Brandenburgische Technische Universität Cottbus - Senftenberg
Platz der Deutschen Einheit 1, 03046 Cottbus

Brandenburgische
Technische Universität
Cottbus - Senftenberg

Modulhandbuch für den Studiengang Chemistry: Materials, Engineering and Sustainability (universitäres Profil), Master of Science, Prüfungsordnung 2025

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Module 14310 Practical Research Training

assign to: Total Account

Study programme Chemistry: Materials, Engineering and Sustainability

Degree	Module Number	Module Form
Master of Science	14310	Mandatory

Modul Title	**Practical Research Training** Forschungspraktikum
Department	Faculty 2 - Environment and Natural Sciences
Responsible Staff Member	Prof. Dr. rer. nat. habil. Klepel, Olaf
Language of Teaching / Examination	English
Duration	1 semester
Frequency of Offer	Every winter semester
Credits	30
Learning Outcome	In the practical research training programme, students can apply and deepen the theoretical concepts, methods and strategies they have learnt during their studies when working on a complex scientific problem in the field of materials chemistry or process engineering. Using the infrastructure of external research institutions, students also acquire knowledge and skills in new methods and technologies. They become familiar with organisational forms of research networks. At the end of the module, students will have consolidated skills in dealing with scientific information sources, in data collection, documentation and evaluation as well as in summarising, presenting and discussing scientific results.
Contents	- Reviewing and analysing scientific information sources including primary literature - Processing a scientific task using experimental and/or theoretical methods - Collecting, documenting and analysing data - Preparation of the written thesis - Colloquium with oral presentation and discussion
Recommended Prerequisites	Completion of at least 5 modules of the specialisation "Materials Chemistry" or "Fluid- and Process Engineering"
Mandatory Prerequisites	none
Forms of Teaching and Proportion	Self organised studies - 900 hours
Teaching Materials and Literature	Original scientific literature on the research topic to be addressed; provided by the supervisor

Module Examination	Continuous Assessment (MCA)
Assessment Mode for Module Examination	Written report about 20 pages, 50% Colloquium including discussion, 45 min 50%
Evaluation of Module Examination	Performance Verification – graded
Limited Number of Participants	none
Remarks	The research internship is usually completed at a research institution outside the BTU under the supervision of a university lecturer involved in the curriculum. The choice of research institution is up to the students. In reasonable exceptional cases, the internship can also be completed in a working group within the BTU.
Module Components	- self organized studies - colloquium
Components to be offered in the Current Semester	No assignment

Module 14311 Master Thesis

assign to: Total Account

Study programme Chemistry: Materials, Engineering and Sustainability

Degree	Module Number	Module Form
Master of Science	14311	Mandatory

Modul Title	**Master Thesis** Master-Arbeit
Department	Faculty 2 - Environment and Natural Sciences
Responsible Staff Member	Prof. Dr. rer. nat. habil. Klepel, Olaf
Language of Teaching / Examination	English
Duration	1 semester
Frequency of Offer	Every summer semester
Credits	30
Learning Outcome	Students acquire the ability to solve a scientific problem within a limited time budget under the guidance of a supervisor. They use their acquired theoretical and practical knowledge to justify scientifically their solution of the problem as well as their improvements. The development of new knowledge and techniques is a major objective. They acquire the ability to present scientific facts clearly in written and oral form. Students have acquired practical personal skills related to the degree programme through communicative interaction with members of the working groups.
Contents	- Guided, mostly experimental work on a complex scientific problem - Accompanying study of primary literature on the research topic - Participation in literature and progress seminars of the working group - Laboratory report on the establishment of the experimental approach for the elaboration of the task and discussion of the first results - Preparation of the written thesis - Colloquium with oral presentation and discussion
Recommended Prerequisites	none
Mandatory Prerequisites	Students will be admitted to the Master's thesis if they have acquired at least 72 CP including the Practical Research Training at the time of registration for the Master's thesis.
Forms of Teaching and Proportion	Self organised studies - 900 hours
Teaching Materials and Literature	It depends on the individual subject. Corresponding material will be named and provided by the supervisor.

Module Examination	Continuous Assessment (MCA)
Assessment Mode for Module Examination	The grade of the Master thesis results from the thesis, which accounts for 75 percent, and its defense, which accounts for 25 percent. The presentation and the discussion go into equal parts in the grade of the colloquium.
Evaluation of Module Examination	Performance Verification – graded
Limited Number of Participants	none
Remarks	none
Module Components	- Self organised studies - Colloquium with oral presentation and discussion
Components to be offered in the Current Semester	No assignment

Module 11803 Fundamentals of Additive Manufacturing

assign to: Specialisation Materials Chemistry

Study programme Chemistry: Materials, Engineering and Sustainability

Degree	Module Number	Module Form
Master of Science	11803	Compulsory elective

Modul Title	**Fundamentals of Additive Manufacturing** Grundlagen der additiven Fertigung
Department	Faculty 3 - Mechanical Engineering, Electrical and Energy Systems
Responsible Staff Member	Prof. Dr.-Ing. Härtel, Sebastian
Language of Teaching / Examination	English
Duration	1 semester
Frequency of Offer	Every summer semester
Credits	6
Learning Outcome	The students will • gain systematic knowledge of the physical and technological fundamentals of welding engineering in view of additive manufacturing technologies, • be able to describe relevant additive manufacturing technologies and will know their respective strengths and weaknesses, • have a critical understanding for the selection of appropriate additive manufacturing technologies based on the specific task, • learn the basics of the finite element method and part-scale modelling techniques to predict residual stresses and distortions.
Contents	Fundamentals of welding engineering and additive manufacturing technologies with particular attention to powder bed fusion and directed energy deposition. Design and Construction of 3D printed parts. Microstructure evolution during the build process and postprocessing. Modelling and numerical simulation in additive manufacturing processes, in particular part-scale thermo-mechanical models to predict thermal stresses and distortions in powder bed fusion. Knowledge is applied in a project using commercial software (Simufact.Additive) to analyze the influence of build orientation and support structures on final build quality.
Recommended Prerequisites	• Fertigungstechnik Grundlagen (or similar)
Mandatory Prerequisites	none
Forms of Teaching and Proportion	Lecture - 2 hours per week per semester Exercise - 2 hours per week per semester

	Study project - 2 hours per week per semester Self organised studies - 90 hours
Teaching Materials and Literature	• Script • You can find further informations on moodle.
Module Examination	Continuous Assessment (MCA)
Assessment Mode for Module Examination	• Final presentation, ~30 min. (30%) and • Written exam, 60 min. (70%)
Evaluation of Module Examination	Performance Verification – graded
Limited Number of Participants	none
Remarks	none
Module Components	• VL Fundamentals of Additive Manufacturing Current Description • ÜB Fundamentals of Additive Manufacturing Current Description • Proj Fundamentals of Additive Manufacturing Current Description
Components to be offered in the Current Semester	**340501** Lecture Fundamentals of Additive Manufacturing - 2 Hours per Term **340502** Exercise Fundamentals of Additive Manufacturing - 2 Hours per Term

Modul 12276 Poröse Materialien

zugeordnet zu: Specialisation Materials Chemistry

Studiengang Chemistry: Materials, Engineering and Sustainability

Akademischer Grad	Modulnummer	Modulform
Master of Science	12276	Wahlpflicht

Modultitel	**Poröse Materialien** Porous Materials
Einrichtung	Fakultät 2 - Umwelt und Naturwissenschaften
Verantwortlich	Prof. Dr. rer. nat. habil. Klepel, Olaf
Lehr- und Prüfungssprache	Deutsch
Dauer	1 Semester
Angebotsturnus	jedes Semester
Leistungspunkte	6
Lernziele	Nach der Teilnahme am Modul sind die Studierenden in der Lage, wesentliche Aspekte der Synthese, Charakterisierung und Anwendung hochporöser Materialien zu verstehen. Die Studierenden werden somit befähigt, wissenschaftliche Aufgabenstellungen zu porösen Materialien im hohen Maße selbstständig zu bearbeiten. Durch das Selbststudium wissenschaftlicher Orginalliteratur können die Studierenden deutsche und englische Texte erschließen sowie deren Inhalte im Kontext des Vorlesungsstoffes reflektieren.
Inhalte	• Texturelle Charakterisierung poröser Materialien verschiedener Porenweitenbereiche (Nanometer bis Mikrometer) mittels adsorptiver und anderer Methoden • Synthesemethoden, Aufbau, Struktur, Anwendung wichtiger Klassen poröser Materialien (z.B. silikatische Materialien, kohlenstoffbasierte Materialien, poröse Polymere)
Empfohlene Voraussetzungen	Kenntnisse in anorganischer und physikalischer Chemie
Zwingende Voraussetzungen	<div id="meta-origin" data-coolorigin="https%3A%2F%2Fwww.b-tu.de%2Forgcloud%2Fapps%2Frichdocumentscode%2Fproxy.php%3Freq%3D%2Fcool%2Fclipboard%3FWOPISrc%3Dhttps%253A%252F%252Fwww.b-tu.de%252Forgcloud%252Findex.php%252Fapps%252Frichdocuments%252Fwopi%252Ffiles%252F9418675_ochtzup9yafk%26ServerId%3D2b3e65df%26ViewId%3D7%26Tag%3D5e4d8ab844db3108"><p class="western">Kein erfolgreicher Abschluss von Modul 14293 Porous Materials.

Lehrformen und Arbeitsumfang	Seminar - 1 SWS Selbststudium - 165 Stunden
Unterrichtsmaterialien und Literaturhinweise	• Marsh, H.; Rodriguez Reinoso, F.: Activated Carbon, Elsevier Science & Technology, 2006. • Weitkamp, J.; Puppe, L.: Catalysis and Zeolites, Springer, 1999. • Schüth, F.; Sing, K.S.W.; Weitkamp, J.: Handbook of porous Solids, Wiley-VCH, 2002. • videobasiertes Lehrmaterial
Modulprüfung	Continuous Assessment (MCA)
Prüfungsleistung/en für Modulprüfung	2 Klausuren jeweils 45 min
Bewertung der Modulprüfung	Prüfungsleistung - benotet
Teilnehmerbeschränkung	keine
Bemerkungen	Das Modul kann nicht belegt werden, wenn das Modul 14293 Porous Materials bereits belegt wurde.
Veranstaltungen zum Modul	• Seminar Poröse Materialien
Veranstaltungen im aktuellen Semester	**220523** Seminar Poröse Materialien - 1 SWS

Module 14041 Processes in Porous Materials

assign to: Specialisation Materials Chemistry

Study programme Chemistry: Materials, Engineering and Sustainability

Degree	Module Number	Module Form
Master of Science	14041	Compulsory elective

Modul Title	**Processes in Porous Materials** Prozesse in porösen Materialien
Department	Faculty 2 - Environment and Natural Sciences
Responsible Staff Member	Prof. Dr. rer. nat. habil. Klepel, Olaf
Language of Teaching / Examination	English
Duration	1 semester
Frequency of Offer	Every semester
Credits	6
Learning Outcome	The students acquire basic knowledge on the nature of highly porous materials (pore widths between 0.5 and 50 nm) and their characterization. They acquire knowledge of important processes which take place in highly porous materials such as adsorption and mass transport processes. By studying original scientific literature on their own, students are able to analyse scientific texts and reflect on their content in the context of the lecture material. In addition, students have acquired further personal skills related to the degree programme through communicative discussion in seminars.
Contents	• nature of porosity • equilibrium adsorption and adsorption kinetics in porous materials • transport processes in porous materials • interplay of chemical reaction and transport processes in heterogeneous catalysis (macro kinetics) • the interplay of mass transport and adsorption of molecules in porous materials investigated by temperature-programmed desorption
Recommended Prerequisites	basic knowledge of porous materials and knowledge of physical chemistry
Mandatory Prerequisites	none
Forms of Teaching and Proportion	Seminar - 1 hours per week per semester Self organised studies - 165 hours
Teaching Materials and Literature	- Video-based teaching material (asynchronous) - Original scientific literature provided by the lecturer

	Text books: M. Baerns, A. Behr, A. Brehm, J. Gmehling, H. Hofmann, U. Onken, A. Renken, K.-O. Hinrichsen, R. Palkovits, Technische Chemie, Wiley-VCH, various editions H. Scott Fogler, Elements of Chemical Reaction Engineering: Pearson New International Edition, Pearson Education Limited, Harlow, 2013
Module Examination	Continuous Assessment (MCA)
Assessment Mode for Module Examination	2 written exams, each 45 minutes, weighted 50%
Evaluation of Module Examination	Performance Verification – graded
Limited Number of Participants	none
Remarks	none
Module Components	Seminar
Components to be offered in the Current Semester	**220522** Seminar Processes in Porous Materials - 1 Hours per Term **220524** Examination Processes in Porous Materials

Module 14284 Heterogeneous Equilibria (Constitution Theory of Metallurgy)

assign to: Specialisation Materials Chemistry

Study programme Chemistry: Materials, Engineering and Sustainability

Degree	Module Number	Module Form
Master of Science	14284	Compulsory elective

Modul Title	**Heterogeneous Equilibria (Constitution Theory of Metallurgy)** Heterogene Gleichgewichte (Konstitutionslehre der Metallkunde)
Department	Faculty 3 - Mechanical Engineering, Electrical and Energy Systems
Responsible Staff Member	Prof. Dr.-Ing. habil. Weiß, Sabine
Language of Teaching / Examination	English
Duration	1 semester
Frequency of Offer	Every summer semester
Credits	6
Learning Outcome	The students are introduced to the basics and application methods of phase diagrams. An expanded knowledge of binary phase diagrams is communicated. The students will be able to interpret unknown and complicated binary phase diagrams. They can analyze phase contents and phase reactions during the cooling process of an alloy and can discuss the microstructure. The students learn to interpret elementary unknown ternary phase diagrams. They can evaluate phase contents and phase reactions followed by the construction of isothermal and concentration sections through the three-dimensional system. Using the examples of binary and ternary systems constitution theory and the basics of thermo-dynamic methods will be trained with the aim to understand the construction and practical use of phase diagrams.
Contents	Lecture and exercises will merge. Based on the fundamentals of the lecture the interpretation of phase diagrams will be developed in collaboration with the students. The students will receive exercises and master copies which will be explicated during the lecture and subsequently solved in cooperation. The main contents of the lecture are • one-, two- and three-component diagrams, • naming the phase rooms, • construction of schematic cooling curves, • calculation of phase contents, • application of the lever principle and the Gibbs law. • Using simplified ternary systems as examples the construction of isothermal- and concentration sections is trained.

