies within the framework of a relevant doctoral program and to take up a position at the interface between chemistry and the development of sustainable products and processes. The program enables graduates to realize clean technologies and innovations in the field of green chemistry that are oriented towards the UN Sustainability Goals, as well as to contribute to a future circular economy, thus making them internationally competitive.

Building on a bachelor degree with an experimental focus at the interface of chemistry and biosciences or an equivalent degree, this master degree leads to a professional qualification that enables employment in private and public university and research institutions, in industry and in public administration. The graduates fulfill tasks in the research and development of environmentally friendly chemical or bio-based products, in the implementation of sustainable production processes, as well as in the interdisciplinary fields of risk assessment, chemical law and approval.

The participation of three universities provides graduates with a broad education beyond the individual core expertise of each institution, ranging from complementary knowledge in regulatory and toxicological issues, to methods of digitalization and modeling of chemical processes, to the technological implementation of green production processes for chemical products.

Based on professional requirements, the master study *Green Chemistry* imparts qualifications with regard to the following categories.

Technical and methodological competencies Graduates of the master program *Green Chemistry*, depending on the chosen specialization block, have

- the ability to realize clean green technologies and innovations in the field of chemistry;
- the expertise to critically examine sustainable resource use and closed loop recycling;
- a profound insight into legal and regulatory framework conditions and the comprehensive technology assessment including toxicological aspects;

- the tools to positively develop the subject of chemistry towards sustainability, taking into account the 12 principles of green chemistry.

Cognitive and practical competencies Graduates of the *Green Chemistry* master program possess an understanding of the sustainable implementation of chemical processes and the associated framework. They are able to use metric indicators in a technological experimental setting to evaluate sustainability, assessing risks to humans and the environment in the handling and application of products and processes. They have learned to work on interdisciplinary technological and ecological issues in an inter-university and international study environment.

Social competencies and self-competencies Graduates of the master program *Green Chemistry* are able to critically evaluate existing methods and technologies, in terms of their sustainability and ecological risks, and improve them if necessary. They are aware of the social, ecological and economic dimensions and responsibilities of their activities. They are accustomed to working in multicultural and diverse teams through English-language education and collaboration with international fellow students. They are able and willing to engage in continuous professional development and to assume leadership responsibilities. Based on the inherent culture of cooperation between the three universities implementing the curriculum, they are practiced in working across disciplines and institutions.

3. Duration and Scope

The workload for the master study *Green Chemistry* amounts to 120 ECTS points. This corresponds to an intended study duration of 4 semesters as full-time study.

ECTS points are a measure for the amount of work required of students. One academic year comprises 60 ECTS points.

The regulations for the completion of the study program can be found in *7 Examination Regulations*.

4. Admission to the Master Study

Admission to the master program *Green Chemistry* requires the completion of a relevant bachelor's program or another relevant program of at least the same level of higher education at a recognized domestic or foreign post-secondary educational institution.

Admission to the master program *Green Chemistry* in any case requires proof of the following qualitative admission requirements:

- Within the framework of the studies, 48 ECTS of chemical subjects such as fundamentals of chemistry, organic, physical, analytical chemistry and biochemistry have been completed.

- Within the framework of the chemical subjects, at least 16 ECTS laboratory exercises in the field of fundamentals of chemistry, physical chemistry, preparative laboratory or synthesis chemistry, analytical chemistry or biochemistry must have been completed.
- Another 60 ECTS of courses must be from the close field of chemistry/natural sciences such as chemical technology, process engineering, theoretical chemistry, biology, metrology, and similar fields.

In any case, the bachelor studies *Technical Chemistry* at the TU Wien, *Food and Biotechnology* at the University of Natural Resources and Applied Life Sciences Vienna and *Chemistry* at the University of Vienna are eligible. By completing one of these studies, proof of the qualitative admission requirements is deemed to have been provided in any case. For all other bachelor studies, even if the qualitative admission requirements are fulfilled, it has to be checked whether they are eligible

To compensate for significant technical differences, supplementary examinations may be prescribed, which must be taken by the end of the second semester of the master program. The notice of admission may specify which of these supplementary examinations are a prerequisite for taking the examinations provided for in the curriculum of the master program at the respective university. If the essential subject-related differences exceed the extent of 30 ECTS credits, then there is no study in question from a technical point of view.

Admission to the master program *Green Chemistry* further requires the receipt of a study place in accordance with the Regulation issued by the Rectorate of the TU Wien on the admission procedure for the master study *Green Chemistry*.

Persons whose first language is not English have to prove knowledge of the English language. In accordance with the Regulation of the Rectorates according to § 54e Abs 3 UG, the regulations of the TU Wien apply to the proof of English language skills. For a successful continuation of studies, knowledge of English according to reference level B2 of the Common European Framework of Reference for Languages is required.

5. Structure of the Study

The contents and the qualifications of the study program are provided through *modules*. A module is a teaching and learning unit, which is characterized by input and output qualifications, content, teaching and learning forms, the standard workload and performance assessment. The completion of modules takes place in the form of a single or several *lectures* connected in content. Thematically similar modules are combined into *examination subjects*, the designation of which, together with the scope in ECTS and grade, is shown in the final certificate.

Examination subjects and associated modules

The master study *Green Chemistry* is divided into following examination subjects with the modules assigned to them.

Basics of Green Chemistry (36,0 ECTS)

Concepts of Green Chemistry (Compulsory Module) (6,0 ECTS)
Feedstocks and Renewables (Compulsory Module) (6,0 ECTS)
Environmental Analytical Chemistry and Toxicology (Compulsory Module) (6,0 ECTS)
Sustainable Development (Compulsory Module) (6,0 ECTS)
Green Chemistry Laboratory (Compulsory Module) (12,0 ECTS)

All five modules are mandatory.

Bound Electives (at least 36,0 ECTS)

Design (Elective Module) (Minimum 12,0 ECTS)
Synthesis (Elective Module) (mindestens 12,0 ECTS)
Reagents and Feedstocks (Elective Module) (mindestens 12,0 ECTS)
Processes and Utilization (Elective Module) (mindestens 12,0 ECTS)

In the elective modules, at least 12 ECTS must be selected from three different modules. Within a module, at least 6 ECTS must be selected from the course types lecture or seminar.

In the three modules, a total of at least 9 ECTS must be selected from laboratory exercises, tutorials, internships or projects. At least 9 ECTS of elective courses must be completed at each university.

If more than 36 ECTS are completed within the elective modules, in the module *Free Electives and Transferable Skills* to the same extent fewer ECTS points can be completed, however, at least 6 ECTS credits from the area of transferable skills must be completed.

Free Electives and Transferable Skills (18,0 ECTS)

Free Electives and Transferable Skills (Compulsory Module) (18,0 ECTS)

The courses of this module can be freely chosen from the range of scientific and artistic courses, which serve to deepen the subject or to acquire extra-subject knowledge, skills and competencies, of all recognized domestic and foreign post-secondary educational institutions, but at least 6.0 ECTS credits from the area of Transferable Skills must be completed.

Master Thesis (30,0 ECTS)

The examination subject *Masterarbeit* comprises 30 ECTS points and consists of the scientific work (Master Thesis, see *9 Master Thesis*), which is assessed with 27 ECTS points, as well as the commission final examination in the amount of 3 ECTS points (see *7. Examination Regulations*).

Brief description of the modules

In the following the modules of the master study *Green Chemistry* are characterized briefly. A detailed description can be found in Appendix refapp:AMB.

