JUSTUS-LIEBIG-UNIVERSITÄT GIESSEN

The President

Announcements of the Justus Liebig University Giessen

Issue from **18.10.2025**

7.36.08 Nr. 6
Special Regulations for the Master's Degree Programme Sustainable Chemistry

Special Regulations for the Master's Degree Programme Sustainable Chemistry of the Faculty 08 – Biology and Chemistry – of the Justus Liebig University Giessen

Of 21.06.2023

These regulations enter into force on the day after their announcement and apply from the winter semester 2025/2026.

	Faculty Council	Senate	Presiding Board	Announcement
Original Version	21.06.2023	13.09.2023	26.09.2023	17.10.2023
1st amendment	17.01.2024	07.02.2024	20.02.2024	28.02.2024
2nd amendment	23.04.2025	11.06.2025	24.06.2025	18.10.2025

Based on § 50 para. 1 of the Hessian Higher Education Act of 14 December 2021, the faculty council of Faculty 08 – Biology and Chemistry – is issuing the following regulations on 21.06.2023:

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§ 1 (to § 1 of the General Regulations)

Complementing the General Regulations for the Bachelor's and Master's degree programmes (General Regulations) of Justus Liebig University Giessen dated 20 February 2019, these regulations govern the study and examinations in the Master's degree programme Sustainable Chemistry.

§ 2 Aim of the degree programme (to § 2 and 6 of the General Regulations)

(1) The Master's degree programme Sustainable Chemistry provides a professional qualification and comprises 4 semesters.

(2) The study programme can only be started in the winter semester.

(3) The study programme is taught in English.

§ 3 Academic degree (to § 3 of the General Regulations)

(1) The Faculty 08 - Biology and Chemistry - of the Justus Liebig University Giessen awards the academic degree "Master of Science" (abbreviated to "M. Sc.") upon successful completion of the programme.

§ 4 Admission to the Master's programme (to § 5 of the General Regulations)

(1) Admission to the Master's degree programme Sustainable Chemistry requires a Bachelor's degree with at least 180 ECTS credits that corresponds to the “Recommendations of the GDCh Study Commission for Bachelor's Degree Programmes in Chemistry at Universities”. This is verified by the board of examiners.

(2) The board of examiners may recognise other degree programmes as equivalent following a case-by-case assessment. The admission may include a coursework of up to 30 CP, which must be completed within the first two semesters. These do not form part of the scope of the Master's degree programme.

(3) The board of examiners may make admission to the Master's degree programme dependent on passing an entrance examination in the cases described in paragraph 2. In this examination, the skills and knowledge required for the Master's degree programme are tested based on the “Recommendations of the GDCh Study Commission for the Bachelor's degree programme in Chemistry at Universities”. The board of examiners shall schedule the entrance examination.

(4) The entrance examination is conducted by an examination committee appointed by the board of examiners. This examination committee consists of two professors. In the case of a written assignment, this is compiled and assessed by the board of examiners.

(5) Applicants will be invited to the entrance examination with at least three weeks' notice.

(6) The entrance examination should take place no later than six weeks after the application deadline.

§ 5 Language requirements (for § 5 of the General Regulations)

(1) For admission to the Master's degree programme Sustainable Chemistry, students must demonstrate very good English language skills at CEFR B2 level. These are proven by:

a) TOEFL test ITB (internet-based test) with at least 80 points or IELTS test with at least a score of 6 in the academic test;

b) Local university entrance qualification in one of the following countries: Australia, Ireland, Canada, New Zealand, USA, United Kingdom, South Africa;

c) Completion of an English-language Bachelor's degree programme in one of the following countries: Australia, Ireland, Canada, New Zealand, USA, United Kingdom, South Africa;

d) "UNIcert II" certificate.

The board of examiners decides on the acceptance of other language certificates.

§ 6 Structure of the degree programme (to §§ 6, 7 and 8 of the General Regulations)

(1) The Master's degree programme is divided into a one-year introductory phase and a one-year research phase. The introductory phase (first year of study) comprises core modules totalling 42 CP and optional modules totalling 18 CP. The optional modules must be selected from the range of optional modules offered in the M.Sc. Chemistry Master's degree programme (see Appendix 2 of the Special Regulations for the Master's degree programme in Chemistry at Faculty 08 - Biology and Chemistry - at Justus Liebig University Giessen dated 16 February 2022, as amended). Alternatively, they can be chosen from the range of modules offered by other degree programmes at JLU. The selection of these modules requires the approval of the examination board. The research phase (second year of study) serves to specialise in a subject.