Recommended Prerequisites	• Module 36104 or 11915 Grundlagen der Werkstoffe (or equivalent expertise in fundamentals of materials)
Mandatory Prerequisites	none
Forms of Teaching and Proportion	Lecture - 2 hours per week per semester Study project - 2 hours per week per semester Self organised studies - 120 hours
Teaching Materials and Literature	The teaching materials are provided via the Moodle learning platform. The structure of the module as an "inverted classroom" (provision of the lecture and exercise materials as well as accompanying literature, study-units and learning videos prior to the event) enables students to familiarize with a topic independently, to plan courses of action under given conditions and to work within the module to organize themselves. Furthermore, they can reflect on their learning progress in short tests, check their own results using sample solutions and communicate and discuss their open questions during the event. If necessary, the event can also be held as an online event.
Module Examination	Continuous Assessment (MCA)
Assessment Mode for Module Examination	• Online processing of submissions which are graded. The 10 best of in total 11 submissions result in the overall grade. Each of the relevant submissions generates 10% of the points for the overall grade.
Evaluation of Module Examination	Performance Verification – graded
Limited Number of Participants	none
Remarks	none
Module Components	• Heterogeneous Equilibriums (Lecture) • Heterogeneous Equilibriums (Exercise)
Components to be offered in the Current Semester	No assignment

Module 14285 Interfacial Chemistry

assign to: Specialisation Materials Chemistry

Study programme Chemistry: Materials, Engineering and Sustainability

Degree	Module Number	Module Form
Master of Science	14285	Compulsory elective

Modul Title	**Interfacial Chemistry** Grenzflächenchemie
Department	Faculty 2 - Environment and Natural Sciences
Responsible Staff Member	Prof. Dr. rer. nat. habil. Acker, Jörg
Language of Teaching / Examination	English
Duration	1 semester
Frequency of Offer	Every winter semester
Credits	6
Learning Outcome	After completing the module, students will be able to analyze and apply modern concepts, methods and theories of physical interfacial chemistry. Students will gain a sound understanding of the fundamentals of the thermodynamics of phase boundaries and interfacial processes, methods for determining interfacial tension, films, interfaces with amphiphilic molecules (surfactants and micelles), colloids and adsorption phenomena. Students will also learn the fundamentals and applications of physical methods for characterizing solid surfaces using microscopic and spectroscopic methods. The module should enable students to transfer and apply the acquired knowledge independently and across disciplines to problems of interfacial chemistry. They learn the methodology of structuring scientific questions and using the methods of physical chemistry to examine them qualitatively and quantitatively, while making critical preliminary assessments, considerations and quantitative estimates and evaluating scientific plausibility. Students also learn problem-solving strategies, the description and communicative discussion of physical-chemical issues in interfacial chemistry and acquire social skills such as communication, creativity and scientific discourse.
Contents	Section 1: Thermodynamics of phase boundaries and interfacial processes Thermodynamic description of interfaces Phase boundaries between two pure phases, between two phases with several components and involving three phases: Interfacial tension, pressure difference of two phases on curved surfaces (Young/Laplace equation), vapor pressure of a liquid (Kelvin equation), nucleation and growth of phases, wetting phenomena (contact angle, Young equation, wetting transitions);

	measurement methods, examples from interfacial chemistry, including surfactants, micelles and colloids; adsorption phenomena and examples of interfaces with unique properties. Section 2: Spectroscopic and microscopic methods for the characterisation of solid surfaces: - Electron Spectroscopy (UPS, XPS, Augerelectron spectroscopy) - Ion Spectroscopic Techniques (SIMS, Laser-MS) - Surface Photon Spectroscopic Methods (linear/non-linear methods) - Electron-Stimulated Microanalysis Methods (Scanning electron microscopy) - Scanning Probe Microscopy (Atomic force microscopy, Scanning tunnelling microscopy) - Thin films / Optical coatings (Fabrication (PLD), Characterization, Application)
Recommended Prerequisites	Inorganic Chemistry, Inorganic Materials, Physical Chemistry, Quantum Theory and Spectroscopy, Instrumental Analysis
Mandatory Prerequisites	none
Forms of Teaching and Proportion	Lecture - 4 hours per week per semester Self organised studies - 120 hours
Teaching Materials and Literature	P.W. Atkins, J. de Paula „Physikalische Chemie“, 4. Aufl., Wiley-VCH, 2006 G. Wedler „Lehrbuch der Physikalischen Chemie“, 5. Aufl., Wiley-VCH, 2004 G. Brezesinski, H.-J. Mögel, Grenzflächen und Kolloide, Spektrum 1993 H.-D. Dörfler, Grenzflächen und kolloid-disperse Systeme, Springer Berlin, Heidelberg, 2002 H. Naumer, W. Heller „Untersuchungsmethoden in der Chemie: Eine Einführung in die moderne Analytik“, Wiley-VCH, 2010 D.A. Skoog, F.J. Holler, R.S. Crouch „Instrumentelle Analytik, Grundlagen-Geräte-Anwendungen“, Springer Spektrum, 2013
Module Examination	Final Module Examination (MAP)
Assessment Mode for Module Examination	Written exam, 120 minutes, (graded)
Evaluation of Module Examination	Performance Verification – graded
Limited Number of Participants	none
Remarks	**No offer in WiSe 2025/26.**
Module Components	Lecture Examination
Components to be offered in the Current Semester	No assignment

Module 14286 Principles of Spectrochemistry

assign to: Specialisation Materials Chemistry

Study programme Chemistry: Materials, Engineering and Sustainability

Degree	Module Number	Module Form
Master of Science	14286	Compulsory elective

Modul Title	**Principles of Spectrochemistry** Prinzipien der Spektrochemie
Department	Faculty 2 - Environment and Natural Sciences
Responsible Staff Member	Prof. Dr. rer. nat. habil. Acker, Jörg
Language of Teaching / Examination	English
Duration	1 semester
Frequency of Offer	Every winter semester
Credits	6
Learning Outcome	After completing the module, students will be able to evaluate and analyze the fundamental relationships, measurement principles and experimental methods of element analysis. The aim is to provide a basic understanding of the advantages and disadvantages of the various methods for individual problems in applied quantitative element analysis. To this end, students gain a sound understanding of the physical principles of the methods, the most important components and instrumental details of the measuring devices, data analysis and data evaluation as well as sources of error and how to avoid them. They will be able to understand systematic processes for identifying known and unknown substances and the classification of compounds in complex substance systems. At the end of the module, students should be able to apply the acquired knowledge independently and across disciplines to problems of identification and characterization of predominantly inorganic materials.
Contents	Review and practice-oriented consolidation of concepts of physical chemistry: quantum chemical structure of atoms (electronic states) and statistical thermodynamics (state sums and occupation probabilities) Atomic absorption spectrometry: structure and measuring principles, device components, methods of background correction, data evaluation, application examples, special techniques: different flame types, graphite tube, hydride and cold vapor, atomic emission spectrometry Atomic absorption and emission spectrometry with high-resolution continuum AAS: structure and measuring principles, device components, methods of background correction, data evaluation, advantages and disadvantages compared to classical AAS, molecular absorption and emission spectrometry, application examples

	Plasma spectrometric methods: ICP-OES and GD-OES, structure and measuring principles, device components, methods of background correction, data evaluation, application examples Elemental mass spectrometry: fundamentals of mass spectrometry, overview of MS separation methods, technical conditions and requirements for the MS detection of atoms, GD-MS/ICP-MS: differences and similarities Techniques of element analysis: Sample preparation, sample digestion, trace analysis
Recommended Prerequisites	Physical Chemistry, Quantum Theory and Spectroscopy, Instrumental Analysis
Mandatory Prerequisites	none
Forms of Teaching and Proportion	Lecture - 4 hours per week per semester Self organised studies - 120 hours
Teaching Materials and Literature	P.W. Atkins, J. de Paula „Physikalische Chemie“, Wiley-VCH, 2006. D.A. Skoog, F.J. Holler, S.R. Crouch „Instrumentelle Analytik“, Springer, 2013. J. M. Hollas „Moderne Methoden in der Spektroskopie“, Vieweg & Sohn, 1995. B. Welz, H. Becker-Ross, S. Florek, U. Heitmann „High-resolution continuum source AAS“, Wiley-VCH, 2005. B. Welz, M.Sperling „Atomic Absorption Spectrometry“, Wiley-VCH, 1999. J.A.C. Broekaert “Analytical Atomic Spectrometry with Flames and Plasmas”, Wiley-VCH, 2005. J. Nölte „ICP Emission Spectrometry“, Wiley-VCH, 2003.
Module Examination	Final Module Examination (MAP)
Assessment Mode for Module Examination	written exam, 90 minutes
Evaluation of Module Examination	Performance Verification – graded
Limited Number of Participants	none
Remarks	none
Module Components	• lecture Principles of Spectrochemistry, 4 SWS • written exam, 90 minutes
Components to be offered in the Current Semester	**220668** Examination Principles of Spectrochemistry

Module 14287 Materials for Energy Conversion and Storage

assign to: Specialisation Materials Chemistry

Study programme Chemistry: Materials, Engineering and Sustainability

Degree	Module Number	Module Form
Master of Science	14287	Compulsory elective

Modul Title	**Materials for Energy Conversion and Storage** Materialien für Energiewandlung und Energiespeicherung
Department	Faculty 2 - Environment and Natural Sciences
Responsible Staff Member	Prof. Dr. rer. nat. habil. Acker, Jörg
Language of Teaching / Examination	English
Duration	1 semester
Frequency of Offer	Every summer semester
Credits	6
Learning Outcome	After completing the module, students will have a broad overview of chemical and physical concepts for storing and converting energy and their technical implementation. In the module, students gain a chemical and physical understanding of processes and materials for storing and converting energy, including theoretical principles, measurement methods and performance parameters. Students are familiarized with the most important aspects and procedures for the extraction and processing of the required raw materials as well as their recovery and recycling. Students reflect on the course content and communicate open questions. They learn to make references to current issues, carry out literature research, open up scientific texts and formulate and present content in a structured manner. After completing the module, students will be able to apply materials for energy storage and energy conversion, their functionality and applicability as well as their production, recovery and recycling and to understand, analyze, evaluate and communicate associated processes.
Contents	Theoretical principles of electrochemistry Electrochemical characterization methods Supercapacitors Battery storage technology Fuel cell Electrolysis Redox flow battery Lithium-ion batteries Battery materials for lithium-ion batteries New developments in battery materials

	Recycling of lithium-ion batteries Battery as an economic sector
Recommended Prerequisites	Inorganic Chemistry, Inorganic Materials, Physical Chemistry, Quantum Theory and Spectroscopy, Instrumental Analysis
Mandatory Prerequisites	none
Forms of Teaching and Proportion	Lecture - 4 hours per week per semester Self organised studies - 120 hours
Teaching Materials and Literature	A. Kwade, J. Diekmann (Eds.); „Recycling of Lithium-Ion Batteries - The LithoRec Way“ Springer International Publishing AG 2018, ISBN 978-3-319-70571-2 R. Korthauer (Ed.); „Lithium-Ion Batteries: Basics and Applications“ Springer-Verlag GmbH Germany, part of Springer Nature 2018, ISBN 978-3-662-53069-6 G. Wedler, H.-J. Freund; „Lehr- und Arbeitsbuch Physikalische Chemie“, Wiley-VCH, Weinheim 2018, ISBN: 978-3-527-34611-0 R.A. Huggins; „Energy Storage“, Springer Science&Business Media, LLC 2010, ISBN 978-1-4419-1023-3 C. Breitkopf, K. Swider-Lyons (Eds.); „Springer Handbook of Electrochemical Energy“ Springer-Verlag Berlin Heidelberg 2017, ISBN: 978-3-662-46656-8 R. Dronskowski, S. Kikkawa, A. Stein (Edt.); *Handbook of Solid State Chemistry: Materials and Structure of Solids, Synthesis, Characterization, Nano and Hybrid Materials, Theoretical Description, Applications: Functional Materials*; Verlag Wiley-VCH Verlag; Weinheim; 1. Auflage 2017; ISBN: 978-3527325870. J. Goldstein, D. Newbury, D. Joy, J. Michael, N.W.M. Ritchie, J.H. Scott, *Scanning Electron Microscopy and X-Ray Microanalysis*; Verlag Springer, Berlin, Heidelberg; 4. Auflage 2017; ISBN: 978-1493966745. G. Schwedt, T. Schmidt, O. J. Schmitz; *Analytische Chemie: Grundlagen, Methoden und Praxis*; Verlag Wiley-VCH; Weinheim; 3. Auflage 2016; ISBN: 978-3527340828. E. Tag, Elektrochemie, Studienbücher Chemie, Diesterweg, Salle, Sauerländer, ISBN:3425053884 V.S. Bagotsky, Fundamentals of Electrochemistry, Verlag Wiley-VCH, 2005, ISBN:9780471700586 R. Holze, Y. Wu, Elektrochemische Energiewandler und -speicher: Eine Einführung, Verlag Wiley-VCH, 2023, ISBN: 9783527334308 C. Daniel, J.O. Besenhard, Handbook of Battery Materials, Verlag Wiley-VCH, 2011, ISBN:9783527326952
Module Examination	Final Module Examination (MAP)
Assessment Mode for Module Examination	written exam, 90 minutes
Evaluation of Module Examination	Performance Verification – graded
Limited Number of Participants	none
Remarks	none
Module Components	Lecture

Components to be offered in the Current Semester	**220670** Lecture Materials for Energy Conversion and Storage - 4 Hours per Term **220678** Examination Materials for Energy Conversion and Storage

Module 14293 Porous Materials

assign to: Specialisation Materials Chemistry

Study programme Chemistry: Materials, Engineering and Sustainability

Degree	Module Number	Module Form
Master of Science	14293	Compulsory elective

Modul Title	**Porous Materials** Poröse Materialien
Department	Faculty 2 - Environment and Natural Sciences
Responsible Staff Member	Prof. Dr. rer. nat. habil. Klepel, Olaf
Language of Teaching / Examination	English
Duration	1 semester
Frequency of Offer	Every semester
Credits	6
Learning Outcome	The students acquire comprehensive knowledge on important classes of porous materials, their preparation and characterization. By studying original scientific literature on their own, students are able to analyse scientific texts and reflect on their content in the context of the lecture material. In addition, students have acquired further personal skills related to the degree programme through communicative discussion in seminars.
Contents	• nature of porosity • textural characterization of porous materials by adsorption methods • material classes: zeolites, activated carbons, silica gel, porous glass, metal organic frameworks, porous polymers, ordered mesoporous material, membranes
Recommended Prerequisites	Knowledge of inorganic, organic and physical chemistry
Mandatory Prerequisites	Module 12276 Porous Materials was not successfully completed.
Forms of Teaching and Proportion	Seminar - 1 hours per week per semester Self organised studies - 165 hours
Teaching Materials and Literature	• Video-based teaching material (asynchronous) • Original scientific literature
Module Examination	Continuous Assessment (MCA)
Assessment Mode for Module Examination	2 written exams, each 45 minutes, weighted 50%

Evaluation of Module Examination	Performance Verification – graded
Limited Number of Participants	none
Remarks	Cannot be taken if Module 12276 Porous Materials has already been taken or is being taken at the same time.
Module Components	Seminar Porous Materials
Components to be offered in the Current Semester	**220527** Seminar Porous Materials - 1 Hours per Term **220528** Examination Porous Materials