Concepts of Green Chemistry (Compulsory Module) (6,0 ECTS) This compulsory module is dedicated to principles, parameters and current innovations in green chemistry as well as legal and regulatory frameworks.

Feedstocks and Renewables (Compulsory Module) (6,0 ECTS) This compulsory module is dedicated to the analysis, conversion and utilization of renewable raw materials and the fundamentals of biorefinery.

Environmental Analytical Chemistry and Toxicology (Compulsory Module) (6,0 ECTS) This compulsory module is devoted to the fundamentals of toxicology and current analytical methods for environmental issues.

Sustainable Development (Compulsory Module) (6,0 ECTS) This compulsory module is dedicated to interdisciplinary sustainability research and analysis. The impact of new technical developments in chemistry and technology on society, environment and economy is considered. The sustainable use of resources is explained with special focus on recovery and loop closure of critical raw materials to discuss the development of innovative ideas for product (re-)design.

Green Chemistry Laboratory (Compulsory Module) (12,0 ECTS) Hands-on testing of Green Chemistry principles as part of a research-guided exercise in the laboratory.

Design (Elective Module) (Minimum 12,0 ECTS) This elective module is devoted to computer-based methods for process optimization, material description and data evaluation, and the legal principles of environmental protection.

Synthesis (Elective Module) (mindestens 12,0 ECTS) This elective module is dedicated to learning modern chemical synthesis and synthesis techniques, aiming to reduce the environmental footprint of preparative chemistry.

Reagents and Feedstocks (Elective Module) (mindestens 12,0 ECTS) This elective module is devoted to the use of reagents and development of resources through bio- and genetic engineering, natural products technologies, and recycling processes.

Processes and Utilization (Elective Module) (mindestens 12,0 ECTS) This elective module is devoted to processes for biotechnological, chemical, or thermal utilization of resources, as well as the chemistry and technology of new materials.

Free Electives and Transferable Skills (Compulsory Module) (18,0 ECTS) The courses of this compulsory module serve the deepening of the subject as well as the acquisition of non-subject-specific knowledge, skills and and competencies.

6. Courses

The contents of the modules are conveyed through courses. The courses of the individual modules are specified in Appendix A in the respective module descriptions. Courses are assessed by examinations as defined by the UG. The methods of registration for courses and examinations as well as the assessment of examinations are specified in *refsec:PO. Examination Regulations*.

The governing body under study law of the TU Vienna is responsible for the recognition of examinations. If the requested recognition refers to courses or examinations which are not to be completed at the TU Wien, but at the University of Vienna or the University of Natural Resources and Applied Life Sciences, the agreement of the governing body under study law of the university at which the course or examination is to be completed must be reached prior to the decision.

7. Examination Regulations

Positive completion of the master degree requires:

1. the positive completion of the modules prescribed in the curriculum, whereby a module is considered to have been positively completed if the courses attributable to it according to the module description have been completed positively,

2. the writing of a positively assessed master thesis and

3. the positive completion of the final examination. This takes place orally in front of an examination board in accordance with the *statutes concerning study law* of the university to which the supervisor of the master thesis is assigned, and serves to present and defend (*Defensio*) the master thesis and to prove the mastery of the scientific environment. mastery of the scientific environment. Thereby especially above all understanding and overview knowledge must be taken into account. The registrationrequirements for the commissional final examination are fulfilled, if the points 1 and 2 are provided.

The certificate of completion includes

(a) the examination subjects together with the respective scope in ECTS credits and the respective grade,

(b) the topic and the grade of the master thesis,

(c) the grade of the final examination,

(d) upon request of the student, the overall grade of the completed studies according to §72a UG.

The grade of the examination subject „Master thesis“ results from the grade of the master thesis and the grade of the final board examination with the weighting 70% to 30%. The grade of any other examination subject is obtained by averaging the grades of those courses which are to be assigned to the examination subject via the modules contained therein, whereby the grades are weighted with the ECTS scope of the courses. If the decimal part is less than or equal to 0.5, the result is rounded down, otherwise it is rounded up.

Courses of the type VO (lecture) are assessed on the basis of a final examination, which may consist of an oral and/or written examination part. All other courses have an immanent examination character; the assessment is carried out by several partial performances.

The positive success of examinations as well as scientific and artistic work is to be assessed as "very good"(1), "good"(2), ßatisfactory"(3) or ßufficient"(4), the negative success is to be assessed as "not sufficient"(5). In the case of courses for which an assessment in the above-mentioned form is not possible, these are evaluated by "participated with successör "participated without success".

In accordance with the ordinance of the rectorates pursuant to the Regulation of the Rectorates according to § 54e Abs. 3 UG, courses and examinations shall be governed Legal Regulations for Studies of the university at which they are offered. The responsible governing body for study law of the respective university to which the course or the examination is assigned to is responsible for the course or the examination.

8. Studyability and Mobility

Students of the master program *Green Chemistry* should be able to complete their study with reasonable effort in the time allotted.

Students are advised to complete their studies according to the semester recommendation in Appendix C. Students who begin their studies in the summer semester are advised to complete their studies according to the semester recommendation inappendix D.

9. Master Thesis

The master thesis is a scientific work that serves as proof of the ability to independently work on a topic in terms of content and methodology in a justifiable manner. The topic of the master thesis can be freely chosen by the student and must be in line with the qualification profile. In accordance with the Regulation of the Rectorates according to § 54e Abs 3 UG, the study regulations of the university to which the supervisor of the master thesis is assigned, apply to the supervision, submission for assessment and assessment of the master thesis,

The governing body of the university at which the master thesis is supervised, submitted for assessment and assessed is responsible for enforcing the respective provisions of study law.

The acceptance of the notification of the topic and the supervision of the master thesis as well as the prohibition of the topic and the supervision of the master thesis shall take place in accordance with the Regulation of the Rectorates according to § 54e Abs. 3 UG in any case by the competent governing body for study law of the university to which the supervisor is assigned to.

10. Academic Degree

Graduates of the master program *Green Chemistry* are awarded the academic degree "Master of Science“ – abbreviated „MSc“ –.

11. Quality Management

Quality management of the master program *Green Chemistry* is carried out according to the respective regulations of the participating universities for the courses held at these universities.

Lehrveranstaltungskapazitäten

In accordance with the Regulation of the Rectorates according to § 54e Abs. 3 UG, the admission of students to courses shall take place in accordance with the Legal Regulations for Studies of the respective universities at which the courses are held.

For courses that are also offered in other regular studies at one of the participating universities, the group sizes specified for these studies at the respective university apply for the corresponding course types (see appendix B); for original courses of the Master Study *Green Chemistry*, the following group sizes apply at the respective universities.

TU Wien

	Group size	
Course type	per course leader	per Tutor
VO	100	
UE with tutors	30	15
UE	15	
LU with tutors	20	8
LU	8	
EX, PR, SE	10	

For courses of the type VU, the group size for VO is used for the lecture part and the group size for UE is used for the exercise part.

University of Natural Resources and Applied Life Sciences

Course type	Group size per course leader
VO	100
UE	15 – 30
EX, PR, SE	10 – 20

For courses of the types VU/VS/VX the group size for VO is used for the lecture part and for the exercise/seminar/excursion part the group sizes for UE/SE/EX are used.

University of Vienna

For courses immanent to examinations, in the case of limited space, personnel or financial resources and/or due to other logistical conditions, the governing body for study law may impose restrictions on participation.

As a rule, the following general restrictions on participation apply:

Course type	Group size per course leader
VU	12
SE	12
UE	10
PR	10

12. Effective date

This study plan comes into effect with October 1, 2022.