(2) The curriculum is described in Appendix 1, the modules are described in Appendix 2.

(3) The thesis module comprises 30 CP.

(4) Any modules that have already been attended or taken as part of the Bachelor's degree programme in Chemistry, either exactly or with identical content, cannot be re-attended or credited as optional modules for the Master's degree programme Sustainable Chemistry.

(5) Students who are enrolled for a part-time degree programme discuss an individual study plan with the chairperson of the board of examiners.

§ 7 Requirements for participation and examination prerequisites (to § 8 and 17 of the General Regulations)

(1) Prerequisites for module and course participation are explicitly listed in the module descriptions.

(2) In the event that the participation requirements or previous examination results cannot be proven, the student will be deregistered from the module and re-registered in the next cycle.

§ 8 Module examinations (to §§ 8, 16, 18, 19, 22, 23 und 24 of the General Regulations)

(1) The examination requirements for initial and repeat examinations are regulated in the respective module description (Appendix 2).

(2) Further forms of examination, in addition to those listed in the General Regulations are the thesis (with colloquium), written examination, oral examination and term paper, are:

- oral presentation: oral presentation of an elaborated issue, possibly with a computer presentation; processing time: 3 weeks;
- Report: text document that deals comprehensively with a set task or question; the module description may stipulate that this report is explained or presented orally; processing time: 3 weeks;
- Project work: Work on a defined task, e.g. programming a programme or a routine and preparing a report; processing time: 4 weeks;
- Exercise: working on a set task and explaining the processing steps, processing time: 1 week;
- Protocol (also final protocol): written description of the planning, exact implementation and results of experiments, observations and analyses, including an evaluation; processing time: 1 week.

(3) The examination may be conducted as a group examination with up to five examinees at the decision of the module coordinator, provided that the individual contribution of the examinee can be clearly defined and assessed.

(4) Registration for examinations, including repeat examinations, shall take place by attending the examination.

§ 9 Thesis (to § 21 of the General Regulations)

(1) The Master's thesis should generally be carried out in the subject area in which the laboratory project was taken. The laboratory project should be chosen from one of the two research modules.

(2) The topic of the thesis is issued by the board of examiners. The workload for the thesis is 30 CP, which corresponds to 900 hours. The board of examiners determines the submission deadline for the thesis, considering other parallel modules and coursework. The topic must be written in such a way that it can be completed within the set deadline.

(3) The thesis can generally be started after the modules of the first three semesters have been completed. The board of examiners decides on exceptions.

§ 10 Calculation of overall grade (to § 20 of the General Regulations)

(1) The following modules are included in the calculation of the final grade: the 6 core modules of the first year of study (SuC-MC1 to SuC-MC6) and the thesis module (SuC-MC11).

(2) The overall grade is determined by calculating the sum of the weighted grades of the modules mentioned in paragraph 1 (grade of each module multiplied by the weighting factor g_i assigned to the module).

(3) The overall grade is calculated as follows:

$$\text{Gesamtnote} = \sum_{i=1}^{7} (\text{Note}_i \cdot g_i)$$

The weighting factors g_i are:

g_i = 1/9 for the compulsory modules of the 1st or 2nd semester

g_i = 3/9 for the Master’s thesis

§ 11 Examination management system (to § 16 of the General Regulations)

(1) The registration for all core modules of the Master's degree programme Sustainable Chemistry in the examination administration system is automatic. Optional modules are registered by the students themselves via the examination administration system.

(2) It is not possible to deregister from modules if examinations or partial examinations have already been taken.

§ 12 Entry into force

These regulations in the version of the 2nd amendment resolution of 23rd April 2025 enter into force on the day after their announcement and apply for all students, who start their studies from winter semester 2025/2026 on; until then, the previous provisions will continue to apply.