Module 14294 Lab Course Processes in Porous Materials

assign to: Specialisation Materials Chemistry

Study programme Chemistry: Materials, Engineering and Sustainability

Degree	Module Number	Module Form
Master of Science	14294	Compulsory elective

Modul Title	**Lab Course Processes in Porous Materials** Laborkurs Prozesse in porösen Materialien
Department	Faculty 2 - Environment and Natural Sciences
Responsible Staff Member	Prof. Dr. rer. nat. habil. Klepel, Olaf
Language of Teaching / Examination	English
Duration	1 semester
Frequency of Offer	Every summer semester
Credits	6
Learning Outcome	After completing the module, students will be able to experimentally investigate and analyse physico-chemical processes in highly porous materials and draw conclusions about the properties of the investigated material. They are able to derive strategies for the synthesis of porous materials based on the evaluation of scientific literature and to implement them in practice. The ability to work in a team is promoted by working in small groups. Students are able to familiarise themselves independently with a topic and plan courses of action under given boundary conditions. They have acquired personal skills related to the degree programme through the communicative discussion during the practical course and are able to work on and discuss questions relating to the practical course in small groups.
Contents	- development of strategies for the synthesis of porous materials - Characterisation of surface functionalities of porous materials - Experimental investigation of adsorptive properties of porous materials (e.g. silicate or carbon-based materials) - Experimental investigations into the transport behaviour of substances in porous materials
Recommended Prerequisites	• Knowledge in the field of porous materials such as porous carbons, zeolites or porous silicate materials • Knowledge of adsorption, diffusion and heterogeneous catalysis • Successfully completed the modules 14293 Porous Materials, 14041 Processes in Porous Materials and 14641 Heterogeneous Catalysis
Mandatory Prerequisites	none

Forms of Teaching and Proportion	Laboratory training - 5 hours per week per semester Self organised studies - 105 hours
Teaching Materials and Literature	- Instructions for the laboratory course - Marsh, H., Rodriguez Reinoso, F.: Activated Carbon, Elsevier Science & Technology, 2006. - Weitkamp J., Puppe, L.: Catalysis and Zeolites, Springer, 1999. - Schüth, F., Sing, K.S.W., Weitkamp, J.: Handbook of porous Solids, Wiley-VCH, 2002.
Module Examination	Continuous Assessment (MCA)
Assessment Mode for Module Examination	5 Practical experiments with 10 pages protocol (70%) and summarising 20-minute presentation (30%)
Evaluation of Module Examination	Performance Verification – graded
Limited Number of Participants	none
Remarks	none
Module Components	• laboratory training
Components to be offered in the Current Semester	**220521** Practical training Processes in Porous Materials - 5 Hours per Term

Module 14296 Thermo-mechanical Treatment of Metallic Materials

assign to: Specialisation Materials Chemistry

Study programme Chemistry: Materials, Engineering and Sustainability

Degree	Module Number	Module Form
Master of Science	14296	Compulsory elective

Modul Title	**Thermo-mechanical Treatment of Metallic Materials** Thermomechanische Behandlung von metallischen Werkstoffen
Department	Faculty 3 - Mechanical Engineering, Electrical and Energy Systems
Responsible Staff Member	Prof. Dr.-Ing. habil. Weiß, Sabine
Language of Teaching / Examination	English
Duration	1 semester
Frequency of Offer	Every winter semester
Credits	6
Learning Outcome	Students will gain an in-depth knowledge of the fundamentals of hot forming of metallic materials and the microstructure evolution during hot forming. They will learn about the main defects that occur during different thermomechanical processes and how to mitigate their formation. They will also learn how to apply the Dynamic Materials Model to evaluate the hot formability of various metals and alloys. The thermo-mechanical treatment of different types of steels will be reviewed, giving students further knowledge of forming and deformation of steels in different applications, e.g. car body and pipeline applications.
Contents	Introduction to plasticity: • Flow stress and strains • Yield criteria • Fracture Hot deformation: • Flow stresses • Hot deformation microstructures • Hot deformation and dynamic softening mechanisms • Recovery • Recrystallization of single-phase and two-phase alloys • Grain growth following recrystallization Hot workability assessment • Dynamic materials model • Processing maps Forming techniques:

	• Forging • Rolling • Extrusion • Wire drawing Defects in thermo-mechanical processing: • Form defects • Surface defects • Cracking • Other structural and process-related defects Thermomechanical processing of steel: • Low carbon steels • Dual phase and TRIP steels • HSLA steels Severe plastic deformation
Recommended Prerequisites	• 11915 Grundlagen der Werkstoffe (or equivalent expertise in fundamentals of materials)
Mandatory Prerequisites	none
Forms of Teaching and Proportion	Lecture - 2 hours per week per semester Study project - 2 hours per week per semester Self organised studies - 120 hours
Teaching Materials and Literature	none
Module Examination	Continuous Assessment (MCA)
Assessment Mode for Module Examination	• Study project with final presentation, ~30 min. (30%) and • Written exam, 60 min. (70%)
Evaluation of Module Examination	Performance Verification – graded
Limited Number of Participants	none
Remarks	none
Module Components	none
Components to be offered in the Current Semester	No assignment

Module 14297 Polymer Chemistry

assign to: Specialisation Materials Chemistry

Study programme Chemistry: Materials, Engineering and Sustainability

Degree	Module Number	Module Form
Master of Science	14297	Compulsory elective

Modul Title	**Polymer Chemistry** Polymerchemie
Department	Faculty 2 - Environment and Natural Sciences
Responsible Staff Member	Prof. Dr. rer. nat. Neffe, Axel T.
Language of Teaching / Examination	English
Duration	1 semester
Frequency of Offer	Every summer semester
Credits	6
Learning Outcome	After completing the module, students will be able to correlate the chemical structures of polymers with their physico-chemical properties. They have become familiar with the structure, various methods for the synthesis, properties and modern applications of functional polymers. Students have knowledge and practical skills in the planning, implementation and evaluation of laboratory projects. They are able to plan tasks assigned to them with the aid of literature research, implement them using standard laboratory equipment, evaluate, document and present the results. In the practical laboratory work, students are familiarized with basic operations for the synthesis and purification of polymers. The synthesis operations enable students to set up and operate standard reaction apparatus and encourage them to develop purification strategies for polymer reaction products. Using the example of carrying out syntheses that follow known reaction mechanisms and processing organic analyses, the practical part pursues the fundamental aim of consolidating existing theoretical knowledge of the reactivity of functional groups and applying it in practice. This provides students with knowledge and practical skills in the planning, implementation and evaluation of laboratory projects. They are able to plan the tasks assigned to them with the aid of literature research, implement them using standard laboratory equipment, evaluate, document and present the results. Students have acquired course-related personal skills through communicative discussion in seminars / practical training.
Contents	Technical polymerizations, materials from regrowing ressources and circular polymer economy, ring-opening polymerization, stereocrystallization, gelatin- and silk-based materials, advanced

	polymer synthesis, functional polymers and their applications such as electrically conducting polymers, liquid-crystalline elastomers, self-healing materials, and shape-memory polymers, AI in polymer research.
Recommended Prerequisites	a preliminary introduction to polymer chemistry would be helpful
Mandatory Prerequisites	none
Forms of Teaching and Proportion	Lecture - 2 hours per week per semester Practical training - 4 hours per week per semester Self organised studies - 90 hours
Teaching Materials and Literature	All lecture contents are provided as slides for download. In addition to the stated original literature, text books of help could e.g. b • Hiemenz, P.C.: Polymer Chemistry. The Basic Concepts. • Young RJ, Lovell PA, Introduction to Polymers (3rd Ed), CRC Press. • Hiemenz PC, Lodge TP, Polymer Chemistry (2nd Ed), CRC Press. • Bovey, F.A. and Winslow, F.H., Eds.: Macromolecules, an introduction to polymer science. • Cowie, J.M.G.; Arrighi, V: Polymers: Chemistry and Physics of Modern Materials, CRC Press. • Koltzenburg, S.; Maskos, M.; Nuyken, O.: Polymere: Synthesis, Properties and Applications, Springer Spektrum. • Tieke, B.: Makromolekulare Chemie – Eine Einführung, Wiley VCH.
Module Examination	Prerequisite + Final Module Examination (MAP)
Assessment Mode for Module Examination	Prerequsite: Participation in the practical course with 6-8 experiments, at least 2/3 of the experiments successfully performed, and an accepted version of the protocol MAP: oral examination on the lecture and practical part, 30 min.
Evaluation of Module Examination	Performance Verification – graded
Limited Number of Participants	20
Remarks	none
Module Components	• Lecture Polymer Chemistry • Practical training Polymer Chemistry • Modul examination (oral)
Components to be offered in the Current Semester	**220370** Lecture Polymer Chemistry - 2 Hours per Term **220373** Practical training Polymer Chemistry - 4 Hours per Term

Module 14298 Methods in Material Analytics

assign to: Specialisation Materials Chemistry

Study programme Chemistry: Materials, Engineering and Sustainability

Degree	Module Number	Module Form
Master of Science	14298	Compulsory elective

Modul Title	**Methods in Material Analytics** Methoden der Materialanalytik
Department	Faculty 2 - Environment and Natural Sciences
Responsible Staff Member	Prof. Dr. rer. nat. habil. Schmidt, Peer Prof. Dr. rer. nat. Neffe, Axel T.
Language of Teaching / Examination	English
Duration	1 semester
Frequency of Offer	Every winter semester
Credits	6
Learning Outcome	The aim is for students to be able to apply classical methods of inorganic and organic analytical chemistry to materials and to become familiar with other analytical methods that have been developed specifically for the characterization of materials. After completing the module, students will be able to select suitable characterization methods for a specific problem, reproduce and explain the physicochemical principles of the measurement methods, and evaluate and correlate the data obtained from the various methods. In the practical laboratory work, students are familiarized with typical methods of material analysis and learn about sources of error. Practical work includes the evaluation and assessment of the data obtained. This provides students with knowledge and practical skills in the planning, implementation and evaluation of laboratory projects. They are able to plan tasks assigned to them with the help of literature research, implement them using standard laboratory equipment, evaluate, document and present the results. Students have acquired course-related personal skills through communicative discussion in seminars / practical training.
Contents	• Introduction: Symmetry of solid state and molecular structures • Introduction: Interactions of electromagnetic radiation with matter • Diffraction (XRD/WAXS/SAXS) • Electron microscopy (SEM, SE, BSE, Auger, EDX/WDX) • Thermal analysis methods (DTA, DSC, TGA, coupling methods) • Mechanical investigations (rheology, tensile strain experiments) • Spectroscopy (NMR, IR, Raman) • Mass spectrometry of surfaces and macromolecules

	• Light scattering, viscosimetry • Chromatographic methods (GPC/SEC, HPLC)
Recommended Prerequisites	Basics in instrumental analytics and spectroscopy
Mandatory Prerequisites	none
Forms of Teaching and Proportion	Lecture - 2 hours per week per semester Practical training - 3 hours per week per semester Self organised studies - 105 hours
Teaching Materials and Literature	All content of the lecture can be downloaded as slides. In addition, selected parts of: • Mass Spectrometry in Polymer Chemistry (Ed. by C. Barner-Kowollik, T. Gründling, J. Falkenhagen, S. Weidner), Wiley-VCH • Koltzenburg, S.; Maskos, M.; Nuyken, O.: Polymer Chemistry, Springer Spektrum. • Spectroscopic Techniques for Polymer Characterization (Ed. by Yukihiro Ozaki and Harumi Sato), Wiley-VCH • K. Tashiro: Structural Science of Crystalline Polymers, Springer • U.W. Gedde, M.S. Hedenqvist, M. Hakkarainen, F. Nilsson, O. Das, Applied Polymer Science, Springer • Experimental Approaches of NMR Spectroscopy - Methodology and Application to Life Science and Materials Science (Ed. by A. Naito, T. Asakura, I. Shimada, K. Takegoshi, Y. Yamamoto), Springer
Module Examination	Prerequisite + Final Module Examination (MAP)
Assessment Mode for Module Examination	Prerequisite: Conducting experiments and approved protocol MAP: Written exam, 120 min.
Evaluation of Module Examination	Performance Verification – graded
Limited Number of Participants	none
Remarks	none
Module Components	Lecture Methods in Analytical Chemistry Practical training Methods in Analytical Chemistry Modul Examination (written)
Components to be offered in the Current Semester	**220278** Examination Methods in Material Analytics

Module 14309 Modern Concepts of Materials Design

assign to: Specialisation Materials Chemistry

Study programme Chemistry: Materials, Engineering and Sustainability

Degree	Module Number	Module Form
Master of Science	14309	Compulsory elective

Modul Title	**Modern Concepts of Materials Design** Moderne Konzepte der Materialentwicklung
Department	Faculty 2 - Environment and Natural Sciences
Responsible Staff Member	Prof. Dr. rer. nat. habil. Klepel, Olaf
Language of Teaching / Examination	English
Duration	1 semester
Frequency of Offer	Every winter semester
Credits	6
Learning Outcome	After completing the module, students will have an overview of current topics and activities in materials research. They will be able to derive strategies for the synthesis and characterisation of materials based on the evaluation of scientific literature and implement them in practice using selected examples.
Contents	- Current materials research in the working groups of the Institute of Materials Chemistry - Synthesis and characterisation of inorganic or organic materials using selected examples, scope and content will be determined by the working group leaders at the beginning of the practical course
Recommended Prerequisites	none
Mandatory Prerequisites	none
Forms of Teaching and Proportion	Lecture - 1 hours per week per semester Laboratory training - 4 hours per week per semester Self organised studies - 105 hours
Teaching Materials and Literature	Scientific literature on the research topics of the Institute's working groups
Module Examination	Continuous Assessment (MCA)
Assessment Mode for Module Examination	1. Report on the laboratory work carried out in the form of a scientific publication of approx. 10 to 20 pages (60%) 2. Presentation (15 min) and discussion (10 min) of the results (40%)

Evaluation of Module Examination	Performance Verification – graded
Limited Number of Participants	20
Remarks	At the beginning of the module, the research groups of the Institute of Materials Chemistry present their research topics as part of a lecture block, which usually takes place in the first week of the semester. The students then work on a task from a current research topic of a research group. Students can choose the group themselves, although the current capacities of the group must be taken into account. The decision as to whether the internship can be completed in a research group therefore lies with the head of the group.
Module Components	Lecture and Laboratory training
Components to be offered in the Current Semester	No assignment