13. Transitional Provisions

In the case of changes to the curriculum involving changes to examination subjects, modules to be completed or courses to be taught, transitional provisions shall in any case be adopted in agreement by all the senates of the participating universities and shall be published.

Appendices

Overview of the following appendices:

A: Module Descriptions

(starting on page13)

B: Course Types

(starting on page 26)

C: Semester Recommendation for Courses

(starting on page 28)

D: Semester Recommendation for Students Entering at a Slant

(starting on page 29)

E: Examination Subjects with the Assigned Modules and Courses

(starting on page 30)

A. Module Descriptions

The courses assigned to the modules are listed in the following form:
9,9/9,9 XX Title of the Course

Courses which are carried out jointly, are offered by the university that is listed first in the module description.

The first number indicates the scope of the course in ECTS credits and the second its scope in semester hours. ECTS points are a measure for the students' workload, with one academic year comprising 60 ECTS points and one ECTS point corresponding to 25 hours of 60 minutes each. The type of course (XX) is explained in detail for each of the participating universities in Appendix B.

Current information for students on the courses offered in the modules can be found in the course catalogs of the respective universities.

Concepts of Green Chemistry (Compulsory Module)

Regular Workload: 6,0 ECTS

Learning Outcomes:

Technical and methodological competencies: Clean green technologies as well as innovations in the field of chemistry are learned using the 12 principles of Green Chemistry and key figures (Green Chemistry Metrics) to assess sustainability.

Cognitive and practical competencies: Upon completion of the module, students will be able to evaluate, whether a chemical transformation can be classified as environmentally friendly and sustainable, or which parameters need to be optimized in order to achieve this.

Social competencies and self-competencies: Students are aware of the social, ecological, and economic dimensions and responsibilities of the dimensions and responsibilities of the profession of chemists.

Contents: Principles of green chemistry (waste reduction, atom economy, non-hazardous syntheses, safe chemicals and solvents, minimal energy consumption, renewable energy consumption, renewable raw materials, simple chemistry, catalysis, degradability, real-time analysis, and accident prevention), green chemistry metrics to assess sustainability, legal and regulatory framework of chemical law and -approval. Current trends, developments and innovations in sustainable chemistry from academic and industrial research.

Expected prior knowledge:

Technical and methodological competencies: Fundamentals of chemistry (reaction equations, organic and inorganic chemistry, principles of catalysis).

Cognitive and practical competencies: Stoichiometry, i.e., setting up and calculating chemical equations.

Social competencies and self-competencies: Ability to work in a team for joint learning in an international environment, critical examination of current problems in chemistry.

Mandatory requirements: None.

Courses of the module: The following courses are mandatory:
3,0/2,0 VO Green Chemistry (TUW)
3,0/2,0 VO Green Chemistry: Recent Trends and Innovations (TUW, together with BOKU and Uni Wien)

Feedstocks and Renewables (Compulsory Module)

Regular Workload: 6,0 ECTS

Learning Outcomes:

Technical and methodological competencies: Students will be able to identify the major components of various raw materials, to explain the isolation and conversion of the pure substances, and to derive possible applications from their basic properties.

Cognitive and practical competencies: After positive completion of the course, students are able to identify renewable raw materials, understand the macroscopic properties of the major components and recognize them in products.

Social competencies and self-competencies: Based on the knowledge acquired, students generate their own view of advanced biorefineries in the context of bioeconomic concepts as an alternative to finite resources.

Contents: Composition of renewable raw materials, structure and properties of the main components, technical processes for the production and and processing of renewable raw materials, mechanical, chemical, and enzymatic conversion into different material streams; molecular structure, properties, use and degradability of bioplastics.

Expected prior knowledge:

Technical and methodological competencies: Fundamentals of organic chemistry, biochemistry and organic technology (Bachelor-level)

Cognitive and practical competencies: Overview of the current state of knowledge on natural products and biomaterials.

Social competencies and self-competencies: Reflection on a sustainable lifestyle using the example of everyday items such as clothing, packaging materials etc.

Mandatory requirements: None.

Courses of the module: The following courses are mandatory:
2,0/2,0 VO Chemicals from biomass (BOKU)
2,0/2,0 VO Chemistry and technology of sustainable resources (BOKU)
2,0/2,0 VO Biopolymers for sustainable utilization (BOKU)

Environmental Analytical Chemistry and Toxicology (Compulsory Module)

Regular Workload: 6,0 ECTS

Learning Outcomes:

Technical and methodological competencies: Fundamentals of toxicology and risk assessment of chemicals, applicability and possible uses of current chemical and instrumental analytical techniques in process- and environmental analysis.

Cognitive and practical competencies: After positive completion of the course, students are able to assess and evaluate the applicability, information content, and any limitations of toxicological models, as well as the most important instrumental analytical techniques in relation to the respective sample or problem.

Social competencies and self-competencies: Students will be able to explain aspects of toxicology and environmental analysis and to find links to current environmental issues.

Contents: Basics of absorption and metabolism, introduction to cell culture and toxicological in vitro test systems as well as insight into modern risk assessment of chemicals; in-depth knowledge of the various spectroscopic subfields and of the processing of complex data information; current trends, developments and innovations from sustainable analytical chemistry in the environmental compartments water, soil, and air.

Expected prior knowledge:

Technical and methodological competencies: Elementary knowledge of inorganic and organic and chemistry, as well as physics and biochemistry.

Cognitive and practical competencies: Overview of the current state of knowledge on chemical and instrumental analytics.

Social competencies and self-competencies: Critical examination of current problems in chemical safety and the impact of substances on the environment.

Mandatory requirements: None.

Courses of the module: The following courses are mandatory:

4,0/2,0 VO Principles of Toxicology (Uni Wien)

2,0/1,0 VO Innovative Analytics in Green and Environmental Chemistry (Uni Wien, together with TUW and BOKU)

Sustainable Development (Compulsory Module)

Regular Workload: 6,0 ECTS

Learning Outcomes:

Technical and methodological competencies: The students learn methods and tools of technology assessment and social ecology and bring them in context to Sustainable Development Goals (SDG). They know the structure and requirements of a Life Cycle Analysis (LCA) to evaluate the ecological impacts of products or product systems

along the entire life cycle. Students know critical raw materials that are essential for European industries and can actively discuss the topic of resource management and identify opportunities for efficient, ecological use within global boundaries.

Cognitive and practical competencies: Students can identify critical areas in terms of sustainable development for new products, materials or processes. They have basic knowledge of how to apply the methods and interpret the results.

Social competencies and self-competencies: Students learn to reflect their attitude towards new developments as well as to design transdisciplinary projects and can also grasp possible effects of developments in the field of chemistry on society, the environment, and the economy. They are aware of their responsibility as chemists for social development.

Contents: In the courses of this module, methods and indications for evaluating the environmental impact and the potential contribution to an improvement in terms of sustainability goals are presented and discussed on the basis of case studies and an introduction to the methods of technology assessment and social ecology is given.Further contents are the presentation of the basic structure and calculation methods of a life cycle assessment and a material flow analysis, an introduction to aspects of socio-ecological indicators for sustainable innovations, and an explanation of the European directives on resource management and critical raw materials, circular economy, disposal, and recycling.

Expected prior knowledge:

Technical and methodological competencies: Fundamentals of general chemistry and chemical technologies.

Cognitive and practical competencies: Setting up equations and balancing.

Social competencies and self-competencies: Interest in the interconnections of science, technology, business and society.