Attachment 1 Curriculum

Module title / Module code	CP	Semester			
		1	2	3	4
1. Introduction to Principles of Sustainability SuC-MC1	6	Le Se			
2. M. Sc. Seminar: New Frontiers in Chemical Sustainability SuC-MC2	6	Se			
3. Chemical Concepts of Sustainability SuC-MC11	6	Le Ex			
4. Optional Module*	6				
5. Optional Module*	6				
CP 1st semester	**30**				
6. Sustainable inorganic chemistry: criticality, synthesis, substitution, and recoverySuC-MC4	6		Le Ex		
7. Sustainable Energy Technologies SuC-MC5	6		Le Ex		
8. Circular Economy SuC-MC6	6		Le Ex		
9. Sustainability of Organic Reactions: Principles of Green Chemistry: SuC-MC3	6		Le Ex		
10. Optional Module*	6				
CP 2nd semester	**30**				
11. Research module 1 (in chemistry) SuC-MC7	10			Pr Se	
12. Research module 2 (in any group) SuC-MC8	10			Pr Se	
13. Laboratory Project SuC-MC9	10			Pr Se	
total CP 3rd semester	**30**				
14. Thesis SuC-MC10	30				Th
CP 4th semester	**30**				
Total	**120**				

Le=Lecture
Se=Seminar
Ex=Exercise
Pr=Practical
Th=Thesis

* The optional modules are to be chosen from the offered optional modules of the Master's programme M.Sc. Chemistry (see Annex 2 of the Special Regulations for the Master's programme Chemistry of the Faculty 08 - Biology and Chemistry - of the Justus Liebig University Giessen of 16.02.2022 in the currently valid version)

Attachment 2 Module Descriptions

SuC-MC1	**Introduction to Principles of Sustainability** **Einführung in die Prinzipien der Nachhaltigkeit**	6 CP
Core module	08 / Chemistry / Physical Chemistry, Organic Chemistry, Inorganic and Analytic Chemistry First offered in winter 2024/25	1st semester

Academic objectives:

The students
- can discuss the different declinations of sustainability on a scientific as well as a socio-economic level,
- can address the challenges posed by climate changes and global warming as well as resource depletion and understand general environmental issues in a holistic and interconnected approach,
- can perform a critical analysis of current state of the art and literature in the field of sustainability,
- can address the complexity of sustainability by correlating in a holistic view different aspects and concepts related to apparently far disciplines (e.g., chemistry and economics),
- know the relevant standards and regulations on sustainability and sustainability assessments for Germany and the EU and can apply them.

Content:
- basics concepts of sustainability, starting from an historical perspective and providing different declinations of chemistry related sustainability (e.g., but not limited to, circular economy, resource depletion, raw materials criticality, global warming)
- relevant standards and regulations on sustainability for Germany and the EU
- complexity and interdependencies underpinning the concept of sustainability (e.g., relationships between global warming and chemical processes)

Module frequency and duration: each year, 1 Semester (winter)

Professorship or position responsible for module coordination: Professor of Physical Chemistry, Professor of Organic Chemistry, Professor of Inorganic Chemistry*

Applicable to following study programs: M.Sc. Sustainable Chemistry/core module, M.Sc. Chemistry / optional module

Participation prerequisites: none

Course:	Contact hours	Preparation and follow-up work
Lecture	45	90
Seminar	15	30
Total:	180	

Examination requirements: Attendance at least 80% of the seminar hours

Module examinations:
- Type of examination: oral exam (20-40 min) or oral presentation (20-40 min) or written exam (90-120 min)

Language of tuition and examination: English

Notes: *currently: Prof. Dr. Bernd Smarsly, Prof. Dr. Richard Göttlich, Prof. Dr. Klaus Müller-Buschbaum

SuC-MC11	**Chemical Concepts of Sustainability** **Einführung in die Prinzipien der Nachhaltigkeit**	6 CP
Core module	08 / Chemistry / Physical Chemistry, Organic Chemistry, Inorganic and Analytic Chemistry First offered in winter 2025/26	1st semester

Academic objectives:

The students
- can recognise concepts of general chemistry and apply them to relevant sustainability issues,
- are familiar with the relevant organic chemical substance groups, their properties, syntheses and their significance for sustainability,
- can apply principles of reaction mechanisms in organic chemistry to discuss concepts for improving sustainability,
- understand the principles of chemical thermodynamics and kinetics and apply them to sustainability aspects in chemical synthesis and energy conversion,
- know the structure, properties and synthesis of inorganic substances and can discuss them in terms of their significance for sustainable chemical processes and applications,
- have a general knowledge of the chemistry of the main groups and transition metals, including synthesis, properties and significance.