Module 14326 Solid State Chemistry

assign to: Specialisation Materials Chemistry

Study programme Chemistry: Materials, Engineering and Sustainability

Degree	Module Number	Module Form
Master of Science	14326	Compulsory elective

Modul Title	**Solid State Chemistry** Festkörperchemie
Department	Faculty 2 - Environment and Natural Sciences
Responsible Staff Member	Prof. Dr. rer. nat. habil. Schmidt, Peer
Language of Teaching / Examination	English
Duration	1 semester
Frequency of Offer	Every winter semester
Credits	6
Learning Outcome	The students will be able to recognize the connection between bonding theory concepts for solids and the formation of characteristic structural motifs and distinguish the typical crystal structures of inorganic solids. They are also able to demonstrate the structure-property relationships of inorganic solids. With the help of their acquired knowledge of the thermodynamics and kinetics of solid-state reactions, students gain a rational approach to methods and processes of inorganic solid-state and materials synthesis. The students reflect on the lecture material and are able to discuss relevant scientific problems in solid state and materials chemistry. With reference to current issues, they can carry out literature research and open up scientific publications and reports. They will be able to combine different concepts in relation to synthesis approaches, the description of ideal and real structures, and the structure-property relationships of inorganic solids and materials. The students can collaborate in small working groups, develop solutions to given problems and present their results orally and in writing. Students will also be enabled to transfer their knowledge to laboratory work. They are able to familiarize themselves independently with an experimental topic, plan work processes under given conditions, organize themselves in a laboratory group and carry out chemical experiments. Finally, they can save experimental data, document their work in reports and communicate in presentations. The specialist knowledge in theory and laboratory work provides students with in-depth expertise of syntheses, structures and properties

	of inorganic solids and materials and qualifies them for further involvement in scientific research as well as in application-oriented research and development of new materials.
Contents	Lecture: - Bonding concepts for inorganic solids - Structures of crystalline inorganic solids - Structure-property relationships of inorganic solids and materials - Thermodynamics and kinetics of phase formation - Synthesis of inorganic solids and materials - Crystal growth processes of inorganic solids and materials - Current concepts in solid state chemistry Practical course: - Modern laboratory methods of chemical synthesis of inorganic solids and materials - Chemical analysis and structure determination of inorganic solids and materials - Application of basic thermodynamic calculation methods for rational synthesis planning
Recommended Prerequisites	Knowledge of the topics/basic courses in general chemistry, inorganic chemistry, physical chemistry, instrumental analytics
Mandatory Prerequisites	none
Forms of Teaching and Proportion	Lecture - 2 hours per week per semester Laboratory training - 3 hours per week per semester Self organised studies - 105 hours
Teaching Materials and Literature	• L. Smart, E. Moore, *Solid State Chemistry: An Introduction,* CRC Press; 5. Edition, 2020, ISBN: 978-0367135720. • A.R. West, *Solid State Chemistry and its Applications*, Wiley & Sons; 2. Edition, 2022, ISBN: 978-1118447444 • U. Müller, *Inorganic Structural Chemistry (Inorganic Chemistry, Band 22)*, Wiley & Sons Inc; 2. Edition (2006), ISBN: 978-0470018644. • U. Schubert, N. Hüsing; *Synthesis of Inorganic Materials*; Verlag Wiley-VCH; Weinheim; 4. Auflage 2019; ISBN: 978-3527344574. • D. Klimm, *Thermal Analysis and Thermodynamics: In Materials Science*, De Gruyter; 1. Edition, 2022, ISBN: 978-3110743777. • R. Dronskowski, S. Kikkawa, A. Stein (Edt.); *Handbook of Solid State Chemistry: Materials and Structure of Solids, Synthesis, Characterization, Nano and Hybrid Materials, Theoretical Description, Applications: Functional Materials*; Verlag Wiley-VCH Verlag; Weinheim; 1. Auflage 2017; ISBN: 978-3527325870.
Module Examination	Prerequisite + Final Module Examination (MAP)
Assessment Mode for Module Examination	**Prerequisite:** • Successful completion of the practical course **Final module examination:** • Written examination, 120 min.

Evaluation of Module Examination	Performance Verification – graded
Limited Number of Participants	none
Remarks	none
Module Components	• Lecture solid state chemistry • Laboratory training solid state chemistry • Module examination (written exam)
Components to be offered in the Current Semester	No assignment

Module 14327 Crystal Chemistry and Crystal Growth

assign to: Specialisation Materials Chemistry

Study programme Chemistry: Materials, Engineering and Sustainability

Degree	Module Number	Module Form
Master of Science	14327	Compulsory elective

Modul Title	**Crystal Chemistry and Crystal Growth** Kristallchemie und Kristallzüchtung
Department	Faculty 2 - Environment and Natural Sciences
Responsible Staff Member	Prof. Dr. rer. nat. habil. Schmidt, Peer
Language of Teaching / Examination	English
Duration	1 semester
Frequency of Offer	Every summer semester
Credits	6
Learning Outcome	After completing the module, the students will be able to recognize the connection between phase diagrams and crystallization pathways. They are also able to describe the crystalline state and the typical crystal structures of inorganic solids and materials. With the help of the acquired knowledge of the thermodynamics and kinetics of crystal growth processes, students gain a rational approach to methods of crystallization of inorganic solids and materials. Students reflect on the lecture material and are able to discuss relevant scientific problems in crystal chemistry. With reference to current issues, they can carry out literature research and open up scientific publications and reports. They are able to combine different concepts relating to crystal growth processes and the formation of ideal and real structures of solids. Students can work together in small working groups, develop solutions to given problems and present their results orally and in writing. Students are also able to transfer their knowledge to simple modeling approaches and laboratory work. They are able to familiarize themselves independently with an experimental topic, plan work processes under given conditions, organize themselves in a laboratory group and carry out chemical experiments. Finally, they can save experimental data, document their work in reports and communicate in presentations. The specialist knowledge in theory and laboratory work provides students with in-depth knowledge of crystal growth processes and crystal structures of inorganic solids and materials and qualifies them

	for further collaboration in scientific research as well as in application-oriented research and development of new materials.
Contents	Lecture: - The crystalline state and crystal structures of inorganic solids - Existence ranges of inorganic solids and pathways to their crystallization - Thermodynamic fundamentals of phase diagrams of inorganic solids and basics for their thermochemical modelling - Nucleation and crystal growth - Methods of crystal growth in the laboratory and in industrial practice - Applications of crystalline solids as functional materials Exercise: - Calculation of phase diagrams with simple spreadsheets - Calculation/modelling of phase diagrams by Calphad-method - Calculation/modelling of crystallization pathways Practical course - Methods of crystal growth in the laboratory and in industrial practice - Chemical analysis of crystalline materials - Fundamentals of crystal structure analysis
Recommended Prerequisites	Knowledge of the topics/basic courses in general chemistry, inorganic chemistry, physical chemistry, instrumental analytics
Mandatory Prerequisites	none
Forms of Teaching and Proportion	Lecture - 2 hours per week per semester Exercise - 1 hours per week per semester Practical training - 2 hours per week per semester Self organised studies - 105 hours
Teaching Materials and Literature	• U. Müller, *Inorganic Structural Chemistry (Inorganic Chemistry, Band 22)*, Wiley & Sons Inc; 2. Edition (2006), ISBN: 978-0470018644. • G. Dhanaraj (Edt.), Springer Handbook of Crystal Growth, Springer; 2010, ISBN-13 : 978-3540741824 • M. Binnewies, R. Glaum, M. Schmidt, P. Schmidt, *Chemical Vapor Transport reactions*, Verlag: De Gruyter; 1. Auflage 2012; ISBN: 978-3110254648. • A.R. West, *Solid State Chemistry and its Applications*, Wiley & Sons; 2. Edition, 2022, ISBN: 978-1118447444
Module Examination	Prerequisite + Final Module Examination (MAP)
Assessment Mode for Module Examination	**Prerequisite:** • Successful completion of the practical course • Successful completion of exercises **Final module examination:** • Written examination, 120 min.
Evaluation of Module Examination	Performance Verification – graded

Limited Number of Participants	none
Remarks	No offer in 2026.
Module Components	• Lecture crystal chemistry • Exercise crystal chemistry • Practical course in solid state chemistry • Module examination (written exam)
Components to be offered in the Current Semester	No assignment

Module 14408 Biomaterials I

assign to: Specialisation Materials Chemistry

Study programme Chemistry: Materials, Engineering and Sustainability

Degree	Module Number	Module Form
Master of Science	14408	Compulsory elective

Modul Title	**Biomaterials I** Biomaterialien I
Department	Faculty 2 - Environment and Natural Sciences
Responsible Staff Member	Prof. Dr. rer. nat. Rosencrantz, Ruben R.
Language of Teaching / Examination	English
Duration	1 semester
Frequency of Offer	Every winter semester
Credits	6
Learning Outcome	Lernziele / *Learning Outcome**

At the end of the module the students are able to understand the use of biomaterials in various modern concepts as well as the definition of biomaterials versus biofunctional materials. The module is designed to provide students with a comprehensive understanding of the principles, design, and applications of materials used in biological settings. By the end of the module, students will have acquired theoretical knowledge essential for the development, characterization, and evaluation of biomaterials.

Specifically, students will be able to:

Understand the fundamental principles of biomaterials

- Identify the different types of biomaterials and understand their chemical, physical, and biological properties.
- Comprehend the key concepts of biocompatibility, biodegradability, and biofunctionality.

Explore the interactions between biomaterials and biological systems

- Analyze the chemical and physical interactions between biomaterials and biological tissues, focusing on factors such as protein adsorption, immune responses, and tissue integration.

Design and tailor biomaterials for specific biomedical applications

- Evaluate the materials' suitability for specific uses, such as in tissue engineering, drug delivery, and medical devices.
- Understand the requirements and strategies for tailoring material properties to improve functionality

Characterize and assess the performance of biomaterials

- Master analytical techniques for the characterization of biomaterials, including mechanical, chemical, and biological properties.

	In the seminar students will critically analyze recent advances and emerging trends in biomaterials research - Stay up to date with the latest scientific and technological advancements in biomaterials, including nanomaterials, smart materials, and 3D bioprinting.
Contents	- Definition biomaterials, degradable polymers, biodegradation - Polymer synthesis and characterization - Functional Polymers - Functional Biomolecules (Proteins, DNA, Glycans) - Combining functional biomolecules and polymers - Bioassays - Interactions of polymeric materials and cells
Recommended Prerequisites	Basic knowledge of organic and inorganic chemistry, polymer science, and physical chemistry is recommended.
Mandatory Prerequisites	none
Forms of Teaching and Proportion	Lecture - 3 hours per week per semester Seminar - 2 hours per week per semester Self organised studies - 105 hours
Teaching Materials and Literature	Materials will be provided (lecture script, publications and other materials) at the start of the lecture and subsequently during the module
Module Examination	Prerequisite + Final Module Examination (MAP)
Assessment Mode for Module Examination	Prerequisite: • Presentation on given topic in the seminar (15 minutes) and discussion (not graded) MAP: • Written or oral exam on the topics of the lecture (graded), 90 minutes
Evaluation of Module Examination	Performance Verification – graded
Limited Number of Participants	none
Remarks	none
Module Components	• Lecture Biomaterials I • Seminar Biomaterials I
Components to be offered in the Current Semester	No assignment

Module 14409 Biomaterials II Lab Course

assign to: Specialisation Materials Chemistry

Study programme Chemistry: Materials, Engineering and Sustainability

Degree	Module Number	Module Form
Master of Science	14409	Compulsory elective

Modul Title	**Biomaterials II Lab Course** Biomaterialien II Laborkurs
Department	Faculty 2 - Environment and Natural Sciences
Responsible Staff Member	Prof. Dr. rer. nat. Rosencrantz, Ruben R.
Language of Teaching / Examination	English
Duration	1 semester
Frequency of Offer	Every summer semester
Credits	6
Learning Outcome	The Biomaterials module is designed to provide students with a comprehensive understanding of the principles, design, and applications of materials used in biomedical settings. By the end of the module, students will have acquired both theoretical and practical knowledge essential for the development, characterization, and evaluation of biomaterials. Specifically, students will be able to: • Understand the fundamental principles of biomaterials • Comprehend the key concepts of biocompatibility, biodegradability, and biofunctionality • Explore the interactions between biomaterials and biological systems • Synthesize biomaterials • Analyze the chemical and physical interactions between biomaterials and biological matter • Design and tailor biomaterials • Assess the degradation of materials • Utilize 3D-bioprinting
Contents	• Synthesis and characterization of biomaterials or components therof • Functional Biomolecules • Bioassays • 3D printing of biomaterials
Recommended Prerequisites	Successfully completed Module „Biomaterials I“
Mandatory Prerequisites	none

Forms of Teaching and Proportion	Seminar - 1 hours per week per semester Laboratory training - 4 hours per week per semester Self organised studies - 105 hours
Teaching Materials and Literature	Materials will be provided (script for practical course, publications and other materials) at the start of the module and subsequently during the semester.
Module Examination	Continuous Assessment (MCA)
Assessment Mode for Module Examination	• Reports on the laboratory work of approx. 10 to 20 pages (60%) • Presentation (15 min) and discussion (10 min) of the results (40%)
Evaluation of Module Examination	Performance Verification – graded
Limited Number of Participants	5
Remarks	none
Module Components	• Seminar Biomaterials II • Laboratory training Biomaterials II
Components to be offered in the Current Semester	**220726** Seminar Biomaterials II - 1 Hours per Term **220723** Practical training Biomaterials II - 4 Hours per Term

Module 14641 Heterogeneous Catalysis

assign to: Specialisation Materials Chemistry

Study programme Chemistry: Materials, Engineering and Sustainability

Degree	Module Number	Module Form
Master of Science	14641	Compulsory elective

Modul Title	**Heterogeneous Catalysis** Heterogene Katalyse
Department	Faculty 2 - Environment and Natural Sciences
Responsible Staff Member	Prof. Dr. rer. nat. habil. Klepel, Olaf
Language of Teaching / Examination	English
Duration	1 semester
Frequency of Offer	Every semester
Credits	6
Learning Outcome	After completing this module, students will be able to investigate the course of heterogeneously catalysed reactions by linking knowledge from inorganic, physical and organic chemistry. They will be able to describe the structure and mode of action of important catalyst systems and characterise important catalyst types. Through self-study of original scientific literature, students will be able to understand German and English texts and reflect on their content in the context of the lecture material. In addition, students will have acquired further personal skills relevant to their degree programme through communicative interaction in seminars.
Contents	Fundamentals of micro- and macrokinetics, synthesis and characterisation of solid catalysts (acid catalysts, metal catalysts, transition metal oxides, carbon materials) and mechanisms of associated catalysed reactions, fundamentals of electrocatalysis and heterogeneous photocatalysis
Recommended Prerequisites	fundamental knowledge in general, inorganic, physical chemistry and physics
Mandatory Prerequisites	none
Forms of Teaching and Proportion	Seminar - 1 hours per week per semester Self organised studies - 165 hours
Teaching Materials and Literature	• Video-based teaching material (asynchronous) • Baerns, M.; Behr, A.; Brehm, A. et al.: Technische Chemie, Wiley-VCH, 2013.