Mandatory requirements: None.

Teaching and learning methods used and appropriate performance assessment: Teaching of the contents by lecture and by joint discussion in the context of current case studies. Independent solving of simple tasks. Performance is assessed by written and oral examinations (theoretical and practical questions).

Courses of the module: The following courses are mandatory:
4,0/3,0 VU Social Ecology and Technology Assessment (TUW together with BOKU)
2,0/1,0 VO Extraction and Recovery of Critical Materials (Uni Wien)

Green Chemistry Laboratory (Compulsory Module)

Regular Workload: 12,0 ECTS

Learning Outcomes:

Technical and methodological competencies: Practical testing of the principles of Green Chemistry in the context of a research-guided exercise in the laboratory.

Cognitive and practical competencies: Preparation of experiments, planning and execution of preparative work, analysis and interpretation of measurement results, preparation of protocols.

Social competencies and self-competencies: Ability to develop sustainable and safe synthesis pathways, utilize renewable resources, and address environmental analytical issues.

Contents: Green Chemistry I: Learning of new catalytic methods (e.g. bio-, photo- or organocatalysis), use of modern synthetic methods such as microwave-, ultrasound- and flow chemistry; utilization, conversion and analysis of renewable raw materials, synthesis and analysis of biopolymers and modern (bio-) "materials.

Green Chemistry II: Recovery and recycling of critical raw materials, learning modern environmental analytical techniques, methods of (electro-)chemical energy storage and -conversion, modeling and risk assessment of current issues in environmental protection.

Expected prior knowledge:

Technical and methodological competencies: Preparative organic and inorganic chemistry (synthesis, isolation, purification and analysis of new compounds), knowledge of spectroscopic techniques and other measurement methods.

Cognitive and practical competencies: Solid knowledge of laboratory technology and safety, knowledge of instrumental analysis.

Social competencies and self-competencies: Ability to work in a team environment and be responsible for collaborative, safe chemical research.

Mandatory requirements: None.

Courses of the module: The two laboratories on Green Chemistry I and Green Chemistry II are mandatory to be completed at two different universities and offered in the appropriate form at each of the participating universities:

6,0/6,0 LU Laboratory on Green Chemistry I (TUW)
or
6,0/6,0 UE Laboratory on Green Chemistry I (BOKU)
or
6,0/6,0 PR Laboratory on Green Chemistry I (Uni Wien)
or else
3,0/3,0 PR Laboratory on Green Chemistry I A (Uni Wien)
and
3,0/3,0 PR Laboratory on Green Chemistry I B (Uni Wien)

Thematic alignment:
Principles of Green Chemistry or *Feedstock and Renewables.*

6,0/6,0 LU Laboratory on Green Chemistry II (TUW)
or

6,0/6,0 UE Laboratory on Green Chemistry II (BOKU)
or
6,0/6,0 PR Laboratory on Green Chemistry II (Uni Wien)
or else
3,0/3,0 PR Laboratory on Green Chemistry IIA (Uni Wien)
and
3,0/3,0 PR Laboratory on Green Chemistry IIB (Uni Wien)

Thematic alignment:
Environmental Analytical Chemistry and Toxicology or *Sustainable Development.*

Design (Elective Module)

Regular Workload: Minimum 12,0 ECTS

Learning Outcomes:

Technical and methodological competencies: After completing the module, students have theoretical knowledge in methods of modeling materials as well as process simulation, and have learned to implement these concepts and apply them to environmentally relevant problems. At the same time, they know the basics of legislation and environmental law in order to be able to use the acquired legal knowledge to assess and answer practical questions.

Cognitive and practical competencies: Based on the acquired knowledge, students are able to apply computer-assisted methods to support the answering of environmentally relevant questions and have basic knowledge of legal regulations at Union- and National level.

Social competencies and self-competencies: By using computer-based methods, students learn resource-saving procedures.

Contents: Basic data-processing- and data-modeling-skills; bioinformatics methods and simulation techniques for problems in the fields of bio- and materials chemistry; computer-aided analysis and presentation of extensive data sets for automation in everyday laboratory work and for process optimization; legal basics of environmentally relevant topics, such as plant protection law, biotechnology, etc.; political-economic approaches to resource economics.

Expected prior knowledge:

Technical and methodological competencies: Fundamentals of chemistry at Bachelor-level.

Cognitive and practical competencies: Digital knowledge and skills for computer-based work.

Social competencies and self-competencies: Interest in computer-based methods as well as legal responsibilities, approval procedures and measures.

Mandatory requirements: None.

Courses of the module:

Within the framework of this elective module, students must complete courses amounting to at least 12 ECTS, of which at least 6 ECTS must be of the type of a lecture or a seminar.

The courses currently eligible are listed each semester in the course catalog of the respective universities. In particular, students may choose courses from the following lists of courses, according to availability. Other courses at the participating universities may be accepted for this elective module.

TU Wien

3,0/2,0 VO Development and Evaluation of Sustainable Processes (TUW)
3,0/2,0 VO Applied Modeling in Process and Energy Engineering (TUW)
3,0/2,0 VO Process Simulation (TUW)
3,0/2,0 VO Fluid Dynamics (CFD) of Thermal Separation Processes (TUW)
6,0/6,0 UE Computer Aided Chemical Engineering (TUW)
3,0/2,0 VU Process Optimisation Methods and Applications (TUW)
3,0/2,0 VU Data Science Methods for Green Chemistry and Engineering (TUW)
4,0/4,0 LU Elective Exercise Technological (TUW)
6,0/6,0 LU Elective Exercise Technological (TUW)
4,0/4,0 LU Elective Exercise Chemical (TUW)
6,0/6,0 LU Elective Exercise Chemical (TUW)

Universität für Bodenkultur Wien

3,0/2,0 VO Legislation in environmental and plant protection affairs (BOKU)
3,0/2,0 VO Global waste management I (BOKU)
3,0/2,0 VO Global change ecology (BOKU)
2,0/2,0 VU Process simulation (BOKU)

Universität Wien

2,0/1,0 VO Computer Graphics and Molecular Modelling (Uni Wien)
3,0/3,0 PR Laboratory Course: Computer Graphics and Molecular Modelling (Uni Wien)
4,0/2,0 VU Machine Learning for Molecules and Materials (Uni Wien)
4,0/4,0 PR Research Examples from Theoretical Chemistry (Uni Wien)
3,0/2,0 VU Computational Systems Biology: from Enzymes to Networks (Uni Wien)
3,0/3,0 PR Data Science in Bioanalysis (Uni Wien)
3,0/2,0 VU Introduction to Metabolic Modelling (Uni Wien)
3,0/2,0 VU (Introduction to) Network Analysis with Python (Uni Wien)
4,0/2,0 VU Bio-inspired Materials and Applications in Research (Uni Wien)
6,0/6,0 PR Research Examples: Bioinspired/Composite Materials (Uni Wien)
2,0/2,0 UE Laboratory Course in Environmental Chemistry (Uni Wien)
2,0/2,0 UE Green Chemistry and Environmental Science (Uni Wien)
2,0/1,0 VO Environmental Chemistry (Uni Wien)

2,0/1,0 VO Ecotoxicology (Uni Wien)
6,0/6,0 PR Research Example Ecotoxicology (Uni Wien)
2,0/1,0 VO Selected Chapters of Ecotoxicology (Uni Wien)
2,0/2,0 UE Public Recognition of Environmental Chemistry and Ecotoxicology (Uni Wien)
6,0/6,0 PR Evironmental Chemistry Lab Including Scientific Field Work (Uni Wien)
2,0/1,0 VO Environmental Analytical Chemistry (Uni Wien)
3,0/2,0 VO Food and Environmental Contaminants (Uni Wien)

Synthesis (Elective Module)

Regular Workload: mindestens 12,0 ECTS

Learning Outcomes:

Technical and methodological competencies: Upon completion of the module, students will master modern and atom-efficient strategies of preparative chemistry, taking into account the 12 principles of green chemistry.