Content:
- Basic chemical reactions
- Basic functional groups of organic compounds and relevant, fundamental reaction mechanisms
- Synthesis, structure and properties of economically important organic compounds
- Fundamentals of chemical thermochemistry: laws of thermodynamics, enthalpy, entropy, free enthalpy, chemical equilibrium; basic chemical kinetics
- Chemical bonding, synthesis and properties of inorganic substances relevant to sustainability
- Fundamentals of main group and transition metal chemistry

Module frequency and duration: each year, 1 Semester (winter)

Professorship or position responsible for module coordination: Professor of Physical Chemistry, Professor of Organic Chemistry, Professor of Inorganic Chemistry*

Applicable to following study programs: M.Sc. Sustainable Chemistry/core module

Participation prerequisites: none

Course:	Contact hours	Preparation and follow-up work
Lecture	60	60
Exercise	30	30
Total:	180	

Examination requirements: Attendance at least 80% of the exercise hours. 50% of the maximum achievable points from the written exercises must be attained.

Module examinations: – Type of examination: oral exam (20-40 min) or written exam (90-120 min) – Module grade: ungraded
Language of tuition and examination: English
Notes: *currently: Prof. Dr. Bernd Smarsly, Prof. Dr. Richard Göttlich, Prof. Dr. Maren Lepple

SuC-MC2	**M.Sc. Seminar: New Frontiers in Chemical Sustainability** **M.Sc. Seminar: Aktuelle Themen der chemischen Nachhaltigkeit**	6 CP
Core module	08 / Chemistry / Organic Chemistry, Physical Chemistry, Inorganic and Analytic Chemistry First offered in winter 2024/25	1st semester

Academic objectives:

The students can

- familiarize themselves independently with the context of a selected topic from current research in the field of sustainable chemistry,
- independently conduct a search to obtain the scientific knowledge required to solve a subtask (databases, literature research, etc.),
- summarize the state-of-the-art in the current literature,
- explain a current research topic in a larger context and present it,
- conduct a scientific discussion about a specific topic in the field of sustainable chemistry.

Content:

- project work with chemical content within framework of current research work on a topic of sustainable chemistry including carrying out a sustainability assessment

Module frequency and duration: each year, 1 Semester (winter)

Professorship or position responsible for module coordination: Professor of Organic Chemistry, Professor of Inorganic and Analytic Chemistry, Professor of Physical Chemistry*

Applicable to following study programs: M.Sc. Sustainable Chemistry/core module, M.Sc. Chemistry/optional module

Participation prerequisites: none

Course:	Contact hours	Preparation and follow-up work
Seminar	60	75
Self-structured work	45	
Total:	180	

Examination requirements: none

Module examinations:

- Type of examination: oral presentation (20-40 min) or report (20-30 pages)

Language of tuition and examination: English

Notes: *currently: Prof. Dr. Richard Göttlich, Prof. Dr. Klaus Müller-Buschbaum, Prof. Dr. Bernd Smarsly

SuC-MC3	**Sustainability of Organic Reactions: Principles of Green Chemistry** **Nachhaltigkeit organisch-chemischer Reaktionen: Prinzipien der „Green Chemistry“**	6 CP
Core module	08 / Chemistry / Organic Chemistry First offered in winter 2024/25	2nd semester

Academic objectives:

The students can

- analyse and evaluate organic-chemical processes based on the relevant sustainability standards for Germany and the EU,
- evaluate reactions and processes according to the principles of green chemistry and categorise them in the context of sustainability,
- correlate sources and available technologies for designing sustainable organic chemical processes,
- design alternative (sustainable) modes of performing organic chemical transformations,
- correlate quantitative and qualitative measures to evaluate the sustainable potential of chemical processes,
- define major sources of biomass and their valorisation for useful chemicals and materials,
- identify and evaluate the environmental parameters of a chemical process,
- design sustainable organic chemical processes and circular processes,
- analyse the influence of reaction components and isolation procedures on the sustainable parameters of a chemical process.