	• Reschetilowski, W.: Einführung in die Heterogene Katalyse, Springer 2015. • Weitkamp J., Puppe, L.: Catalysis and Zeolites, Springer, 1999.
Module Examination	Continuous Assessment (MCA)
Assessment Mode for Module Examination	2 written exams, each 45 minutes, weighted 50%
Evaluation of Module Examination	Performance Verification – graded
Limited Number of Participants	none
Remarks	none
Module Components	Seminar, examination
Components to be offered in the Current Semester	**220582** Seminar Heterogeneous Catalysis - 1 Hours per Term

Module 12233 Experiments in Aerodynamics and Fluid Mechanics

assign to: Specialisation Fluid- and Process Engineering

Study programme Chemistry: Materials, Engineering and Sustainability

Degree	Module Number	Module Form
Master of Science	12233	Compulsory elective

Modul Title	**Experiments in Aerodynamics and Fluid Mechanics** Experimente in Aerodynamik und Strömungslehre
Department	Faculty 3 - Mechanical Engineering, Electrical and Energy Systems
Responsible Staff Member	Prof. Dr.-Ing. Egbers, Christoph
Language of Teaching / Examination	English
Duration	1 semester
Frequency of Offer	Every winter semester
Credits	6
Learning Outcome	Participants of the module Experiments in aerodynamics and fluid mechanics will be able to understand the topic from an analytic and a practical point of view. The main scope is the understanding of fundamental Fluid mechanics. At the end of the module the students are able to understand basic aerodynamic and fluid mechanics phenomena as well as measurement techniques which are state of the art.
Contents	The specific topics will be explained theoretically in the lecture while in the exercise experiments will be performed. The experiments will focus on different fundamental flow phenomena and investigate them using different measurement techniques. The main contents of the module will be: • Wind tunnel • Water tunnel • Flow around bodys • Principle of Airfoil • Laminar flow • Turbulence • Pipe flow • Rotating Machinery • Flow Instabilities • Taylor-Couette flow • Convection • Aeroacoustics • Aeolsharp • Karman Vortex street • Car Aerodynamics • Wheel housing

	• Flow Visualization techniques • Pressure measurements • LASER-based measurement techniques • Particle Image Velocimetry • Laser Doppler Anemometry
Recommended Prerequisites	none
Mandatory Prerequisites	none
Forms of Teaching and Proportion	Lecture - 1 hours per week per semester Exercise - 3 hours per week per semester Self organised studies - 120 hours
Teaching Materials and Literature	• Selected literature will be presented at the beginning of the module. • Guidelines for the experiments will be given in first lecture
Module Examination	Continuous Assessment (MCA)
Assessment Mode for Module Examination	• Written project reports of 10 experiments (2/3) • Oral defense of one experiment, 10 minutes (1/3)
Evaluation of Module Examination	Performance Verification – graded
Limited Number of Participants	none
Remarks	This module is based on experimental and fluid mechanical knowledge. The interested students should bring skills on these fields.
Module Components	participation in lecture, exercise
Components to be offered in the Current Semester	No assignment

Module 12886 Flow Measurements

assign to: Specialisation Fluid- and Process Engineering

Study programme Chemistry: Materials, Engineering and Sustainability

Degree	Module Number	Module Form
Master of Science	12886	Compulsory elective

Modul Title	**Flow Measurements** Flow Measurements
Department	Faculty 3 - Mechanical Engineering, Electrical and Energy Systems
Responsible Staff Member	Prof. Dr.-Ing. Egbers, Christoph
Language of Teaching / Examination	English
Duration	1 semester
Frequency of Offer	Every winter semester
Credits	6
Learning Outcome	Understanding the bases of the experimental and optical measurement techniques. The students learn and know the basics of optical flow measurements for Fluid Mechanics and Aerodynamics. After successful completion of the module, they are able to apply the basic methods and measurement techniques to solve experimental Fluid Mechanics and Aerodynamics problems. They are able to work in a team and they are able to present their work in a seminar.
Contents	Methods of Flow Visualization, Overview on Optical Measurement Techniques, Laser-Doppler-Anemometry; Particle-Image-Velocimetry; Particle-Tracking-Velocimetry; Liquid Crystal Technique, Dye-Injection Method; Hot-Wire- and Hot-Film Anemometry, Doppler-Global Velocimetry, Oil-Fim-Technique, Measurement Techniques for Channeland Pipe Flows, Wind Tunnel Measurement Techniques (i.e. Pressure Sensitive Paints).
Recommended Prerequisites	none
Mandatory Prerequisites	none
Forms of Teaching and Proportion	Lecture - 2 hours per week per semester Exercise - 2 hours per week per semester Self organised studies - 120 hours
Teaching Materials and Literature	• Selected literature will be presented at the beginning of the module. • Guidelines for the experiments will be given in first lecture
Module Examination	Prerequisite + Final Module Examination (MAP)

Assessment Mode for Module Examination	Prerequisite: • Successful written project reports of 10 experiments Final Module Examination: • Oral examination, 30 minutes
Evaluation of Module Examination	Performance Verification – graded
Limited Number of Participants	none
Remarks	The lecturer also answers questions in German.
Module Components	• Flow Measurements (Lecture) • Flow Measurements (Excercise) • Flow Measurements (Examination)
Components to be offered in the Current Semester	No assignment

Module 12989 Process System Technology II

assign to: Specialisation Fluid- and Process Engineering

Study programme Chemistry: Materials, Engineering and Sustainability

Degree	Module Number	Module Form
Master of Science	12989	Compulsory elective

Modul Title	**Process System Technology II** Prozesssystemtechnik II
Department	Faculty 3 - Mechanical Engineering, Electrical and Energy Systems
Responsible Staff Member	No assignment
Language of Teaching / Examination	English
Duration	1 semester
Frequency of Offer	Every summer semester
Credits	6
Learning Outcome	none
Contents	none
Recommended Prerequisites	none
Mandatory Prerequisites	none
Forms of Teaching and Proportion	No assignment
Teaching Materials and Literature	none
Module Examination	Unspecified - Specification from winter semester 2016/17 required!
Assessment Mode for Module Examination	none
Evaluation of Module Examination	Performance Verification – graded
Limited Number of Participants	none
Remarks	none
Module Components	none
Components to be offered in the Current Semester	No assignment

Module 13278 Energy Systems Engineering

assign to: Specialisation Fluid- and Process Engineering

Study programme Chemistry: Materials, Engineering and Sustainability

Degree	Module Number	Module Form
Master of Science	13278	Compulsory elective

Modul Title	**Energy Systems Engineering** Energiesystemtechnik
Department	Faculty 3 - Mechanical Engineering, Electrical and Energy Systems
Responsible Staff Member	Prof. Dr.-Ing. Arellano-Garcia, Harvey
Language of Teaching / Examination	English
Duration	1 semester
Frequency of Offer	Every summer semester
Credits	6
Learning Outcome	At the end of the module the students are able to analyse, formulate, and solve energy-related engineering problems. They will be able to evaluate, improve and design engineered systems and processes, using modern engineering tools and approaches and demonstrate in-depth knowledge of energy systems in research, manufacturing and management. They will develop an interdisciplinary understanding of the variety of approaches to development, deployment and sustainability of global energy resources.
Contents	• Fundamentals of energy analysis: thermodynamics of energy conversion; mass, energy and exergy balance; systems modelling, analysis, design, and optimisation; control systems • Energy issues, definitions and resources; energy economics. • Sustainable energy technologies; design and operation of distributed energy systems
Recommended Prerequisites	none
Mandatory Prerequisites	none
Forms of Teaching and Proportion	Lecture - 2 hours per week per semester Exercise - 2 hours per week per semester Self organised studies - 120 hours
Teaching Materials and Literature	• Handouts and reading list • Manual and tutorial of the modelling programmes
Module Examination	Final Module Examination (MAP)

Assessment Mode for Module Examination	• Written examination, 90 minutes
Evaluation of Module Examination	Performance Verification – graded
Limited Number of Participants	none
Remarks	none
Module Components	Energy Systems Engineering, Lecture / Exercises
Components to be offered in the Current Semester	**360350** Lecture/Exercise Energy Systems Engineering - 4 Hours per Term **360382** Examination Energy Systems Engineering

Module 13515 Advanced Methods in Process, Energy and Systems Engineering

assign to: Specialisation Fluid- and Process Engineering

Study programme Chemistry: Materials, Engineering and Sustainability

Degree	Module Number	Module Form
Master of Science	13515	Compulsory elective

Modul Title	**Advanced Methods in Process, Energy and Systems Engineering** Erweiterte Methoden zur Prozessmodellierung und Optimierung in der Energie- und Verfahrenstechnik
Department	Faculty 3 - Mechanical Engineering, Electrical and Energy Systems
Responsible Staff Member	Prof. Dr.-Ing. Arellano-Garcia, Harvey
Language of Teaching / Examination	English
Duration	1 semester
Frequency of Offer	Every summer semester
Credits	6
Learning Outcome	The module requires a basic background in calculus and linear algebra, thus allowing easy understanding of mathematical reasoning. In addition, numerous examples in process, energy, environmental and systems engineering will demonstrate key concepts and algorithms. The practical exercises will involve theoretical derivations and small-size numerical problems in modelling systems like matlab, python, octave, GAMS thus putting knowledge into practice.
Contents	This module will teach approaches to modelling and optimization frameworks to address the complex process and energy problems, which arise in design and operation of process and energy systems in an integrated way. Moreover, the presented theoretical and methodological concepts are joined conceptionally with optimal designed experiments to adjust the fundamental mathematical models and to validate the developed process concepts. The taught methods are of generic character, and thus, producing optimal design and operational plans for process and energy systems ranging from microscale to mega-scale stages over operative time horizons from milliseconds to years. The approaches to be discussed will mainly be around superstructure-based modelling, mixed-integer linear and nonlinear programming, multiobjective optimization, optimization under uncertainty, and life-cycle assessment. The presented case studies will be around advanced process systems for renewable energy conversion, separation and reaction systems as well as biotechnological production systems.

Recommended Prerequisites	• Basic backround in process engineering • calculus and linear algebra
Mandatory Prerequisites	none
Forms of Teaching and Proportion	Lecture - 2 hours per week per semester Exercise - 2 hours per week per semester Self organised studies - 120 hours
Teaching Materials and Literature	• Script zur Vorlesung • Advanced Optimization for Process Systems Engineering. Ignacio E. Grossmann, Cambridge University Press • Optimization for Chemical and Biochemical Engineering: Theory, Algorithms, Modeling and Applications. Vassilios S. Vassiliadis, Walter Kähm, Ehecatl Antonio del Rio Chanona, Cambridge University Press • Systematic Methods of Chemical Process Design. Lorenz T. Biegler, Ignacio E. Grossmann, Arthur W. Westerberg, Prentince Hall • Nonlinear Programming: Concepts, Algorithms, and Applications to Chemical Processes. Lorenz T. Biegler, SIAM, 2010
Module Examination	Final Module Examination (MAP)
Assessment Mode for Module Examination	• Written Examination 90 min
Evaluation of Module Examination	Performance Verification – graded
Limited Number of Participants	none
Remarks	• The module takes place as a block course • The appointment will be announced in the current semester
Module Components	• VL Advance Methods in Process, Energy and systems Engineering • Ü Advance Methods in Process, Energy and systems Engineering • P Advance Methods in Process, Energy and systems Engineering
Components to be offered in the Current Semester	**360351** Lecture/Exercise Advanced Methods in Process, Energy and systems Engineering - 4 Hours per Term **360389** Examination Advanced Methods in Process, Energy and systems Engineering

Module 13519 CFD 1

assign to: Specialisation Fluid- and Process Engineering

Study programme Chemistry: Materials, Engineering and Sustainability

Degree	Module Number	Module Form
Master of Science	13519	Compulsory elective

Modul Title	**CFD 1** CFD 1
Department	Faculty 3 - Mechanical Engineering, Electrical and Energy Systems
Responsible Staff Member	No assignment
Language of Teaching / Examination	English
Duration	1 semester
Frequency of Offer	Every semester
Credits	6
Learning Outcome	none
Contents	none
Recommended Prerequisites	none
Mandatory Prerequisites	none
Forms of Teaching and Proportion	No assignment
Teaching Materials and Literature	none
Module Examination	Unspecified - Specification from winter semester 2016/17 required!
Assessment Mode for Module Examination	none
Evaluation of Module Examination	Performance Verification – graded
Limited Number of Participants	none
Remarks	none
Module Components	none
Components to be offered in the Current Semester	No assignment

Module 13717 Decarbonisation of Industrial Processes

assign to: Specialisation Fluid- and Process Engineering

Study programme Chemistry: Materials, Engineering and Sustainability

Degree	Module Number	Module Form
Master of Science	13717	Compulsory elective

Modul Title	**Decarbonisation of Industrial Processes** Dekarbonisierung von Industrieprozessen
Department	Faculty 3 - Mechanical Engineering, Electrical and Energy Systems
Responsible Staff Member	No assignment
Language of Teaching / Examination	English
Duration	1 semester
Frequency of Offer	Every semester
Credits	6
Learning Outcome	none
Contents	none
Recommended Prerequisites	none
Mandatory Prerequisites	none
Forms of Teaching and Proportion	No assignment
Teaching Materials and Literature	none
Module Examination	Unspecified - Specification from winter semester 2016/17 required!
Assessment Mode for Module Examination	none
Evaluation of Module Examination	Performance Verification – graded
Limited Number of Participants	none
Remarks	none
Module Components	none
Components to be offered in the Current Semester	No assignment

Module 13831 Process Simulation in Chemical and Process Engineering

assign to: Specialisation Fluid- and Process Engineering

Study programme Chemistry: Materials, Engineering and Sustainability

Degree	Module Number	Module Form
Master of Science	13831	Compulsory elective

Modul Title	**Process Simulation in Chemical and Process Engineering** Prozesssimulation in der Chemie- und Verfahrenstechnik
Department	Faculty 3 - Mechanical Engineering, Electrical and Energy Systems
Responsible Staff Member	Prof. Dr.-Ing. Arellano-Garcia, Harvey
Language of Teaching / Examination	English
Duration	1 semester
Frequency of Offer	Every winter semester
Credits	6
Learning Outcome	After completing the module, students will be able to analyse physical and chemical phenomena involved in different processes, develop mathematical models and use different process simulation approaches using ASPEN PLUS.
Contents	• Fundamentals: Continuity equations, energy conservation, momentum conservation and state equations; Transport properties; Equilibrium and chemical kinetics; Thermodynamic correlations for estimating physical properties. • Use and scope of mathematical modelling; principles of model formulation; principles of steady-state and dynamic simulation; simulation of models; sequential modular approach; Equation-based approach; analysis of simulation data. • Introduction and use of process simulation software for flowchart simulation • Modelling and simulation of specific systems: e.g., heat conduction in a rod; laminar flow of Newtonian fluid in a pipe; heat exchanger; gravity tank, Power Engineering
Recommended Prerequisites	Physics, Mathematics, Thermodynamics
Mandatory Prerequisites	none
Forms of Teaching and Proportion	Lecture - 2 hours per week per semester Practical training - 2 hours per week per semester Self organised studies - 120 hours

Teaching Materials and Literature	• Handouts and reading list • Manual and tutorial of the modelling programs
Module Examination	Final Module Examination (MAP)
Assessment Mode for Module Examination	• Written examination (90 min)
Evaluation of Module Examination	Performance Verification – graded
Limited Number of Participants	none
Remarks	none
Module Components	none
Components to be offered in the Current Semester	No assignment

