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TRANSLATION OF

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Administrative Bulletin of the Public Sector and the Foundation

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— Subject-specific Annex 5.15b Sustainability Science: Resources, Materials and Chemistry to the Framework Examination Regulations (FER) for the Master's Programs at the Leuphana Graduate School of the Leuphana University of Lüneburg

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Subject-specific Annex 5.15b Sustainability Science: Resources, Materials and Chemistry to the Framework Examination Regulations for the Master's Programs at the Leuphana Graduate School of the Leuphana University of Lüneburg

Based on § 41 para. 1 sentence 1 of the Lower Saxony Higher Education Act (NHG) in the version of February 26, 2007 (Nds. GVBl. p. 69), last amended by Art. 7 of the Act of March 23, 2022 (Nds. GVBl. p. 218), the Faculty Council of the Faculty of Sustainability on November 08. 2023 adopted the following Subject-Specific Annex 5.15b to the Framework Examination Regulations for the Master's Programs at the Graduate School of Leuphana University of Lüneburg of September 17, 2008 (Leuphana Gazette No. 15/08 of October 06, 2008), last amended on April 19, 2023 (Leuphana Gazette No. 49/23 of June 16, 2023). The Presidential Board approved the subject-specific annex in accordance with § 44 para. 1 sentence 3 and § 37 para. 1 sentence 3 no. 5b) NHG on December 13, 2023.

Section I

To §2 FER, Aim of the study programme, purpose of the examination

Professional competences

Successful graduates of the Master

- have a critical understanding of key theories, methods, and discourses in sustainability science.
- have in-depth knowledge of material resources and technological processes needed for substances, materials and products, composition of substances, materials and products as well as an understanding of design approaches such as the circular economy or "Benign by Design" and green, regenerative and sustainable chemistry.
- are able to analyse questions and problems in research, on a local, regional, national and international level in the public sector, in civil society as well as in the implementation of sustainability goals in business enterprises and to structure and advance their solution processes with the participation of relevant actors.
- know methods and concepts of inter- and transdisciplinary research and are able to apply them in international and national working contexts.
- are able to identify, work on and solve sustainability-relevant issues together with experts from different disciplines as well as practitioners.

Personal competences

Successful graduates of the master's degree are able to,

- to work responsibly in teams of experts and to introduce current findings in sustainability science into the work process.
- to systematically analyse complex problems, to develop participatory solutions and to successfully accompany their implementation by applying their acquired knowledge in sustainability science with a focus on the

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sustainable design of materials, substances and products and related flows and the use of renewable and non-renewable resources.

- to deal with problems in a team with foresight and to lead and take responsibility for group processes against the background of heterogeneity.
- to represent complex sustainability-related problems and solutions to experts in a transdisciplinary dialogue and to develop them further with them.

TO § 3 FER, Modularisation, study structure and scope, standard period of study

The standard period of study is two years. The scope of study is 120 credit points.

Module overview Master Sustainability Science: Resources, Materials and Chemistry

(cf. Also the subject-specific Annex 8 Complementary Studies)

Masterforum 5 CP	Master-Arbeit 25 CP				
Elective 5 CP	Circularity and Recycling 5 CP	Benign by Design 5 CP	Renewable Resources 5 CP	Elective 5 CP	Complementary Studies 5 CP
Transdisciplinary Research Project 10 CP		Life Cycle Assessment 5 CP	Non-Renewable Resources 5 CP	Elective 5 CP	Complementary Studies 5 CP
Sustainability Science 5 CP	Transdisciplinary Research Design 5 CP	Methods 5 CP	Resources, Materials, Products and Sustainable Chemistry 5 CP	Elective 5 CP	Complementary Studies 5 CP

	Profile Modules
	Integration
	Electives
	Complementary Studies

In the first semester the following modules must be taken:

- Sustainability Science (MA-NaWi-3, 5 CP)
- Transdisciplinary Research Design (MA-Sust-2a, 5 CP)
- Methods (MA-Sust-3, 5CP)
- Resources, Materials, Products and Sustainable Chemistry (MA-RMC-1, 5 CP)

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as well as one module of the following electives:

- Introduction to Biodiversity and Ecosystem Functions (MA-EBS-1, 5 CP)
- Introduction I: Organisational Sustainability Transformation Management & Entrepreneurship (MA-EAL-1, 5 CP)
- Introduction to Sustainability Governance (MA-GL-1, 5 CP)

In the second semester the following modules must be taken:

- Transdisciplinary Research Project (MA-NaWi-6, 10 CP)
- Life Cycle Assessment (MA-RMC-2, 5 CP)
- Non-Renewable Resources (MA-RMC-3, 5 CP)

as well as one module of the following electives:

- Practices of Sustainable Entrepreneurship (MA-EAL-3, 5 CP)
- Current Topics of Sustainability Science I (MA-Sust-4, 5 CP)
- Introduction to Law and Sustainability Transformation (MA-GL-2, 5 CP)

In the third semester the following modules must be taken:

- Renewable Resources (MA-RMC-6, 5 CP)
- Benign by Design (MA-RMC-5, 5 CP)
- Circularity and Recycling (MA-RMC-4, 5 CP)

as well as two modules of the following electives:

- Communication of Scientific Results (MA-Sust-11b, 5 CP)
- Sustainable Energies (MA-Sust-7, 5 CP)
- Consumers as Agents for Sustainable Development (MA-EAL-5, 5 CP)
- Site Characteristics & Biogeochemical Processes (MA-EBS-4, 5 CP)
- Current Topics of Sustainability Science II (MA-Sust-5, 5 CP)

To § 5 FER, Academic degrees

Master of Arts (M. A.)

To § 6 para. 10 FER

The language of teaching and examination is exclusively english.

To § 8 para. 1, Master's thesis

The processing time for the Master's thesis is 5 months.

To § 8 para. 8, Oral examination

There will be an oral examination complementary to the Master's thesis. The grade for the oral examination is be included in the overall grade of the Master's thesis with a proportion of one fifth.

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Modules Master Sustainability Science: Governance and Law

Compulsory Modules

Modul	Content	Types of taught components (type and number of courses, CH)	Module requirements	CP	Comments
1st semester					
Sustainability Science (MA-NaWi-3)	Beginning with an overview of the existing theoretical foundations of sustainability science and research, the seminar deals with the historical development, current challenges and future potential of this research field. Key aspects include an examination of coupled human-environment systems, sustainable development, and global change. The interaction of disciplinary, interdisciplinary and transdisciplinary research in sustainability science and the fundamentals of a problem- and solution-oriented research field are also discussed.	1 Seminar (1 CH) 1 lecture (1 CH)	Combined assessment	5	English
Transdisciplinary Research Design (MA-Sust-2a)	This module provides the theoretical and epistemological fundamentals of transdisciplinary sustainability research. It introduces integrative approaches to socially-relevant problems, transformative methods of sustainability research, collaboration skills, and team roles. In parallel to the lecture, students begin to familiarize themselves with the strand-specific case (i.e., context, structures and processes, historical development), and explore possible joint research objects.	1 Lecture (2 CH) 1 Seminar (1 CH)	Combined assessment	5	English
Methods (MA-Sust-3)	Within the module students will gain an overview of the wide array of research methods that are applied in sustainability science. The module will also teach the students to obtain information on how to learn more about methods, and how to learn new methods and apply these in their specific work. The course is designed to enable students to develop methodological designs with a mixed methods approach. Building on a broad and diverse conceptual basis the students will work in smaller groups, thereby learning the collaborative skills necessary to utilise the diverse knowledge of the participants.	1 Lecture (3 CH)	Combined assessment	5	English
Resources, Materials, Products and Sustainable Chemistry (MA-RMC-1)	Concepts of sustainable chemistry along the life cycle of chemical substances, materials and complex products are explained (e.g. sustainable chemistry and green chemistry, importance of resources and their extraction, green syntheses, materials and products, specifics of metals, recycling, dissipation, benign by design; safe and sustainable by design, and other concepts, new business models, international substance, material, and chemical management, EU Green Deal with a view to materials and chemicals).	Lecture (2 CH)	Combined Assessment	5	English