Content:

- basic concepts of green chemistry as a subfield of sustainable chemistry
- overview of alternative modes of activation of chemical reactions (i.e., microwaves, ultrasound, light), their mode of action and use in organic chemistry
- principles of photochemistry and photocatalysis for the synthesis of organic molecules
- application of mechanochemistry for selective transformations of organic molecules
- principles of electrochemistry and their application in organic synthesis
- flow systems and microreactors for synthesis
- homogeneous and heterogeneous catalysts for the development of sustainable chemical processes
- valorization of the use of organic solvents and an overview of the development of alternative solvents (new solvents from biomass resources, ionic liquids, deep eutectic salts, water...)
- biomass as a source of chemicals and an analysis of the sustainable use of biomass
- biorefinery concept for valorization of biomass to useful chemicals and materials
- relevant sustainability standards for Germany and the EU
- green chemistry metrics for valorization of chemical reactions and processes
- quantitative and qualitative evaluation of the environmental potential of chemical processes

Module frequency and duration: each year, 1 Semester (summer)

Professorship or position responsible for module coordination: Professor of Organic Chemistry*

Applicable to following study programs: M.Sc. Sustainable Chemistry/core module, M.Sc. Chemistry/optional module

Participation prerequisites: Module SuC-MC11 Chemical concepts of sustainability passed

Course:	Contact hours	Preparation and follow-up work
Lecture	60	75
Exercise	15	30
Total:	180	
Examination requirements: none		
Module examinations: – Type of examination: written exam (90-120 min) or oral exam (20-40 min)		
Language of tuition and examination: English		
Notes: *currently: Prof. Dr. Hermann A. Wegner		

SuC-MC4	**Sustainable inorganic chemistry: criticality, synthesis, substitution and recovery** **Nachhaltige Anorganische Chemie: Kritikalität, Synthese, Substitution und Rückgewinnung**	6 CP
Core module	08 / Chemistry / Inorganic and Analytic Chemistry First offered in summer 2025	2nd semester

Academic objectives:

The students can

- recognise and apply sustainability criteria in inorganic chemistry based on the relevant standards for Germany and the EU,
- evaluate important synthesis methods in inorganic chemistry in the context of sustainability,
- apply principles and concepts of qualitative and quantitative developments in sustainable chemistry to inorganic compounds,
- understand and describe the lifespan of inorganic materials,
- understand and evaluate criticality for inorganic compounds including the criteria of critical resources and possibilities for substitution and reduction,
- describe and evaluate inorganic chemistry methods for recovering critical elements including urban mining,
- understand and evaluate the importance of developing new recycling processes for a circular economy,
- apply advanced methods and concepts such as green inorganic chemistry, carry out sustainability assessments and present the results.

Content:

- sustainability criteria in inorganic chemistry
- synthesis methods of inorganic chemistry in the context of sustainability including large-scale production processes (e.g., basic elements, metals, semiconductors and selected compounds)
- structure-synthesis relations, structure-properties of sustainable and green inorganic chemistry
- principles and developments of sustainable chemistry of inorganic compounds
- critical resources, life-time, substitution, reduction with reference to inorganic chemistry (raw material extraction of inorganic minerals, the problem of so-called "rare earths", use of inorganic resources in future technologies, e.g., electromobility and renewable energies, batteries, PV, wind turbines, LEDs)
- recovery, recycling, and urban mining of critical inorganic resources
- technical examples of circular economy (e.g., lead batteries, precious metal recovery)

Module frequency and duration: each year, 1 semester (summer)

Professorship or position responsible for module coordination: Professors of Inorganic Chemistry*

Applicable to following study programs: M.Sc. Sustainable Chemistry/core module, M.Sc. Chemistry/optional module

Participation requirements: Module SuC-MC11 Chemical concepts of sustainability passed

Course:	Contact hours	Preparation and follow-up work
Lecture	45	45
Exercise	15	30
Self-structured work	45	
Total:	180	
Examination requirements: none		
Module examination: – Type of examination: written exam (90-120 min) or oral exam (20-40 min)		
Language of tuition and examination: English		
Notes: *currently: Prof. Dr. Klaus Müller-Buschbaum, Prof. Dr. Maren Lepple		