Cognitive and practical competencies: Students recognize atom-efficient synthesis pathways and can realize them by catalytic methods, among others.

Social competencies and self-competencies: Through modern synthesis design and techniques, students are able to reduce waste and inefficiencies.

Contents: Catalytic methods in synthesis (biocatalysis, organocatalysis, photocatalysis, and others); modern metal-assisted transformations (C-H-activation, catalysis by non-noble metals); artificial photosynthesis, synthesis in alternative solvents; modern synthesis methods such as mechano-, ultrasonic-, and microwave chemistry; flow chemistry and online-analysis.

Expected prior knowledge:

Technical and methodological competencies: Fundamentals of organic chemistry at Bachelor level.

Cognitive and practical competencies: Knowledge of laboratory techniques and synthetic-preparative work.

Social competencies and self-competencies: Interest in modern synthesis methods.

Mandatory requirements: None.

Courses of the module:

Within the framework of this elective module, students must complete courses amounting to at least 12 ECTS, of which at least 6 ECTS must be of the type of a lecture or a seminar.

The courses currently eligible are listed each semester in the course catalog of the respective universities. In particular, students may choose courses from the following lists of courses, according to availability. Other courses at the participating universities may be accepted for this elective module.

TU Wien

3,0/2,0 VO Bioorganic Chemistry (TUW)
3,0/2,0 VO Metal Organic Chemistry (TUW)
3,0/2,0 VO Strategies in Organic Chemistry (TUW)
3,0/2,0 VO Methods in Organic Chemistry (TUW)
4,0/4,0 LU Elective Exercise in Biological Chemistry (TUW)
6,0/6,0 LU Elective Exercise in Biological Chemistry (TUW)
4,0/4,0 LU Elective Exercise Organic Chemistry (TUW)
6,0/6,0 LU Elective Exercise Organic Chemistry (TUW)
4,0/4,0 LU Elective Exercises – General Inorganic Chemistry (TUW)
6,0/6,0 LU Elective Exercises – General Inorganic Chemistry (TUW)

University of Natural Resources and Life Sciences, Vienna

2,0/2,0 VO Organic chemistry and immunobiology of carbohydrates (BOKU)
3,0/3,0 VO Applied biocatalysis (BOKU)
2,0/2,0 VO Enzyme reactions: mechanisms and kinetics (BOKU)

University of Vienna

4,0/2,0 VO Strategies and Tactics in Organic Synthesis (Uni Wien)
2,0/2,0 UE Problem Solving in Organic Chemistry (Uni Wien)
2,0/1,0 VO Enzymes – Mechanisms and Applications (Uni Wien)
4,0/2,0 VO Organometallic Catalysis (Uni Wien)
4,0/2,0 VO Heterocyclic Chemistry and Drug Synthesis (Uni Wien)
4,0/2,0 VO Introduction to Carbohydrate Chemistry (Uni Wien)
4,0/2,0 VO Thermally and Photochemically Induced Reactions (Uni Wien)
4,0/2,0 VO Synthetic and Catalytic Photochemistry (Uni Wien)
4,0/4,0 PR Advanced Lab Course, Bio-organic Chemistry (Uni Wien)
4,0/4,0 PR Advanced Lab Course, Metal-organic and Element-organic Chemistry (Uni Wien)
4,0/4,0 PR Advanced Lab Course, Reaction Mechanisms and Structure – Function Relationships (Uni Wien)
4,0/4,0 PR Advanced Lab Course, Synthetic Organic Chemistry (Uni Wien)

Reagents and Feedstocks (Elective Module)

Regular Workload: mindestens 12,0 ECTS

Learning Outcomes:

Technical and methodological competencies: After completing the module, students will be familiar with details of resource management and material use, including recycling urban storage, plant-based feedstocks, and use of biotechnology strategies such as cell factories.

Cognitive and practical competencies: Students identify potential reagents and their storage sites, as well as metabolic pathways to add material value to them.

Social competencies and self-competencies: The responsible use of resources is intensified by working out new potential sources.

Contents: Resource management and material biomass utilization, recycling and urban mining; utilization scenarios for different raw materials; primary and secondary natural products and their utilization; biochemistry and cell biology of plant raw materials, cell culture technology, metabolic and cell engineering: principles, optimization of metabolic pathways and development of new pathways and products.

Expected prior knowledge:

Technical and methodological competencies: Fundamentals of chemistry and biochemistry at the Bachelor-level.

Cognitive and practical competencies: Creativity to develop new reserves.

Social competencies and self-competencies: Responsible use of resources.

Mandatory requirements: None.

Courses of the module:

Within the framework of this elective module, students must complete courses amounting to at least 12 ECTS, of which at least 6 ECTS must be of the type of a lecture or a seminar.

The courses currently eligible are listed each semester in the course catalog of the respective universities. In particular, students may choose courses from the following lists of courses, according to availability. Other courses at the participating universities may be accepted for this elective module.

TU Wien

3,0/2,0 VO Primary Natural Substances from Plants (TUW)
3,0/2,0 VO Material Biomass Utilization (TUW)
3,0/2,0 VO Recycling (TUW)
3,0/2,0 VO Urban Mining (TUW)
3,0/2,0 VO Residues from Exhaust Gas Purification (TUW)
3,0/2,0 VO Ressource Management (TUW)
3,0/2,0 VO Chemical Technology of Renewable Raw Materials (TUW)
3,0/2,0 VO Genomes and Metagenomes, Resources, Mining, Exploitation (TUW)
3,0/2,0 VO Metabolic Engineering (TUW)
2,0/2,0 SE Biothermodynamics (TUW)
2,0/1,5 VO Metabolomics (TUW)
2,0/1,5 VO Proteomics (TUW)
2,0/1,5 VO Spatial Omics (TUW)
4,0/4,0 LU Elective Exercise Technological (TUW)
6,0/6,0 LU Elective Exercise Technological (TUW)
4,0/4,0 LU Elective Exercise Chemical(TUW)
6,0/6,0 LU Elective Exercise Chemical (TUW)

University of Natural Resources and Life Sciences, Vienna

2,0/2,0 VO Plant polysaccharide analysis (BOKU)
3,0/2,0 VO Biorefinery I (BOKU)
4,0/3,0 PR Technology and properties of natural raw materials (BOKU)
2,0/2,0 VO Biobased and biodegradable plastics (BOKU)
2,5/2,0 VO Plant biochemistry and cell biology (BOKU)
4,0/3,0 VU Introduction to genetics and anatomy of plants (BOKU)
3,0/3,0 VO Molecular genetics of yeasts and hyphal fungi (BOKU)
2,0/1,0 VO Biorefinery and products from renewable resources (BOKU)
4,0/3,0 VO Cell factories (BOKU)
3,0/3,0 UE Practical course in cell culture and fermentation (BOKU)
2,0/2,0 VO Metabolic and cell engineering (BOKU)
2,0/2,0 VX Lecture from industry and excursion to industrial site (BOKU)
2,0/2,0 VO Mechanisms of cell regulation in biotechnology (BOKU)
3,0/3,0 PR Mechanisms of cell regulation in biotechnology practical (BOKU)

University of Vienna

4,0/2,0 VO Functional (Nano)Cellulose – Fundamentals and Applications (Uni Wien)
6,0/6,0 PR Cellulose Laboratory Project (Uni Wien)
2,0/1,0 VO Alternative Solvents (Uni Wien)

Processes and Utilization (Elective Module)

Regular Workload: mindestens 12,0 ECTS

Learning Outcomes:

Technical and methodological competencies: After completing the module, students are familiar with biotechnological, chemical and thermal processes for material- and energy conversion, as well as with the synthesis and characterization of functional materials.