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Modul	Content	Types of taught components (type and number of courses, CH)	Module requirements	CP	Comments
2nd semester					
Transdisciplinary Research Project (MA-NaWi-6)	In this module, students implement the research plan that they developed in the module 'TD Research Design', and autonomously apply methods of transdisciplinary research. In cooperation with practice partners, they work with different strategies and proposals on the co-production of knowledge and solutions for sustainable development. With the help of regular coaching and input from the lecturers, the students work independently to solve the previously identified case-specific problem, in order to close the identified knowledge gaps in both a scientific and practical manner. At the end of the project re-integration products are finalized and final products publicly presented and discussed.	1 Project (4 CH)	<i>Combined assessment</i>	10	English
Life Cycle Assessment (MA-RMC-2)	Life Cycle Assessments (LCA) serve as frameworks that integrate different modelling and simulation approaches (calculation methods) to analyse sustainability impacts of products, organisations, etc. The main challenge of calculation procedures in the field of material flow analyses (MFA) and other tools for environmental modelling is to solve equations numerically. The modelling and simulation approaches comprise two steps or tasks: (1) the specification of a system of equations and (2) the calculation of solutions. Software tools provide support for both tasks. They provide an appropriate user interface (e.g. direct manipulation of objects and properties instead of equations) and a calculation engine (solvers). Different strategies to specify and to solve equations are required: (1) Systems of linear algebraic equations (efficiency analyses like cost accounting or life cycle assessment), (2) System of non-linear algebraic equations (steady state in material and energy flow systems), (3) Systems of ordinary differential equations (dynamics of stocks).	1 seminar (2 CH)	Combined Assessment	5	English
Non-Renewable Resources (MA-RMC-3)	Significance of use of non-renewable resources (e.g., metals, minerals, coal, mineral oil, fossil gas, phosphorous, nitrogen) for sustainability including impact of chemicals, materials and products on soil, air, and water and environmental pollution along their life cycle.	1 Lecture (2 CH)	Combined assessment	5	English

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Modul	Content	Types of taught components (type and number of courses, CH)	Module requirements	CP	Comments
3rd semester					
Circularity and Recycling (MA-RMC-4)	Opportunities and limitations of circularity and recycling and circular economy, subsequent approaches of management of flows of chemicals, materials and products from a material and engineering as well as design point of view will be outlined. Fundamental and challenging leverage points realizing the claimed synergies between the Circular Economy, Sustainable Chemistry and sustainability within Planetary Boundaries and SDGs will be addressed.	1 lecture (2 CH) 1 exercise (2 CH)	Combined assessment	5	English
Benign by Design (MA-RMC-5)	Lecture and exercises cover the theory and implementation of the concept of benign by design and substance evaluation using modern computer-based ("in-silico") methods and modeling in interaction. Fundamentals of chemoinformatics will be learned including building, validation and application of models and software for the prediction of chemical properties. In the lecture and practical exercises, target-oriented substance development is addressed.	1 seminar (2 CH) 1 exercise (2 CH)	Combined assessment	5	English
Renewable Resources (MA-RMC-6)	This module will provide a thorough overview of the concept of renewables in the context of green and sustainable chemistry. Contents related to chemical structure, reactivity, processing (e.g., methods related to the extraction, transformation, including its characterization) as well as the applications of renewable biomass will be addressed (case studies).	1 lecture (2 CH)	Combined scientific work	5	English
4th semester					
Master Forum (MA-RMC-7)	Supervision and assistance in the conception, organization and implementation of individual Master's theses; development, presentation, discussion and reflection of questions, concepts and exposés for Master's theses.	Colloquium (2 CH)	Combined Assessment	5	English
Master Thesis (MA-RMC-8)	Writing of a master thesis	None	1 Master Thesis and 1 oral examination	25	

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Electives

Modul	Content	Types of taught components (type and number of courses, CH)	Module requirements	CP	Comments
Electives					
Introduction to Biodiversity and Ecosystem Functions (MA-EBS-1)	Biodiversity has several components, including species diversity, functional diversity, and phylogenetic diversity, all of which are essential for understanding ecosystem-level consequences of ongoing global biodiversity loss. This course focuses on biodiversity-ecosystem functioning (BEF) research as well as the larger implications of social ecological systems for biodiversity and ecosystem functioning. It examines how global environmental change drives impact on biodiversity but also ecosystem functioning, ecosystem services, and nature's contributions to people.	1 Lecture (1 CH) 1 Seminar (1 CH)	Combined assessment	5	English
Introduction I: Organisational Sustainability Transformation Management and Entrepreneurship (MA-EAL-1)	This course provides an introduction to sustainability transformation management and entrepreneurship for organisations. Sustainability transformation management aims to change an existing company fundamentally towards being both sustainable at the organisational level and to contributing effectively to a sustainable market, society and natural environment beyond organisational boundaries. Sustainable entrepreneurship initiates and establishes sustainability transformations at the meso-level of markets, regions, associations, etc. and the macro-level of societies and planetary ecosystems by founding and scaling new business units or independent organisations, which may be profit- or non-profit oriented or hybrid organisations. By discussing processes, actors and methods of sustainability transformation this course offers an overview of approaches, opportunities and limitations to foster sustainable development for and with organisations.	1 Lecture (2 CH)	Combined exam	5	English
Introduction to Sustainability Governance (MA-GL-1)	This module offers a comprehensive and advanced introduction to environmental and sustainability governance. It aims to provide a thorough understanding of key concepts and theoretical approaches in this field and their application to real-world cases. The module explores the functioning of governance systems in the development and implementation of public policies that address pressing environmental and sustainability issues at local, national, and international levels. The module focuses on both the structural and procedural aspects of governance.	1 Lecture (2 CH)	<i>Written examination under supervision</i>	5	English
Practices of Sustainable Entrepreneurship (MA-EAL-3)	Students develop their own sustainable business ideas, create business models based on these ideas, and begin to implement a mock-up for their sustainable business ideas. The course thus uses participants ideas on how to address challenges of unsustainability as a starting point. Based on these ideas, students evaluate and practically test in how far these ideas can be implemented in an entrepreneurial manner and simultaneously contribute to sustainable development.	1 Seminar (2 CH)	Combined assessment	5	English