SuC-MC5	**Sustainable Energy Technologies** **Nachhaltige Energietechnologien**	6 CP
Core module	08 / Chemistry / Physical Chemistry First offered in summer 2025	2nd semester

Academic objectives:

The students can

- apply basic concepts and fundamental principles of thermodynamics and kinetics to energy storage and conversion systems and methods,
- recognise and evaluate international and national sustainability criteria in the field of energy technologies,
- apply thermodynamic variables as parameters for sustainability in energy processes,
- name, understand and discuss the basics of modern technologies for energy storage, conversion, and transport, especially battery concepts, thermoelectric generators, photovoltaics, electrolysis (water splitting), fuel cells,
- demonstrate their knowledge of different new technology devices, understand their principles, and appreciate their differences,
- define suitable experiments to classify the performance of energy storage and conversion devices,
- determine and discuss sustainability parameters of modern energy technologies as well as appreciate important novel developments in these technologies.

Content:

- thermodynamic, physical and kinetic fundamentals of energy storage and conversion
- energy harvesting:
  - fundamentals of solar technologies: Solar heat; Photovoltaics: charge carrier generation and transport in different types of solar cells
  - fundamentals of mechanical technologies: Wind energy, Tidal power plants
  - fundamentals of thermal technologies: Heat pumps
- thermoelectrics
- energy storage, transport and conversion:
  - fundamentals of electrochemical storage: Galvanic cells, batteries, electrolytes, electronic and ionic transport; Experimental electrochemical methods; Electrolysis (H_2 …)
  - mechanical storage (Pumped hydro, pumped air)
  - thermal storage
  - (bio)chemical storage
- key chemical subjects and challenges: Secondary batteries (also beyond Lithium-based batteries, e.g., redox-flow concepts), fuel cells, solar cells, photo catalysis, electrolysis (water splitting)

Module frequency and duration: each year, 1 semester (summer)

Professorship or position responsible for module coordination: Professors of Physical Chemistry*

Applicable to following study programs: M.Sc. Sustainable Chemistry/core module, M.Sc. Chemistry/optional module

Participation requirements: Module SuC-MC11 Chemical concepts of sustainability passed

Course:	Contact hours	Preparation and follow-up work
Lecture	45	45
Exercise	30	60
Total:	180	
Examination requirements: none		
Module exam: – Type of examination: written exam (90-120 min) or oral exam (20-40 min)		
Language of tuition and examination: English		
Notes: *currently: Prof. Dr. Bernd Smarsly, Prof. Dr. Jürgen Janek, Prof. Dr. Herbert Over		

SuC-MC6	**Circular Economy** **Chemische Wertstoffkreisläufe**	6 CP
Core module	08 / Chemistry / Organic Chemistry, Inorganic and Analytic Chemistry First offered in summer 2025	2nd semester

Academic objectives:

The students can

- discuss consequences of circular economy for chemical production and processes,
- apply basic concepts of chemistry to recycling processes and regeneration of relevant chemicals,
- analyze and interpret the single chemical and processing steps in the generation of compounds, comprising the entire chain starting from the raw materials to the final products,
- analyze, interpret and discuss relevant chemical parameters (yield, energetic costs, etc.) of important chemical substances and compounds in regard to their recycling,
- name and discuss recovered substance cycles for important chemical goods,
- determine and discuss sustainability parameters of chemical processes,
- discuss why certain compounds are difficult to recycle,
- discuss the pros and cons of renewable resources for chemical processes,
- create and evaluate recycling concepts.

Content:

- current technologies and the respective relevant chemicals/compounds: resources, mining, production
- critical elements and compounds: abundance, exploitation, processing and usage
- closed-loops and recycling of important compounds: Energy balance and energy efficiency
- life cycle of materials and substances in emerging mass technologies
- renewable resources

Module frequency and duration: each year, 1 semester (summer)

Professorship or position responsible for module coordination: Professor of Organic Chemistry, Professor of Inorganic Chemistry, Professor of Physical Chemistry*

Applicable to following study programs: M.Sc. Sustainable Chemistry/core module, M.Sc. Chemistry/optional module

Participation prerequisites: none

Course:	Contact hours	Preparation and follow-up work
Lecture	45	45
Exercise	30	60
Total:	180	

Examination requirements: none

Module examination:

- Type of examination: written exam (90-120 min) or oral exam (20-40 min)