Module 13832 Optimisation in Process and Energy Systems Engineering

assign to: Specialisation Fluid- and Process Engineering

Study programme Chemistry: Materials, Engineering and Sustainability

Degree	Module Number	Module Form
Master of Science	13832	Compulsory elective

Modul Title	**Optimisation in Process and Energy Systems Engineering** Optimierung in der Verfahrens- und Energiesystemtechnik
Department	Faculty 3 - Mechanical Engineering, Electrical and Energy Systems
Responsible Staff Member	Prof. Dr.-Ing. Arellano-Garcia, Harvey
Language of Teaching / Examination	English
Duration	1 semester
Frequency of Offer	Every winter semester
Credits	6
Learning Outcome	After participating in this module, the students master the basic knowledge, in terms of mathematical optimization methods and tools. Relevant examples from Energy and Process Engineering are used to enhance the understanding of the various tools and methods taught. The focus is on the formulation of the problems and the approaches for their mathematical solution. The methods covered are applied in accompanying calculation exercises.
Contents	• Introduction: Definition, problem formulation, applications • Linear programming • Non-linear programming • Mixed integer non-linear programming • Dynamic optimization • Stochastic optimization
Recommended Prerequisites	• Chemical Engineering • Thermodynamics • Process Systems Engineering
Mandatory Prerequisites	none
Forms of Teaching and Proportion	Lecture - 2 hours per week per semester Exercise - 1 hours per week per semester Self organised studies - 135 hours
Teaching Materials and Literature	• T. F. Edgar, D. M. Himmelblau, Optimization of Chemical Processes, McGraw-Hill, New York, 2001

- L. T. Biegler, I. E. Grossmann, A. W. Westerberg, Systematic Methods of Chemical Process Design, Prentice Hall, New Jersey, 1997
- C. A. Floudas, Nonlinear and Mixed-Integer Optimization, Oxford University Press, 1995
- J. Nocedal, S. J. Wright, Numerical Optimization, Springer, 2006
- R. Baldick, Applied Optimization, Formulation and Algorithms for Engineering Systems, Cambridge University Press, 2006

Module Examination	Final Module Examination (MAP)
Assessment Mode for Module Examination	• Written examination (90 min)
Evaluation of Module Examination	Performance Verification – graded
Limited Number of Participants	none
Remarks	none
Module Components	VL + Ü + Prü Optimization in Process and Energy Systems Engineerin
Components to be offered in the Current Semester	No assignment

Module 14333 Downstream Processing for Products of Industrial Microbiology

assign to: Specialisation Fluid- and Process Engineering

Study programme Chemistry: Materials, Engineering and Sustainability

Degree	Module Number	Module Form
Master of Science	14333	Compulsory elective

Modul Title	**Downstream Processing for Products of Industrial Microbiology** Aufarbeitung von Produkten der Industriellen Mikrobiologie
Department	Faculty 2 - Environment and Natural Sciences
Responsible Staff Member	Prof. Dr. rer. nat. habil. Stahmann, Klaus-Peter
Language of Teaching / Examination	English
Duration	1 semester
Frequency of Offer	Every winter semester
Credits	6
Learning Outcome	After completing the module, students should have acquired the following skills: • Lecture: familiarization with industrial applications of processing methods for microbial products to gain an overview; understanding the relationships between material properties and methods of enrichment; recognizing the advantages and disadvantages of different separation methods; understanding the causes of economic successes and failures • Seminar: practicing presentation and scientific discussion, i.e. logical and factual argumentation using appropriate technical language, concentrating on the essentials and dealing fairly with discussion partners. Seminar: Practicing presentation and scientific discussion, i.e. logical, factual argumentation in appropriate technical language, concentration on the essentials and fair treatment of discussion partners; developing a critical attitude towards experiments, results and conclusions; independent development of important connections from review articles and original papers
Contents	• **Lecture:** • The lecture deals with the recovery and purification of biotechnical products to achieve the desired specification while maximizing yield and minimizing process costs. Often down-stream processing is the most expensive part of the stream. • The focus is firstly on sedimentation of cells and solid particles as well as on alternatives like flocculation and flotation, filtration and

centrifugation. Disintegration techniques are discussed. Product isolation by extraction or sorption is a further chapter. Furthermore precipitation and chromatography as well as membrane separation, e.g. reverse osmosis or ultrafiltration, are interesting topics. Electrophoresis and drying are closing the separate discussion of single methods. After-wards combined operations are explained. A special chapter is the refolding of proteins, which have to gain function, e.g. enzymatic activity, after, e.g. production as inclusion bodies.
- Several examples show economic solutions: commercial enzymes, recombinant proteins, polysaccharides, antibiotics, organic acids, ethanol, and biomass.

- **Seminar:**
- Self-study of original publications, reviews and patents; presentation of a table or a figure with measurement data or scientific models; critical discussion of the data; comparison of the methods presented with alternative methods; discussion of the strengths and weaknesses of selected models

Recommended Prerequisites	Basic knowledge of physics, chemistry, organic chemistry, biochemistry, molecular biology, microbiology, cell biology
Mandatory Prerequisites	none
Forms of Teaching and Proportion	Lecture - 2 hours per week per semester Seminar - 1 hours per week per semester Self organised studies - 135 hours
Teaching Materials and Literature	Textbooks: Wilson DB, Sahm H, Stahmann KP, Koffas M (2020) Industrial Microbiology, Wiley-VCH, Weinheim Jagschies, G., Lindskog, E., Lacki, K., & Galliher, P. M. (Eds.). (2018). *Biopharmaceutical processing: development, design, and implementation of manufacturing processes*. Elsevier. Selected reviews, e.g. Hohmann HP, Stahmann KP (2010) Comprehensive Natural Products II. Chemistry and Biology, 10, 115-139. Jungbauer, A. (2013). Continuous downstream processing of biopharmaceuticals. *Trends in biotechnology*, *31*(8), 479-492. Nunes, D. D., Pillay, V. L., Van Rensburg, E., & Pott, R. W. M. (2024). Oleaginous microorganisms as a sustainable oil source with a focus on downstream processing and cost-lowering production strategies: A review. *Bioresource Technology Reports*, 101871.
Module Examination	Final Module Examination (MAP)
Assessment Mode for Module Examination	Written exam graded 120 min
Evaluation of Module Examination	Performance Verification – graded
Limited Number of Participants	none

Remarks	none
Module Components	• lecture • seminar • exam
Components to be offered in the Current Semester	No assignment

Module 44107 Safety- and Risk-Analysis for Process Plants

assign to: Specialisation Fluid- and Process Engineering

Study programme Chemistry: Materials, Engineering and Sustainability

Degree	Module Number	Module Form
Master of Science	44107	Compulsory elective

Modul Title	**Safety- and Risk-Analysis for Process Plants** Sicherheits- und Risikoanalyse für Prozessanlagen
Department	Faculty 3 - Mechanical Engineering, Electrical and Energy Systems
Responsible Staff Member	Prof. Dr.-Ing. Arellano-Garcia, Harvey
Language of Teaching / Examination	English
Duration	1 semester
Frequency of Offer	Every summer semester
Credits	6
Learning Outcome	After completing the module, students will be able to apply basic methods for performing and evaluating safety-related aspects for industrial plants. They learn methodical basics for the evaluation of probabilities of occurrence and the derivation of the resulting consequences. Using the methods taught for qualitative and quantitative risk assessment, students are able to independently develop sustainable concepts and solutions. They also have basic knowledge of safety-related plant optimization and can communicate this to plant operators, authorities, etc.
Contents	• Hazard identification methods (e.g. Checklists, FMEA, HAZOP) • Frequency evaluation methods (event tree, fault tree) • Consequence evaluation methods (e.g. one- and two phase flow (critical, sub-critical), dispersion of neutral and dense gas, fire, explosion and toxic hazards) • Qualitative and quantitative risk assessment methods • Safety related plant optimization Exercise: • Realization of safety and risk studies (method, case study)
Recommended Prerequisites	None
Mandatory Prerequisites	none
Forms of Teaching and Proportion	Lecture - 2 hours per week per semester Exercise - 1 hours per week per semester Practical training - 1 hours per week per semester

	Self organised studies - 120 hours
Teaching Materials and Literature	• Lecture notes • Lees,F.P.: Loss prevention in the process industries, Butterworth 1996, Oxford • Guidelines for chemical process quantitative risk analysis AICHE,1989, New York • Guidelines for hazard evaluation procedures AICHE , 1992, New York • W.F.Kenney: Process risk management systems, VCH 1993, New York • D. A. Crowl;J. F. Louvar: Chemical process safety, Prentice Hall, Inc., 2002, New Jersey
Module Examination	Prerequisite + Final Module Examination (MAP)
Assessment Mode for Module Examination	**Prerequisite:** • Successful completion of the exercises within the practical training **Final module examination:** • Written examination, 90 min.
Evaluation of Module Examination	Performance Verification – graded
Limited Number of Participants	none
Remarks	None
Module Components	• 238227 Lecture Safety and risk analysis • 238231 Examination Safety- and risk-analysis
Components to be offered in the Current Semester	**360327** Lecture/Exercise Safety and risk analysis - 4 Hours per Term **360373** Examination Safety- and risk-analysis

Module 44408 Safety Technology

assign to: Specialisation Fluid- and Process Engineering

Study programme Chemistry: Materials, Engineering and Sustainability

Degree	Module Number	Module Form
Master of Science	44408	Compulsory elective

Modul Title	**Safety Technology** Grundlagen der Prozess-, Anlagen- und Betriebssicherheit
Department	Faculty 3 - Mechanical Engineering, Electrical and Energy Systems
Responsible Staff Member	Prof. Dr.-Ing. Arellano-Garcia, Harvey
Language of Teaching / Examination	English
Duration	1 semester
Frequency of Offer	Every winter semester
Credits	6
Learning Outcome	At the end of the module the student are able to prevent and mitigate reaction-, fire- and explosion hazards in process plants, storage tanks/ silos and during transport of hazardous materials.
Contents	1. Theory of heat explosion, fire protection, explosion prevention, reaction safety, theory of pressure relief 2. Basics of experimental determination of safety data and pressure relief devices 3. Experimental development of safety data used for the determination of storage and transport conditions according to national and international standards (EU, UN) , case study -team work- 4. Experiments for the design of pressure relief devices to, case study -team work-
Recommended Prerequisites	Strongly recommended: Fundamentals of mathematics, physics (thermodynamics, heat- and mass-transfer)
Mandatory Prerequisites	none
Forms of Teaching and Proportion	Lecture - 2 hours per week per semester Exercise - 1 hours per week per semester Practical training - 1 hours per week per semester Self organised studies - 120 hours
Teaching Materials and Literature	1. Lecture notes 2. Power Point 3. Literature: see lecture notes
Module Examination	Prerequisite + Final Module Examination (MAP)

Assessment Mode for Module Examination	**Prerequisite:** Successful completion of laboratory tests, as well as the adjoining "check-of-knowledge"-test as part of the internship. **Final module examination:** Written examination, 90 min.
Evaluation of Module Examination	Performance Verification – graded
Limited Number of Participants	none
Remarks	none
Module Components	• 440503 LE Safety technology in process industries/Process and Plant Safety • 440531 Exercise/Practical Training Safety technology in process industries/Process and Plant Safety • 841232 Examination Safety Technology
Components to be offered in the Current Semester	No assignment

Module 11648 Sustainable Waste Management

assign to: Environment, Economy, Human, Law

Study programme Chemistry: Materials, Engineering and Sustainability

Degree	Module Number	Module Form
Master of Science	11648	Compulsory elective

Modul Title	**Sustainable Waste Management** Nachhaltige Abfallwirtschaft
Department	Faculty 2 - Environment and Natural Sciences
Responsible Staff Member	Prof. Dr. habil. Abendroth, Christian
Language of Teaching / Examination	English
Duration	1 semester
Frequency of Offer	Every summer semester
Credits	6
Learning Outcome	In the field of waste management, the student will learn to analyse and to understand typical problems of disposal within the social, economical and technical framework of sustainability. New approaches to solutions of waste problems will be discussed. Students should learn to adapt technological solutions and to develop appropiate strategies to the conditions of their home countries. A deeper focus on biological treatment is given.
Contents	The module is about sustainabilty with a focus on biological treatment technologies. In preparation for the module "municipal soid waste management", this module gives already a glimpse into recent novelties, which adress sustainability and biological treatments. To do so, recent research articles are going to be summarized in order to present novel substrates, integrated sustainability concepts, pre- and post-treatments, which are related to technologies like anaerobic digestion, dark fermentation, biofuel production and fuel cells. In this relation, the following topics will be covered. 1. History on sustainability 2. Legislation in sustainability 3. Waste types and their relation to biological treatments 4. Zero waste and smart cities 5. Novel and problematic substrates for anaerobic digestions 6. Dark fermentation 7. Microbial fuel cells 8. Microbial electrolysis cells 9. Power2Gas 10. Biochar and its application 11. Integrated concepts

	12. Practical training
Recommended Prerequisites	None
Mandatory Prerequisites	None
Forms of Teaching and Proportion	Lecture - 3 hours per week per semester Seminar - 1 hours per week per semester Self organised studies - 120 hours
Teaching Materials and Literature	• Lecture notes • List of recommended literature References/textbooks: • Wellinger, Arthuer, Murphy Jerry, Baxter David: The biogas handbook, 2013 Woodhead Publishing Series in Energy: Number 52, • Kalamdhad: Advances in Waste Management, 2019 • Thomé-Kozmiensky, Karl J.: Waste management, Volume1-4, 2010-2014, TK Verlag • Vesilind, Worrell, Reinhart: Solid Waste Engineering, Brooks/Cole 2002 • Kühle Weidemeier: Waste to resources 2011; mechanical biological waste treatment and material recovery facilities; 2011 • Rada, E.-C.: Biological treatment of solid waste enhancing sustainability, 2016
Module Examination	Prerequisite + Final Module Examination (MAP)
Assessment Mode for Module Examination	Prerequisite: • written work (30% of the final grade) Final module examination: • written examination, 60 min. (70% of the final grade))
Evaluation of Module Examination	Performance Verification – graded
Limited Number of Participants	none
Remarks	none
Module Components	• 230144 Lecture/Seminar Sustainable Waste Management - 4 Hours per Week per Semester • 238106 Examination Sustainable Waste Management
Components to be offered in the Current Semester	**230144** Lecture/Seminar Sustainable Waste Management - 4 Hours per Term **238106** Examination Sustainable Waste Management

Module 13234 Communication of Science and Technology

assign to: Environment, Economy, Human, Law

Study programme Chemistry: Materials, Engineering and Sustainability

Degree	Module Number	Module Form
Master of Science	13234	Compulsory elective

Modul Title	**Communication of Science and Technology** Wissenschafts- und Technikkommunikation
Department	Faculty 5 - Business, Law and Social Sciences
Responsible Staff Member	No assignment
Language of Teaching / Examination	English
Duration	1 semester
Frequency of Offer	Every semester
Credits	6
Learning Outcome	none
Contents	none
Recommended Prerequisites	none
Mandatory Prerequisites	none
Forms of Teaching and Proportion	No assignment
Teaching Materials and Literature	none
Module Examination	Unspecified - Specification from winter semester 2016/17 required!
Assessment Mode for Module Examination	none
Evaluation of Module Examination	Performance Verification – graded
Limited Number of Participants	none
Remarks	none
Module Components	none
Components to be offered in the Current Semester	No assignment