Cognitive and practical competencies: Students recognize and identify the appropriate technologies and processes to convert resources sustainably and efficiently.

Social competencies and self-competencies: Knowledge of chemical conversion and storage as a precursor to renewable energy penetration.

Expected prior knowledge:

Technical and methodological competencies: Fundamentals of technical chemistry at the Bachelor level.

Cognitive and practical competencies: Interest in material- and process development.

Social competencies and self-competencies: Responsible use of material and energy resources.

Mandatory requirements: None.

Courses of the module:

Within the framework of this elective module, students must complete courses amounting to at least 12 ECTS, of which at least 6 ECTS must be of the type of a lecture or a seminar.

The courses currently eligible are listed each semester in the course catalog of the respective universities. In particular, students may choose courses from the following lists of courses, according to availability. Other courses at the participating universities may be accepted for this elective module.

TU Wien

3,0/2,0 VO Electrochemical Energy Conversion and Energy Storage (TUW)
3,0/2,0 VO Biotechnology 2 (TUW)
3,0/3,0 LU Fuel and Energy Technology (TUW)
3,0/3,0 VO Materials for Energy (TUW)
3,0/2,0 VO Supramolecular Chemistry and Self-assembled Materials (TUW)
3,0/3,0 VO Heat Storage (TUW)
3,0/3,0 VO Fuel Cells (TUW)
3,0/2,0 VO Bioprocess Engineering (TUW)
3,0/2,0 VO Bioprocess Engineering – Downstream Processing (TUW)
2,0/2,0 VO Thermal Biomass Utilization (TUW)
4,0/4,0 LU Methods for Separation, Purification and Concentration of Chemical Substances (TUW)
3,0/2,0 VO Membrane Technology (TUW)
4,0/4,0 LU Elective Exercise Technological (TUW)
6,0/6,0 LU Elective Exercise Technological (TUW)
4,0/4,0 LU Elective Exercise Chemical (TUW)
6,0/6,0 LU Elective Exercise Chemical (TUW)

University of Natural Resources and Life Sciences, Vienna

2,0/2,0 VO Biochemical reaction engineering (BOKU)
2,0/2,0 VO Biochemical technology (BOKU)
4,0/3,0 VU Bioprocess engineering I (BOKU)
4,0/3,0 VU Bioprocess engineering II (BOKU)
5,0/5,0 UE Bioprocess engineering laboratory (BOKU)
2,0/2,0 VS Products and processes in biotechnology (BOKU)
2,0/2,0 VO Engineering of biotechnological production facilities (BOKU)
3,0/2,0 VX Renewable energy resources (BOKU)
4,0/3,0 VO Biotechnology for sustainable processes and environmental protection (BOKU)
8,0/8,0 UE Pilot plant BioproEng (BOKU)
3,0/2,0 VU Automation of bioprocesses (BOKU)

University of Vienna

4,0/2,0 VO Colloid and Interface Science (Uni Wien)
6,0/6,0 PR Examples for Research: Colloid and Interface Science (Uni Wien)
2,0/1,0 VO Where Porous Materials Can Make an Impact: 7 Chemical Separations to Change the World (Uni Wien)
4,0/2,0 VO Introduction to Composites (Uni Wien)
6,0/6,0 PR Synthesis and Characterization of (Nano)Porous Materials (Uni Wien)

2,0/1,0 SE Organic Material Manufacturing (Uni Wien)
6,0/6,0 PR Examples for Research in Materials Science (Uni Wien)
4,0/4,0 PR Research Practice of Modern Methods in Materials Chemistry (Uni Wien)
6,0/6,0 PR Research Examples in Theoretical Materials Chemistry, Polymer Science and Characterisation (Uni Wien)

Free Electives and Transferable Skills (Compulsory Module)

Regular Workload: 18,0 ECTS

Learning Outcomes: The courses of this compulsory module serve the deepening of the subject as well as the acquisition of non-subject-specific knowledge, skills and and competencies.

Contents: Depending on the courses chosen.

Expected prior knowledge: Depending on the courses chosen.

Mandatory requirements: Depending on the courses chosen.

Teaching and learning methods used and appropriate performance assessment: Depending on the courses chosen.

Courses of the module: The courses of this module can be freely chosen from the range of scientific and artistic courses, which serve to deepen the subject or to acquire extra-subject knowledge, skills and competencies, of all recognized domestic and foreign post-secondary educational institutions, but at least 6.0 ECTS credits from the area of Transferable Skills must be completed.

If more than 36 ECTS are completed within the elective modules, in the module *Free Electives and Transferable Skills* to the same extent fewer ECTS points can be completed, however, at least 6.0 ECTS credits from the area of transferable skills must be completed.

B. Course Types

At all three participating universities, courses of the following types are offered:

VO: Lectures are courses in which the contents and methods of a subject are presented with particular regard to its specific questions, conceptualizations and approaches. Attendance is not compulsory for lectures.

UE: Exercises are courses in which students work individually or in groups, under the professional guidance and supervision of the lecturers, to learn specific practical skills based on theoretical knowledge by applying them to concrete tasks and deepening them through discussion.

VU: Lectures with integrated tutorial combine the characteristics of the course types VO and UE in a single course.

SE: Seminars are courses in which students deal with a given topic or project and work on it using scientific methods, whereby reflection on the problem solution and scientific discourse are required.

EX: Excursions are courses that take place outside the place of study. They serve to deepen the contents in the respective local context.

At the three participating universities, courses of the following specific types are offered:

TU Wien

LU: Laboratory exercises are courses in which students work in groups under the guidance and supervision by the lecturers, in order to learn the handling of equipment and materials as well as the experimental methodology of the subject.

PR: Projects are courses in which the understanding of sub-areas of a subject is deepened and supplemented by the solution of concrete experimental or theoretical tasks. Projects are oriented towards the practical-professional or scientific goals of the study program and complement the preliminary professional training or scientific education.

University of Natural Resources and Applied Life Sciences

PR: Internships are courses in which students, building on theoretical and practical knowledge, learn and apply specific practical skills.

VS: Lectures with integrated seminar combine the characteristics of the course types VO and SE in a single course. In the lecture part, parts of a subject and its methods are taught in a didactically prepared manner; in the seminar part, which requires attendance, students work out, deepen and discuss teaching content independently.

VX: Lectures with integrated excursions combine didactically prepared teaching of the sub-areas of a subject in the lecture part with the deepening of the acquired knowledge on technical aspects in the real context in the excursion part, which requires attendance.

University of Vienna

PR: Internships are courses in which students build on theoretical and practical knowledge to learn and apply specific practical skills.