Language of tuition and examination: English
Notes: *currently: Prof. Dr. Peter Schreiner, Prof. Dr. Maren Lepple

SuC-MC7	**Research module 1 (in Sustainable Chemistry)** **Forschungsmodul 1 (in Nachhaltiger Chemie)**	10 CP
Core module	08 / Chemistry First offered in winter 2025/26	3rd semester

Academic objectives:

The students are able to

- discuss the results of a project directly related to sustainable chemistry in the context of the current literature,
- make predictions regarding their project and to plan and execute new research,
- gather, present and defend project results,
- carry out sustainability assessments based on standards and regulations relevant to Germany and the EU.

Content:

- collaboration on a project directly related to sustainable chemistry in a research group of the Chemistry department
- work on literature related to the project
- planning and executing research
- discussion regarding the project with co-workers and professors
- compile a project report and a presentation including sustainability assessment for the implemented project

Module frequency and duration: each year, 1 semester (winter), 8 weeks full-time

Professorship or position responsible for module coordination: Professors of the Chemistry department

Applicable to following study programs: M.Sc. Sustainable Chemistry/core module

Participation prerequisites: 6 out of 7 core modules from semester 1 and 2 need to be passed

Course:	Contact hours	Preparation and follow-up work
Practice	150-220	30-60
Seminar	8-16	10-20
Total:	300	

Examination requirements: none

Module examination:

- Type of examination: report (15-25 pages) and oral presentation (20-40 min)
- Re-exam: Revision of report and/or revision of oral presentation
- Module grade: report (50%), oral presentation (50%)

Language if tuition and examination: English

Notes:

SuC-MC8	**Research module 2 (in any group with a focus on sustainability)** **Forschungsmodul 2 (in einer Arbeitsgruppe zum Thema Nachhaltigkeit)**	10 CP
Core module	08 / Chemistry First offered in winter 2025/26	3rd semester

Academic objectives:
The students are able to
- discuss the results of a project directly related to sustainable chemistry in the context of the current literature,
- make predictions regarding their project and to plan and execute new research,
- gather, present and defend project results,
- carry out sustainability assessments based on standards and regulations relevant to Germany and the EU.

Content:
- collaboration on a project directly related to sustainable chemistry in a research group of the Chemistry department
- work on literature related to the project
- planning and executing research
- discussion regarding the project with co-workers and professors
- compile a project report and a presentation including sustainability assessment for the implemented project

Module frequency and duration: each year, 1 semester (winter), 8 weeks full-time

Professorship or position responsible for module coordination: Professors of the Chemistry department

Applicable to following study programs: M.Sc. Sustainable Chemistry/core module

Participation prerequisites: 6 out of 7 core modules from semester 1 and 2 need to be passed

Course:	Contact hours	Preparation and follow-up work
Practice	150-220	30-60
Seminar	8-16	10-20
Total:	300	

Examination requirements: none

Module examination:
- Type of examination: report (15-25 pages) and oral presentation (20-40 min)
- Re-exam: Revision of report and/or revision of oral presentation
- Module grade: report (50%), oral presentation (50%)

Language if tuition and examination: English

Notes:

SuC-MC9	**Laboratory Project in Sustainable Chemistry** **Laborprojekt Nachhaltige Chemie**	10 CP
Core module	08 / Chemistry First offered in winter 2025/26	3rd semester

Academic objectives:

The students are able to

- assess and interpret deeper scientific relationships and own research results,
- independently access and grasp sophisticated literature,
- develop an own approach to a solution for scientific problems and use appropriate methods,
- plan and execute a scientific project independently.

Content:

- advanced questions on current research by a working group directly related to sustainable chemistry
- independent work on literature
- independent planning and execution of research
- development of a project, preparation of a task schedule, implementation including sustainability assessment for the implemented project
- project defense

Module frequency and duration: each year, 1 semester (winter), 8 weeks full-time

Professorship or position responsible for module coordination: Professors of the Chemistry department

Applicable to following study programs: M.Sc. Sustainable Chemistry/core module

Participation prerequisites: 6 out of 7 core modules from semester 1 and 2 and research module 1 need to be passed

Course:	Contact hours	Preparation and follow-up work
Practice	150-220	30-60
Seminar	8-16	10-20
Total:	300	

Examination requirements: none

Module examination:

- Type of examination: report (15-25 pages) and oral presentation (20-40 min)
- Re-exam: Revision of report and/or revision of oral presentation
- Module grade: report (50%), oral presentation (50%)

Language if tuition and examination: English

Notes:

SuC-MC10	**Thesis**	30 CP
	Thesis	
Core module	08 / Chemistry	4th semester
	First offered in summer 2026	

Academic objectives:
The students have the competence to independently work out and complete a project based on a specific task from a field of sustainable chemistry, using scientific methods, evaluating and interpreting their results, and presenting and defending them as scientific work.