Module 13659 Sustainability and Digitalisation

assign to: Environment, Economy, Human, Law

Study programme Chemistry: Materials, Engineering and Sustainability

Degree	Module Number	Module Form
Master of Science	13659	Compulsory elective

Modul Title	**Sustainability and Digitalisation** Digitalisierung und Nachhaltigkeit
Department	Faculty 5 - Business, Law and Social Sciences
Responsible Staff Member	No assignment
Language of Teaching / Examination	English
Duration	1 semester
Frequency of Offer	Every summer semester
Credits	6
Learning Outcome	none
Contents	none
Recommended Prerequisites	none
Mandatory Prerequisites	none
Forms of Teaching and Proportion	No assignment
Teaching Materials and Literature	none
Module Examination	Unspecified - Specification from winter semester 2016/17 required!
Assessment Mode for Module Examination	none
Evaluation of Module Examination	Performance Verification – graded
Limited Number of Participants	none
Remarks	none
Module Components	none
Components to be offered in the Current Semester	No assignment

Module 13705 Sociology of Sustainable Development

assign to: Environment, Economy, Human, Law

Study programme Chemistry: Materials, Engineering and Sustainability

Degree	Module Number	Module Form
Master of Science	13705	Compulsory elective

Modul Title	**Sociology of Sustainable Development** Soziologie der nachhaltigen Entwicklung
Department	Faculty 5 - Business, Law and Social Sciences
Responsible Staff Member	No assignment
Language of Teaching / Examination	English
Duration	1 semester
Frequency of Offer	Every summer semester
Credits	6
Learning Outcome	none
Contents	none
Recommended Prerequisites	none
Mandatory Prerequisites	none
Forms of Teaching and Proportion	No assignment
Teaching Materials and Literature	none
Module Examination	Unspecified - Specification from winter semester 2016/17 required!
Assessment Mode for Module Examination	none
Evaluation of Module Examination	Performance Verification – graded
Limited Number of Participants	none
Remarks	none
Module Components	none
Components to be offered in the Current Semester	No assignment

Module 14069 Biomass and Bioenergy

assign to: Environment, Economy, Human, Law

Study programme Chemistry: Materials, Engineering and Sustainability

Degree	Module Number	Module Form
Master of Science	14069	Compulsory elective

Modul Title	**Biomass and Bioenergy** Biomasse und Bioenergie
Department	Faculty 5 - Business, Law and Social Sciences
Responsible Staff Member	Prof. Dr. phil. Hirschl, Bernd
Language of Teaching / Examination	English
Duration	1 semester
Frequency of Offer	Every semester
Credits	6
Learning Outcome	Students are able to understand the multifunctionality of biomass and know the various pathways of biomass conversion into energy. They are prepared to have critical knowledge regarding biomass cultivation for energy generation by discussing social and environmental concerns, like land use or the competition with food chains. After attending the module, students have expertise in interpreting and presenting scientific texts.
Contents	Sustainable energy generation is seen as one of the largest present challenges of our society. The module “Biomass and Bioenergy” will discuss climate neutral energy systems, where biomass is a sustainable carbon neutral source of energy. This module is highly interdisciplinary. Topics will include: • Overview on biomass production (agriculture and forestry) • Biomass residual waste • Energy conversion technologies • Social and ecological aspects of biomass use • Current bioenergy policies
Recommended Prerequisites	none
Mandatory Prerequisites	none
Forms of Teaching and Proportion	Seminar - 4 hours per week per semester Self organised studies - 120 hours
Teaching Materials and Literature	The following literature can be used for preparation: • Book: Kaltschmitt, M., ed. (2018) Energy from Organic Materials (Biomass). A Volume in the Encyclopedia of Sustainability

	Science and Technology, 1439 p. Springer DOI:https://doi.org/10.1007/978-1-4939-7813-7 • Book: Srivastava, N., Verma, B. & Mishra, P.K., eds. 2023. Agroindustrial Waste for Green Fuel Application. Springer DOI:https://doi.org/10.1007/978-981-19-6230-1 • Journal “Biomass and Bioenergy” (Elsevier) • Journal “Sustainable Energy Technologies and Assessments” (Elsevier)
Module Examination	Prerequisite + Final Module Examination (MAP)
Assessment Mode for Module Examination	**Prerequisite:** • Presentation (15 minutes + discussion) **Final Module Examination:** • Written exam, 120 min
Evaluation of Module Examination	Performance Verification – graded
Limited Number of Participants	none
Remarks	Not offered in **summer semester 2026**.
Module Components	• Seminar: Biomass and Bioenergy • Examination: Biomass and Bioenergy
Components to be offered in the Current Semester	**538909** Examination Biomass and Bioenergy (Wiederholungsprüfung)

Module 14132 Multidimensional Approaches for Technology Assessment

assign to: Environment, Economy, Human, Law

Study programme Chemistry: Materials, Engineering and Sustainability

Degree	Module Number	Module Form
Master of Science	14132	Compulsory elective

Modul Title	**Multidimensional Approaches for Technology Assessment** Multidimensionale Ansätze für Technikfolgenabschätzung
Department	Faculty 5 - Business, Law and Social Sciences
Responsible Staff Member	Prof. Dr. rer. pol. habil. Lee, Roh Pin
Language of Teaching / Examination	English
Duration	1 semester
Frequency of Offer	Every summer semester
Credits	6
Learning Outcome	Students know about a range of technology assessment approaches, methodologies and tools to facilitate the evaluation of decarbonization & sustainability transformation options along socio-technological-economical-ecological-political (*STEEP*) dimensions. On completion of the module, students are able to: • Demonstrate a deep understanding of the multidimensional aspects and systemic interactions in the transformation of energy- and carbon-intensive industries; • Gain familiarity with a range of qualitative and quantitative methodologies in conducting technology assessment; • Design and conduct studies to analyze the opportunities and challenges which will be associated with the transformation of energy- and carbon-intensive industries along multiple dimensions; • Identify, assess and evaluate appropriate sources of information and critically reflect on the methodologies commonly implemented for technology assessment and their usefulness/weaknesses.
Contents	Course coverage: • Relevance and development of technology assessment; • Common methodological approaches and their usefulness/weakness; • Data and approaches for assessment (e.g., primary vs. secondary; qualitative vs. quantitative); • Methodologies for socio-political evaluations, techno-economic evaluations and ecological evaluations; • Application on a case study to assess multidimensional opportunities and challenges associated with the transformation of a specific sector

	and derive implications along the *STEEP* dimensions based on assessment results.
Recommended Prerequisites	none
Mandatory Prerequisites	none
Forms of Teaching and Proportion	Lecture - 1 hours per week per semester Exercise - 1 hours per week per semester Study project - 2 hours per week per semester Self organised studies - 120 hours
Teaching Materials and Literature	• Lee, R.P., Meyer, B., Huang, Q.L, Voss, R. 2020. Sustainable waste management for zero waste cities in China: potential, challenges and opportunities. *Clean Energy*, 4(3): 169 – 201. • Lee, R.P. 2019. Alternative carbon feedstock for the chemical industry? – Assessing the challenges posed by the human dimension in the carbon transition, *Journal of Cleaner Production*, 219: 786-796. • Lee, R. P., Tschoepe, M., Voss, R. 2021. Perception of chemical recycling and its role in the transition towards a circular carbon economy: A case study in Germany. *Waste Management*, 125: 280-292. • Voss, R., Lee, R.P., Seidl, L., Keller, F., Fröhling, M. 2021. Global warming potential and economic performance of gasification-based chemical recycling and incineration pathways for residual municipal solid waste treatment in Germany. *Waste Management*, 134: 206 – 219. • Keller, F., Lee, R.P., Meyer, B. 2020. Life cycle assessment of global warming potential, resource depletion and acidification potential of fossil, renewable and secondary feedstock for olefin production in Germany. *Journal of Cleaner Production*, 250: 119484. • Lee, R.P., Scheibe, A. 2020. The politics of a carbon transition: An analysis of political indicators for a transformation in the German chemical industry, *Journal of Cleaner Production*, 244: 118629. Further materials are provided via Moodle (including lecture slides and additional materials including videos, readings etc.)
Module Examination	Continuous Assessment (MCA)
Assessment Mode for Module Examination	• Individual component (E-assessment), 60-90 min - 50% • Group Project - Part 1: Create a scientific poster (Analysis of e.g., a scientific article, industry report, case study, ...) - 25% • Group Project - Part 2: Presentation, 15min - 25%
Evaluation of Module Examination	Performance Verification – graded
Limited Number of Participants	none
Remarks	none
Module Components	• Lectures & Exercises • Projects

Components to be offered in the Current Semester	**510602** Lecture/Seminar Multidimensional Approaches for Technology Assessment - 4 Hours per Term

Module 41205 Sociology

assign to: Environment, Economy, Human, Law

Study programme Chemistry: Materials, Engineering and Sustainability

Degree	Module Number	Module Form
Master of Science	41205	Compulsory elective

Modul Title	**Sociology** Soziologie
Department	Faculty 5 - Business, Law and Social Sciences
Responsible Staff Member	Prof. Dr. phil. Jaeger-Erben, Melanie
Language of Teaching / Examination	English
Duration	1 semester
Frequency of Offer	Every winter semester
Credits	6
Learning Outcome	General overview on sociological approaches, theories and research topics. Insights into different epistemological perspectives and paradigms. Appropriation of a sociological perspective.
Contents	The module provides basic knowledge of sociological approaches, theories and research topics. The focus is on trying out and acquiring sociological perspectives and approaches in the analysis of society and social change. Various paradigms of past and present sociology are taught and current issues such as the Anthropocene debate or feminist sociology are addressed. Topics include: - Core topics in sociology: social order and social change. - Sociological paradigms: from the linguistic turn to New Materialism - Sociological perspectives on human-environment relations and social relations with nature - Current issues in sociology: socio-ecological transformation, global inequalities and intersectionality, post-pandemic renewal Students will be given various assignments throughout the semester, such as reviews of texts or documentaries, Ted Talks, debate walks, and mappings, which will be presented and discussed in class.
Recommended Prerequisites	None
Mandatory Prerequisites	none
Forms of Teaching and Proportion	Lecture - 2 hours per week per semester Seminar - 2 hours per week per semester Self organised studies - 120 hours

Teaching Materials and Literature	The lecture will partially refer to the following books: • Giddens, A., & Sutton, P. W. (2021). Sociology. John Wiley & Sons. • Dürbeck, G., & Hüpkes, P. (Eds.). (2020). The Anthropocenic Turn: The Interplay Between Disciplinary and Interdisciplinary Responses to a New Age. Routledge. • Harper, C. L., & Snowden, M. (2017). Environment and society: Human perspectives on environmental issues. Routledge. • Abbott, P., Tyler, M., & Wallace, C. (2006). *An introduction to sociology: Feminist perspectives*. Routledge. Further literature will be announced during the lectures.
Module Examination	Continuous Assessment (MCA)
Assessment Mode for Module Examination	• Pecha Kucha Presentation, 7:40 min (30%) • Protocol, 1-2 pages (20%) • Review, 1-2 pages (20%) • Reflection, 2-3 pages (30%)
Evaluation of Module Examination	Performance Verification – graded
Limited Number of Participants	none
Remarks	none
Module Components	• 248106 Lecture Sociology • 248107 Exercise Sociology
Components to be offered in the Current Semester	No assignment

Module 43201 Corporate Environmental Protection

assign to: Environment, Economy, Human, Law

Study programme Chemistry: Materials, Engineering and Sustainability

Degree	Module Number	Module Form
Master of Science	43201	Compulsory elective

Modul Title	**Corporate Environmental Protection** Umweltschutz im Unternehmen
Department	Faculty 5 - Business, Law and Social Sciences
Responsible Staff Member	Prof. Dr. rer. pol. habil. Lee, Roh Pin
Language of Teaching / Examination	English
Duration	1 semester
Frequency of Offer	Every summer semester
Credits	6
Learning Outcome	After attending the module, students will have a basic understanding of environmental and sustainability management. Especially, they: • Understand the **relevance** of environmental protection and sustainability for corporations; • Contextualize the **historical development** of sustainability and the implications for corporations; • Understand **critical terms and concepts** in sustainability within the corporate context; • Have developed an understanding of how to build up a **sustainability management** in a corporation; • Understand the use of **tools and management systems** for environmental and sustainability management; • Understand the most important **legal frameworks** influencing environmental and sustainability management in corporations
Contents	• Concepts of sustainability as guidelines for corporations • The history of sustainability and implications for corporations • Laws and regulations for environmental protection and sustainability and their implications for corporations • Integrated sustainability management in corporations • Evaluation and measuring tools (e.g., life cycle assessment), indicators for ecological performance, and environmental accounting • Management tools and standardisation of management tools: EMAS, DIN ISO 14000

	• Sustainability and environmental protection communications, reports, labels, terms
Recommended Prerequisites	none
Mandatory Prerequisites	none
Forms of Teaching and Proportion	Lecture - 2 hours per week per semester Self organised studies - 120 hours Project Seminars - 2 hours per week per semester
Teaching Materials and Literature	The lecture is based on presentations, which can be used for lecture notes. Additional reading may be referenced during the lectures.
Module Examination	Continuous Assessment (MCA)
Assessment Mode for Module Examination	• Written examination, 60 min. (50 %) • Group examination, 30 min. (50 %)
Evaluation of Module Examination	Performance Verification – graded
Limited Number of Participants	none
Remarks	none
Module Components	• Lectures 2 hours per week per semester • Seminars/Projects 2 hours per week per semester, including presentations
Components to be offered in the Current Semester	**510619** Lecture Corporate Environmental Protection - 2 Hours per Term **510620** Project Seminars Corporate Environmental Protection - 2 Hours per Term

Modul 12818 Basis-Deutsch für den Uni-Alltag

zugeordnet zu: Language Competence

Studiengang Chemistry: Materials, Engineering and Sustainability

Akademischer Grad	Modulnummer	Modulform
Master of Science	12818	Wahlpflicht

Modultitel	**Basis-Deutsch für den Uni-Alltag** Basic German for Student Life
Einrichtung	ZES - Zentrale Einrichtung Sprachen
Verantwortlich	Diebel, Simone
Lehr- und Prüfungssprache	Deutsch
Dauer	1 Semester
Angebotsturnus	jedes Semester
Leistungspunkte	6
Lernziele	**Bei Erreichen der Niveaustufe GER A1** sind die Teilnehmenden befähigt, vertraute, alltägliche Ausdrücke und ganz einfache Sätze zu verstehen und zu verwenden, die auf die Befriedigung konkreter Kommunikationsbedürfnisse zielen. Die Teilnehmenden können sich und andere vorstellen sowie anderen Fragen zu ihrer Person stellen und auf Fragen dieser Art Antwort geben. Sie können sich auf einfache Art verständigen, wenn die Gesprächspartner*innen langsam und deutlich sprechen und bereit sind zu helfen (Vergleich Kann-Beschreibungen des GER A1). **Bei Erreichen der Niveaustufe GER A2** sind die Teilnehmenden imstande, häufig gebrauchte Sätze bzw. Ausdrücke aus Bereichen von unmittelbarer Bedeutung (z.B. Informationen zu Personen, Studium und Beruf, Freizeit und Familie) zu verstehen und anzuwenden. Sie können sich in einfachen, routinemäßigen Situationen verständigen, einfache und direkte Fragen zu vertrauten und geläufigen Dingen stellen und beantworten, kürzere Sachverhalte wiedergeben und mit einfachen Mitteln, Dinge und Zusammenhänge beschreiben (Vergleich Kann-Beschreibungen des GER A2). Schließlich reflektieren die Teilnehmenden im Kontext der vermittelten Inhalte und ihrer eigenen Kultur die Kultur im deutschsprachigen Raum und werden nach Abschluss des Moduls Grundzüge und Gepflogenheiten der Lebensformen im deutschsprachigen Raum verstehen.
Inhalte	**Handlungsorientierte Aufgaben** zum globalen, selektiven und detaillierten Hör- und Leseverstehen, zur Produktion themen- und situationsbezogener schriftlicher Texte, zum themen- und situationsbezogenen mündlichen Ausdruck sowie **Übungen** zum