C. Semester Recommendation for Courses

1. Semester (WS)	**30 ECTS**
Mandatory module *Concepts of Green Chemistry*	6,0 ECTS
Mandatory module *Feedstocks and Renewables*	6,0 ECTS
Courses from the selected elective modules	12,0 ECTS
Free electives and transferable skills	6,0 ECTS

2. Semester (SS)	**30 ECTS**
Mandatory module *Environmental Analytical Chemistry and Toxicology*	6,0 ECTS
Mandatory module *Sustainable Development*	6,0 ECTS
Courses from the selected elective modules	6,0 ECTS
Laboratory for Green Chemistry I	6,0 ECTS
Free electives and transferable skills	6,0 ECTS

3. Semester (WS)	**30 ECTS**
Courses from the selected elective modules	18,0 ECTS
Laboratory for Green Chemistry II	6,0 ECTS
Free electives and transferable skills	6,0 ECTS

4. Semester (SS)	**30 ECTS**
Master Thesis	27,0 ECTS
Commission final examination	3,0 ECTS

D. Semester Recommendation for Students Entering at a Slant

In general, it is recommended that students begin their studies in the winter semester, since many courses in the elective modules build on courses in the mandatory modules.

1. Semester (SS)	**30 ECTS**
Mandatory module *Environmental Analytical Chemistry and Toxicology*	6,0 ECTS
Mandatory module *Sustainable Development*	6,0 ECTS
Courses from the selected elective modules	12,0 ECTS
Free electives and transferable skills	6,0 ECTS

2. Semester (WS)	**30 ECTS**
Mandatory module *Concepts of Green Chemistry*	6,0 ECTS
Mandatory module *Feedstocks and Renewables*	6,0 ECTS
Courses from the selected elective modules	6,0 ECTS
Laboratory for Green Chemistry II	6,0 ECTS
Free electives and transferable skills	6,0 ECTS

3. Semester (SS)	**30 ECTS**
Courses from the selected elective modules	18,0 ECTS
Laboratory for Green Chemistry I	6,0 ECTS
Free electives and transferable skills	6,0 ECTS

4. Semester (WS)	**30 ECTS**
Master Thesis	27,0 ECTS
Commission final examination	3,0 ECTS

E. Examination Subjects with the Assigned Modules and Courses

Prüfungsfach „Basics of Green Chemistry“ (36,0 ECTS)

Modul „Concepts of Green Chemistry (Compulsory Module)“ (6,0 ECTS)

3,0/2,0 VO Green Chemistry (TUW)
3,0/2,0 VO Green Chemistry: Recent Trends and Innovations (TUW, together with BOKU and Uni Wien)

Modul „Feedstocks and Renewables (Compulsory Module)“ (6,0 ECTS)

2,0/2,0 VO Chemicals from biomass (BOKU)
2,0/2,0 VO Chemistry and technology of sustainable resources (BOKU)
2,0/2,0 VO Biopolymers for sustainable utilization (BOKU)

Modul „Environmental Analytical Chemistry and Toxicology (Compulsory Module)“ (6,0 ECTS)

4,0/2,0 VO Principles of Toxicology (Uni Wien)
2,0/1,0 VO Innovative Analytics in Green and Environmental Chemistry (Uni Wien, together with TUW and BOKU)

Modul „Sustainable Development (Compulsory Module)“ (6,0 ECTS)

4,0/3,0 VU Social Ecology and Technology Assessment (TUW together with BOKU)
2,0/1,0 VO Extraction and Recovery of Critical Materials (Uni Wien)

Modul „Green Chemistry Laboratory (Compulsory Module)“ (12,0 ECTS)

6,0/6,0 LU Laboratory on Green Chemistry I (TUW)
6,0/6,0 UE Laboratory on Green Chemistry I (BOKU)
6,0/6,0 PR Laboratory on Green Chemistry I (Uni Wien)
3,0/3,0 PR Laboratory on Green Chemistry I A (Uni Wien)
3,0/3,0 PR Laboratory on Green Chemistry I B (Uni Wien)
6,0/6,0 LU Laboratory on Green Chemistry II (TUW)
6,0/6,0 UE Laboratory on Green Chemistry II (BOKU)
6,0/6,0 PR Laboratory on Green Chemistry II (Uni Wien)
3,0/3,0 PR Laboratory on Green Chemistry IIA (Uni Wien)
3,0/3,0 PR Laboratory on Green Chemistry IIB (Uni Wien)

Prüfungsfach „Bound Electives“ (at least 36,0 ECTS)

Modul „Design (Elective Module)“ (Minimum 12,0 ECTS)

3,0/2,0 VO Development and Evaluation of Sustainable Processes (TUW)
3,0/2,0 VO Applied Modeling in Process and Energy Engineering (TUW)
3,0/2,0 VO Process Simulation (TUW)

3,0/2,0 VO Fluid Dynamics (CFD) of Thermal Separation Processes (TUW)
6,0/6,0 UE Computer Aided Chemical Engineering (TUW)
3,0/2,0 VU Process Optimisation Methods and Applications (TUW)
3,0/2,0 VU Data Science Methods for Green Chemistry and Engineering (TUW)
4,0/4,0 LU Elective Exercise Technological (TUW)
6,0/6,0 LU Elective Exercise Technological (TUW)
4,0/4,0 LU Elective Exercise Chemical (TUW)
6,0/6,0 LU Elective Exercise Chemical (TUW)
3,0/2,0 VO Legislation in environmental and plant protection affairs (BOKU)
3,0/2,0 VO Global waste management I (BOKU)
3,0/2,0 VO Global change ecology (BOKU)
2,0/2,0 VU Process simulation (BOKU)
2,0/1,0 VO Computer Graphics and Molecular Modelling (Uni Wien)
3,0/3,0 PR Laboratory Course: Computer Graphics and Molecular Modelling (Uni Wien)
4,0/2,0 VU Machine Learning for Molecules and Materials (Uni Wien)
4,0/4,0 PR Research Examples from Theoretical Chemistry (Uni Wien)
3,0/2,0 VU Computational Systems Biology: from Enzymes to Networks (Uni Wien)
3,0/3,0 PR Data Science in Bioanalysis (Uni Wien)
3,0/2,0 VU Introduction to Metabolic Modelling (Uni Wien)
3,0/2,0 VU (Introduction to) Network Analysis with Python (Uni Wien)
4,0/2,0 VU Bio-inspired Materials and Applications in Research (Uni Wien)
6,0/6,0 PR Research Examples: Bioinspired/Composite Materials (Uni Wien)
2,0/2,0 UE Laboratory Course in Environmental Chemistry (Uni Wien)
2,0/2,0 UE Green Chemistry and Environmental Science (Uni Wien)
2,0/1,0 VO Environmental Chemistry (Uni Wien)
2,0/1,0 VO Ecotoxicology (Uni Wien)
6,0/6,0 PR Research Example Ecotoxicology (Uni Wien)
2,0/1,0 VO Selected Chapters of Ecotoxicology (Uni Wien)
2,0/2,0 UE Public Recognition of Environmental Chemistry and Ecotoxicology (Uni Wien)
6,0/6,0 PR Evironmental Chemistry Lab Including Scientific Field Work (Uni Wien)
2,0/1,0 VO Environmental Analytical Chemistry (Uni Wien)
3,0/2,0 VO Food and Environmental Contaminants (Uni Wien)

Modul „Synthesis (Elective Module)“ (mindestens 12,0 ECTS)

3,0/2,0 VO Bioorganic Chemistry (TUW)
3,0/2,0 VO Metal Organic Chemistry (TUW)
3,0/2,0 VO Strategies in Organic Chemistry (TUW)
3,0/2,0 VO Methods in Organic Chemistry (TUW)
4,0/4,0 LU Elective Exercise in Biological Chemistry (TUW)
6,0/6,0 LU Elective Exercise in Biological Chemistry (TUW)
4,0/4,0 LU Elective Exercise Organic Chemistry (TUW)
6,0/6,0 LU Elective Exercise Organic Chemistry (TUW)