Content:
- conception of a work plan
- familiarization with the literature
- development of measurement and evaluation methods, implementation and evaluation, discussion of the results including a sustainability assessment
- preparation of the thesis
- put own work in the context of other scientific results and applications

Module frequency and duration: winter/summer, 1 semester

Professorship or position responsible for module coordination: Professors of the Chemistry department

Applicable to following study programs: M.Sc. Sustainable Chemistry/core module

Participation prerequisites: Modules of the first three semesters completed.

Course:	Contact hours	Preparation and follow-up work
Scientific work	780	120
Total:	900	

Examination requirements: none

Module examination:
- Type of examination: thesis (50-100 pages) and defense (oral exam, 30 - 60 min)
- Re-exam: newly made thesis according to AIIB §21
- Module grade: thesis (70%), defense (oral exam) (30%)

Language if tuition and examination: English

Notes:

SuC-MC12	**Organic Synthesis for Material Sciences** Organic Synthesis for Material Sciences	6 CP
Optional module	08 / Chemistry / Organic Chemistry First offered in winter 2026/27	

Academic objectives:

The students

- know basic reactions for the structure of organic materials;
- can analyse synthesis problems and select and discuss synthesis methods;
- can assess and classify the physical and chemical properties of organic materials.

Content:

- Methods for building C-C bonds starting from carbonyls
- Conversions of functional groups; organic redox reactions
- Cycloadditions
- Transition metal- and organocatalysed reactions
- Building larger hydrocarbon systems

Module frequency and duration: winter/summer, 1 Semester

Professorship or position responsible for module coordination: Professor of Organic Chemistry

Applicable to following study programs: M.Sc. Sustainable Chemistry, M.Sc. Advanced Materials

Participation prerequisites: Module SuC-MC11 Chemical concepts of sustainability and Module SuC-MC3 Sustainability of Organic Reactions: Principles of Green Chemistry passed

Course:	Contact hours	Preparation and follow-up work
Lecture	45	75
Exercise	15	45
Total:	180	

Examination requirements: none

Module examinations:

- Type of examination: written exam (90-120 min) or oral exam (20-40 min)

Language of tuition and examination: English

SuC-MC13	**Practical Course Organic Synthesis for Material Sciences**	6 CP
	Practical Course Organic Synthesis for Material Sciences	
Optional module	08 / Chemistry / Organic Chemistry	
	First offered in summer 2026	

Academic objectives:

The students

- can independently plan organic reactions in the laboratory;
- – are familiar with the equipment required for this;
- – can assess and avoid risks in the laboratory;
- – are familiar with the most important organic chemistry techniques and can carry them out;
- – can separate mixtures of substances and analyse substances;
- – can keep a laboratory journal correctly.

Content:

- Conducting organic reactions
- Workup and separation, chromatography
- analysis of organic chemical products (spectroscopy and mass spectrometry)

Module frequency and duration: winter/summer, 1 Semester

Professorship or position responsible for module coordination: Professor of Organic Chemistry

Applicable to following study programs: M.Sc. Sustainable Chemistry, M.Sc. Advanced Materials

Participation prerequisites: Module SuC-MC11 Chemical concepts of sustainability and Module SuC-MC3 Sustainability of Organic Reactions: Principles of Green Chemistry passed

Course:	Contact hours	Preparation and follow-up work
Practical	90	30
Seminar	30	30
Total:	180	

Examination requirements: none

Module examinations:

- None; the module is passed once the practical has been successfully completed: 6–10 compounds prepared; 6–10 protocols approved; length of each protocol: 5–10 pages; processing time: 1–2 weeks each.

Language of tuition and examination: English