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Modul	Content	Types of taught components (type and number of courses, CH)	Module requirements	CP	Comments
Electives					
Current Topics of Sustainability Science I (MA-Sust-4)	The module deepens the knowledge in current research fields of sustainability science. Social-ecological systems are considered in a scientifically sound and interdisciplinary manner and are processed against the background of the respective disciplinary foundations and related to current challenges, whereby the problem-solving contribution and the potential of the research field become clear.	1 lecture (1 CH) and 1 seminar (2 CH)	Written examination without supervision or written examination under supervision	5	English
Introduction to Law and Sustainability Transformation (MA-GL-2)	This course provides an introduction to the concept of law, legal methodology and the role of law in sustainability transformation. It offers a critical understanding of the structure and functioning of international, European and national law both as an important tool to steer societies towards sustainability and, importantly, as a constraint to such efforts. A particular focus of the course is on the interrelationship between the different levels of law as well as key differences between them with respect to actors, law-making, instruments, implementation and enforcement from a global, regional and domestic level.	1 lecture (2 CH) <i>1 Vorlesung (2 SWS)</i>	Written examination under supervision <i>Schriftliche wissenschaftliche Arbeit unter Aufsicht</i>	5	English englischsprachig
Communication of Scientific Results (MA-NaWi-11b)	The subject of the module is the communication of scientific findings, theses and research results. The focus is on addressee- and context-related approaches and strategies in preparation and publication for scientific and non-scientific target groups as well as possibilities and limits of inter- and transdisciplinary communication.	1 seminar (2 CH) or 1 lecture (2 CH)	Combined Assessment or written examination without supervision	5	English
Sustainable Energies (MA-Sust-7)	The seminar focusses on the analysis of sustainable energies in regards of sustainability aspects showing up current research and development examples as well as the analysis of the application of systems.	1 seminar (4 CH)	<i>Written examination without supervision</i>	5	English
Consumers as Agents for Sustainable Development (MA-EAL-5)	The seminar deals with the role of consumers in the context of sustainable development. In order to be able to present unsustainable consumer behavior, different theories and concepts of sustainable consumption will be dealt with. The seminar draws on approaches from different disciplines, such as business administration, economics and psychology. On this basis, barriers and facilitating factors of sustainable consumption are identified and existing concepts for the promotion of sustainable consumption are discussed. Based on this content, students work in groups to develop their own possible measures to strengthen sustainable consumption behavior.	1 seminar (2 CH)	Combined scientific work	5	English
Site Characteristics and Biogeochemical Processes (MA-EBS-4)	An advanced knowledge of site characteristics and biogeochemical processes is an important prerequisite to meeting the many challenges that can occur when trying to restore or protect natural systems. This course aims to deepen an understanding of (terrestrial) ecosystem processes from a biogeochemical point of view. Due to the central role of soil in biogeochemical cycles, and thus ecosystem restoration, the course will, in particular, highlight (interactive) processes between soils, plants and other components of terrestrial ecosystems. Lab and field	1 lecture (2 CH) 1 Seminar/Exercise (2 CH)	Written examination without supervision	5	English

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	exercises will complement lectures and seminars and will impart knowledge on current methods aiming at an analysis of soil ecological processes including an introduction to experimental approaches addressing an assessment of human impacts on processes and biogeochemical cycles in terrestrial ecosystems.				
Current Topics of Sustainability Science II (MA-Sust-5)	The module deepens the knowledge in current research fields of sustainability science. Social-ecological systems are considered in a scientifically sound and interdisciplinary manner and are processed against the background of the respective disciplinary foundations and related to current challenges, whereby the problem-solving contribution and the potential of the research field become clear.	1 seminar (2 CH) or 1 lecture (2 CH)	Written examination without supervision or written examination under supervision	5	English

Section II

Entry into force

This subject-specific annex comes into force in the winter semester 2024/25.

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