4,0/4,0 LU Elective Exercises – General Inorganic Chemistry (TUW)
6,0/6,0 LU Elective Exercises – General Inorganic Chemistry (TUW)
2,0/2,0 VO Organic chemistry and immunobiology of carbohydrates (BOKU)
3,0/3,0 VO Applied biocatalysis (BOKU)
2,0/2,0 VO Enzyme reactions: mechanisms and kinetics (BOKU)
4,0/2,0 VO Strategies and Tactics in Organic Synthesis (Uni Wien)
2,0/2,0 UE Problem Solving in Organic Chemistry (Uni Wien)
2,0/1,0 VO Enzymes – Mechanisms and Applications (Uni Wien)
4,0/2,0 VO Organometallic Catalysis (Uni Wien)
4,0/2,0 VO Heterocyclic Chemistry and Drug Synthesis (Uni Wien)
4,0/2,0 VO Introduction to Carbohydrate Chemistry (Uni Wien)
4,0/2,0 VO Thermally and Photochemically Induced Reactions (Uni Wien)
4,0/2,0 VO Synthetic and Catalytic Photochemistry (Uni Wien)
4,0/4,0 PR Advanced Lab Course, Bio-organic Chemistry (Uni Wien)
4,0/4,0 PR Advanced Lab Course, Metal-organic and Element-organic Chemistry (Uni Wien)
4,0/4,0 PR Advanced Lab Course, Reaction Mechanisms and Structure – Function Relationships (Uni Wien)
4,0/4,0 PR Advanced Lab Course, Synthetic Organic Chemistry (Uni Wien)

Modul „Reagents and Feedstocks (Elective Module)“ (mindestens 12,0 ECTS)

3,0/2,0 VO Primary Natural Substances from Plants (TUW)
3,0/2,0 VO Material Biomass Utilization (TUW)
3,0/2,0 VO Recycling (TUW)
3,0/2,0 VO Urban Mining (TUW)
3,0/2,0 VO Residues from Exhaust Gas Purification (TUW)
3,0/2,0 VO Ressource Management (TUW)
3,0/2,0 VO Chemical Technology of Renewable Raw Materials (TUW)
3,0/2,0 VO Genomes and Metagenomes, Resources, Mining, Exploitation (TUW)
3,0/2,0 VO Metabolic Engineering (TUW)
2,0/2,0 SE Biothermodynamics (TUW)
2,0/1,5 VO Metabolomics (TUW)
2,0/1,5 VO Proteomics (TUW)
2,0/1,5 VO Spatial Omics (TUW)
4,0/4,0 LU Elective Exercise Technological (TUW)
6,0/6,0 LU Elective Exercise Technological (TUW)
4,0/4,0 LU Elective Exercise Chemical (TUW)
6,0/6,0 LU Elective Exercise Chemical (TUW)
2,0/2,0 VO Plant polysaccharide analysis (BOKU)
3,0/2,0 VO Biorefinery I (BOKU)
4,0/3,0 PR Technology and properties of natural raw materials (BOKU)
2,0/2,0 VO Biobased and biodegradable plastics (BOKU)
2,5/2,0 VO Plant biochemistry and cell biology (BOKU)
4,0/3,0 VU Introduction to genetics and anatomy of plants (BOKU)

3,0/3,0 VO Molecular genetics of yeasts and hyphal fungi (BOKU)
2,0/1,0 VO Biorefinery and products from renewable resources (BOKU)
4,0/3,0 VO Cell factories (BOKU)
3,0/3,0 UE Practical course in cell culture and fermentation (BOKU)
2,0/2,0 VO Metabolic and cell engineering (BOKU)
2,0/2,0 VX Lecture from industry and excursion to industrial site (BOKU)
2,0/2,0 VO Mechanisms of cell regulation in biotechnology (BOKU)
3,0/3,0 PR Mechanisms of cell regulation in biotechnology practical (BOKU)
4,0/2,0 VO Functional (Nano)Cellulose – Fundamentals and Applications (Uni Wien)
6,0/6,0 PR Cellulose Laboratory Project (Uni Wien)
2,0/1,0 VO Alternative Solvents (Uni Wien)

Modul „Processes and Utilization (Elective Module)“ (mindestens 12,0 ECTS)

3,0/2,0 VO Electrochemical Energy Conversion and Energy Storage (TUW)
3,0/2,0 VO Biotechnology 2 (TUW)
3,0/3,0 LU Fuel and Energy Technology (TUW)
3,0/3,0 VO Materials for Energy (TUW)
3,0/2,0 VO Supramolecular Chemistry and Self-assembled Materials (TUW)
3,0/3,0 VO Heat Storage (TUW)
3,0/3,0 VO Fuel Cells (TUW)
3,0/2,0 VO Bioprocess Engineering (TUW)
3,0/2,0 VO Bioprocess Engineering – Downstream Processing (TUW)
2,0/2,0 VO Thermal Biomass Utilization (TUW)
4,0/4,0 LU Methods for Separation, Purification and Concentration of Chemical Substances (TUW)
3,0/2,0 VO Membrane Technology (TUW)
4,0/4,0 LU Elective Exercise Technological (TUW)
6,0/6,0 LU Elective Exercise Technological (TUW)
4,0/4,0 LU Elective Exercise Chemical (TUW)
6,0/6,0 LU Elective Exercise Chemical (TUW)
2,0/2,0 VO Biochemical reaction engineering (BOKU)
2,0/2,0 VO Biochemical technology (BOKU)
4,0/3,0 VU Bioprocess engineering I (BOKU)
4,0/3,0 VU Bioprocess engineering II (BOKU)
5,0/5,0 UE Bioprocess engineering laboratory (BOKU)
2,0/2,0 VS Products and processes in biotechnology (BOKU)
2,0/2,0 VO Engineering of biotechnological production facilities (BOKU)
3,0/2,0 VX Renewable energy resources (BOKU)
4,0/3,0 VO Biotechnology for sustainable processes and environmental protection (BOKU)
8,0/8,0 UE Pilot plant BioproEng (BOKU)
3,0/2,0 VU Automation of bioprocesses (BOKU)
4,0/2,0 VO Colloid and Interface Science (Uni Wien)
6,0/6,0 PR Examples for Research: Colloid and Interface Science (Uni Wien)

2,0/1,0 VO Where Porous Materials Can Make an Impact: 7 Chemical Separations to Change the World (Uni Wien)
4,0/2,0 VO Introduction to Composites (Uni Wien)
6,0/6,0 PR Synthesis and Characterization of (Nano)Porous Materials (Uni Wien)
2,0/1,0 SE Organic Material Manufacturing (Uni Wien)
6,0/6,0 PR Examples for Research in Materials Science (Uni Wien)
4,0/4,0 PR Research Practice of Modern Methods in Materials Chemistry (Uni Wien)
6,0/6,0 PR Research Examples in Theoretical Materials Chemistry, Polymer Science and Characterisation (Uni Wien)

Prüfungsfach „Free Electives and Transferable Skills“ (18,0 ECTS)

Modul „Free Electives and Transferable Skills (Compulsory Module)“ (18,0 ECTS)

Prüfungsfach „Master Thesis“ (30,0 ECTS)

27,0 ECTS Master thesis
3,0 ECTS Commission final exam