	Verständnis und zur Festigung sprachlicher Strukturen (Wortschatz und Grammatik). Weiterhin werden Lernstrategien und -techniken für das Selbststudium vermittelt und erprobt. **Thematische und grammatische Schwerpunkte** lt. Empfehlungen des Gemeinsamen Europäischen Referenzrahmens (GER) für die Niveaustufen Deutsch als Fremdsprache A1 und Deutsch als Fremdsprache A2.
Empfohlene Voraussetzungen	Keine Vorkenntnisse für Deutsch als Fremdsprache A1.1 erforderlich Dringend empfohlen: • Niveau GER A1.1 für die Sprachlehrveranstaltung Deutsch als Fremdsprache A1.2 • Niveau GER A1 für die Sprachlehrveranstaltung Deutsch als Fremdsprache A2.1 • Niveau GER A2.1 für die Sprachlehrveranstaltung Deutsch als Fremdsprache A2.2 Die vorhandenen Deutschkenntnisse können zu Semesterbeginn mit einem Eingangstest überprüft oder mittels Zertifikat nachgewiesen werden.
Zwingende Voraussetzungen	keine
Lehrformen und Arbeitsumfang	Übung - 8 SWS Selbststudium - 60 Stunden
Unterrichtsmaterialien und Literaturhinweise	• kurstragendes Lehr- und Übungsmaterial • Zusatzmaterialien
Modulprüfung	Continuous Assessment (MCA)
Prüfungsleistung/en für Modulprüfung	Pro Sprachlehrveranstaltung 3 themenbezogene Abgabeaufgaben oder Tests à 45 – 60 Minuten (je 1/6 Gewichtung für Modulnote)
Bewertung der Modulprüfung	Prüfungsleistung - benotet
Teilnehmerbeschränkung	60
Bemerkungen	• Das Modul richtet sich an Studierende der internationalen englischsprachigen Studiengänge ohne oder mit geringen Deutschvorkenntnissen. Es ist nicht geeignet für Studierende mit höherem Sprachniveau. • Studierende **ohne Deutschvorkenntnisse** können im Rahmen des Moduls den erfolgreichen Abschluss der Sprachlehrveranstaltungen **Deutsch als Fremdsprache A1.1 und A1.2** abrechnen. • Studierende **mit geringen Deutschvorkenntnissen der Niveaustufe GER A1** können im Rahmen des Moduls den erfolgreichen Abschluss der Sprachlehrveranstaltungen **Deutsch als Fremdsprache A1.2** und **A2.1 oder A2.1** und **A2.2** abrechnen. • Eine **zusätzliche und vorherige ANMELDUNG** der Studierenden bei der Zentralen Einrichtung Sprachen (via moodle Projekte Plattform) ist erforderlich!

- Es können nicht mehr als 25 Teilnehmende in jeder Sprachkursgruppe eingeschrieben werden.
- Die Lehrveranstaltungen können in Präsenz oder online durchgeführt werden.

Veranstaltungen zum Modul

Für Interessent*innen ohne Deutschvorkenntnisse:
- Übung: Deutsch als Fremdsprache Start A1.1 - Intensivkurs **oder**
- Übung: Deutsch als Fremdsprache Start A1.1 (semesterbegleitend im Wintersemester oder Sommersemester)

und
- Übung: Deutsch als Fremdsprache Start A1.2 - Intensivkurs **oder**
- Übung: Deutsch als Fremdsprache Start A1.2 (semesterbegleitend im Wintersemester oder Sommersemester)

Für Interessent*innen mit Deutschvorkenntnissen auf der Niveaustufe GER A1:
- Übung: Deutsch als Fremdsprache Start A2.1 - Intensivkurs **oder**
- Übung: Deutsch als Fremdsprache Start A2.1 (semesterbegleitend im Wintersemester oder Sommersemester)

und
- Übung: Deutsch als Fremdsprache Start A2.2 - Intensivkurs **oder**
- Übung: Deutsch als Fremdsprache Start A2.2 (semesterbegleitend im Wintersemester oder Sommersemester)

Veranstaltungen im aktuellen Semester

019101 Übung
Deutsch als Fremdsprache Start A1.1 - 4 SWS
019103 Übung
Deutsch als Fremdsprache A1.2 - 4 SWS
019104 Übung
Deutsch als Fremdsprache A2.1 - 4 SWS
019105 Übung
Deutsch als Fremdsprache A2.2 - 4 SWS
019130 Intensivkurs
Deutsch als Fremdsprache Start A1.1 Intensivkurs - 4 SWS
019131 Intensivkurs
Deutsch als Fremdsprache A1.2 Intensivkurs - 4 SWS
019132 Intensivkurs
Deutsch als Fremdsprache A2.1 Intensivkurs - 4 SWS
019133 Intensivkurs
Deutsch als Fremdsprache A2.2 Intensivkurs - 4 SWS

Modul 13363 Deutsch als Fremdsprache Start A1

zugeordnet zu: Language Competence

Studiengang Chemistry: Materials, Engineering and Sustainability

Akademischer Grad	Modulnummer	Modulform
Master of Science	13363	Wahlpflicht

Modultitel	**Deutsch als Fremdsprache Start A1** German as a Foreign Language Starter A1
Einrichtung	ZES - Zentrale Einrichtung Sprachen
Verantwortlich	Diebel, Simone
Lehr- und Prüfungssprache	Deutsch
Dauer	2 Semester
Angebotsturnus	jedes Semester
Leistungspunkte	6
Lernziele	In diesem Modul werden die Teilnehmenden befähigt, vertraute, alltägliche Ausdrücke und ganz einfache Sätze zu verstehen und zu verwenden, die auf die Befriedigung konkreter Kommunikationsbedürfnisse zielen. Nach Abschluss des Basismoduls können die Teilnehmenden sich und andere vorstellen sowie anderen Fragen zu ihrer Person stellen und auf Fragen dieser Art Antwort geben. Sie können sich auf einfache Art verständigen, wenn die Gesprächspartner*innen langsam und deutlich sprechen und bereit sind zu helfen (vgl. Kann-Beschreibungen des GER A1). Schließlich reflektieren die Teilnehmenden im Kontext der vermittelten Inhalte und ihrer eigenen Kultur die Kultur im deutschsprachigen Raum und werden nach Abschluss des Moduls Grundzüge und Gepflogenheiten der Lebensformen im deutschsprachigen Raum verstehen.
Inhalte	**Handlungsorientierte Aufgaben** zum globalen, selektiven und detaillierten Hör- und Leseverstehen, zur Produktion themen- und situationsbezogener schriftlicher Texte, zum themen- und situationsbezogenen mündlichen Ausdruck sowie **Übungen** zum Verständnis und zur Festigung sprachlicher Strukturen (Wortschatz und Grammatik). Weiterhin werden Lernstrategien und -techniken für das Selbststudium vermittelt und erprobt. **Thematische und grammatische Schwerpunkte** lt. Empfehlungen des Gemeinsamen Europäischen Referenzrahmens (GER) für die Niveaustufe Deutsch als Fremdsprache A1.
Empfohlene Voraussetzungen	keine

Zwingende Voraussetzungen	keine
Lehrformen und Arbeitsumfang	Übung - 8 SWS Selbststudium - 60 Stunden
Unterrichtsmaterialien und Literaturhinweise	• kurstragendes Lehr- und Übungsmaterial • Zusatzmaterialien
Modulprüfung	Continuous Assessment (MCA)
Prüfungsleistung/en für Modulprüfung	Pro Semester je 3 themenbezogene Abgabeaufgaben oder Tests je 45 - 60 Minuten (je 1/6 Gewichtung für Modulnote)
Bewertung der Modulprüfung	Prüfungsleistung - benotet
Teilnehmerbeschränkung	keine
Bemerkungen	• Das Modul richtet sich an Studierende der internationalen Studiengänge ohne Deutschvorkenntnisse. Es ist nicht geeignet für Studierende mit höherem Sprachniveau. • Eine **zusätzliche ANMELDUNG** der Studierenden in der Zentralen Einrichtung Sprachen ist erforderlich (https://www.b-tu.de/sprachen)! • Es können nicht mehr als 25 Teilnehmende in jeder Sprachkursgruppe eingeschrieben werden. • Die Lehrveranstaltungen können in Präsenz oder online durchgeführt werden.
Veranstaltungen zum Modul	• Übung: Deutsch als Fremdsprache Start A1.1 - Intensivkurs **oder** • Übung: Deutsch als Fremdsprache Start A1.1 (semesterbegleitend im Wintersemester oder Sommersemester) **und** • Übung: Deutsch als Fremdsprache Start A1.2 - Intensivkurs **oder** • Übung: Deutsch als Fremdsprache Start A1.2 (semesterbegleitend im Wintersemester oder Sommersemester)
Veranstaltungen im aktuellen Semester	**019101** Übung Deutsch als Fremdsprache Start A1.1 - 4 SWS **019103** Übung Deutsch als Fremdsprache A1.2 - 4 SWS **019130** Intensivkurs Deutsch als Fremdsprache Start A1.1 Intensivkurs - 4 SWS **019131** Intensivkurs Deutsch als Fremdsprache A1.2 Intensivkurs - 4 SWS

Modul 13364 Deutsch als Fremdsprache A2

zugeordnet zu: Language Competence

Studiengang Chemistry: Materials, Engineering and Sustainability

Akademischer Grad	Modulnummer	Modulform
Master of Science	13364	Wahlpflicht

Modultitel	**Deutsch als Fremdsprache A2** German as a Foreign Language A2
Einrichtung	ZES - Zentrale Einrichtung Sprachen
Verantwortlich	Diebel, Simone
Lehr- und Prüfungssprache	Deutsch
Dauer	2 Semester
Angebotsturnus	jedes Semester
Leistungspunkte	6
Lernziele	Nach Abschluss des Moduls sind die Teilnehmenden imstande, häufig gebrauchte Sätze bzw. Ausdrücke aus Bereichen von unmittelbarer Bedeutung (z.B. Informationen zu Personen, Studium und Beruf, Freizeit und Familie) zu verstehen und anzuwenden. Sie können sich in einfachen, routinemäßigen Situationen verständigen, einfache und direkte Fragen zu vertrauten und geläufigen Dingen stellen und beantworten, kürzere Sachverhalte wiedergeben und mit einfachen Mitteln, Dinge und Zusammenhänge beschreiben (vgl. Kann-Beschreibungen des GER A2). Schließlich reflektieren die Teilnehmenden im Kontext der vermittelten Inhalte und ihrer eigenen Kultur die Kultur im deutschsprachigen Raum und werden nach Abschluss des Moduls Grundzüge und Gepflogenheiten der Lebensformen im deutschsprachigen Raum verstehen.
Inhalte	**Handlungsorientierte Aufgaben** zum globalen, selektiven und detaillierten Hör- und Leseverstehen, zur Produktion themen- und situationsbezogener schriftlicher Texte, zum themen- und situationsbezogenen mündlichen Ausdruck sowie **Übungen** zum Verständnis und zur Festigung sprachlicher Strukturen (Wortschatz und Grammatik). Weiterhin werden Lernstrategien und -techniken für das Selbststudium vermittelt und erprobt. **Thematische und grammatische Schwerpunkte** lt. Empfehlungen des Gemeinsamen Europäischen Referenzrahmens (GER) für die Niveaustufe Deutsch als Fremdsprache A2.
Empfohlene Voraussetzungen	Dringend empfohlen:

	• Modul 13363 Deutsch als Fremdsprache Start A1 bzw. Deutschkenntnisse auf dem Niveau GER A1 Die vorhandenen Deutschkenntnisse können zu Semesterbeginn mit einem Eingangstest überprüft werden. Vorkenntnisse auf dem Niveau GER A1 können auch mit einem Zertifikat nachgewiesen werden.
Zwingende Voraussetzungen	keine
Lehrformen und Arbeitsumfang	Übung - 8 SWS Selbststudium - 60 Stunden
Unterrichtsmaterialien und Literaturhinweise	• kurstragendes Lehr- und Übungsmaterial • Zusatzmaterialien
Modulprüfung	Continuous Assessment (MCA)
Prüfungsleistung/en für Modulprüfung	Pro Semester je 3 themenbezogene Abgabeaufgaben oder Tests je 45 - 60 Minuten (je 1/6 Gewichtung für Modulnote).
Bewertung der Modulprüfung	Prüfungsleistung - benotet
Teilnehmerbeschränkung	keine
Bemerkungen	• Das Modul richtet sich an internationale Studierende aller englischsprachigen Studiengänge oder Gaststudierende mit Vorkenntnissen der Zielsprache auf Niveau GER A1. Es ist nicht geeignet für Studierende mit niedrigerem oder höherem Sprachniveau. • Eine **zusätzliche ANMELDUNG** der Studierenden in der Zentralen Einrichtung Sprachen ist erforderlich (https://www.b-tu.de/sprachen)! • Es können nicht mehr als 25 Teilnehmende in jeder Sprachkursgruppe eingeschrieben werden. • Die Lehrveranstaltungen können in Präsenz oder online durchgeführt werden.
Veranstaltungen zum Modul	Übung: Deutsch als Fremdsprache A2.1 - Intensivkurs oder Übung: Deutsch als Fremdsprache A2.1 (semesterbegleitend) **und** Übung: Deutsch als Fremdsprache A2.2 - Intensivkurs oder Übung: Deutsch als Fremdsprache A2.2 (semesterbegleitend)
Veranstaltungen im aktuellen Semester	**019104** Übung Deutsch als Fremdsprache A2.1 - 4 SWS **019105** Übung Deutsch als Fremdsprache A2.2 - 4 SWS **019132** Intensivkurs Deutsch als Fremdsprache A2.1 Intensivkurs - 4 SWS **019133** Intensivkurs Deutsch als Fremdsprache A2.2 Intensivkurs - 4 SWS

Modul 13658 Uni-Deutsch für Fortgeschrittene

zugeordnet zu: Language Competence

Studiengang Chemistry: Materials, Engineering and Sustainability

Akademischer Grad	Modulnummer	Modulform
Master of Science	13658	Wahlpflicht

Modultitel	**Uni-Deutsch für Fortgeschrittene** University German for Advanced Learners
Einrichtung	ZES - Zentrale Einrichtung Sprachen
Verantwortlich	Diebel, Simone
Lehr- und Prüfungssprache	Deutsch
Dauer	1 Semester
Angebotsturnus	jedes Semester
Leistungspunkte	6
Lernziele	**Bei Erreichen der Niveaustufe GER B1** werden die Teilnehmenden zur selbstständigen Sprachverwendung befähigt, d.h. Texte inhaltlich und in ihren speziellen sprachlichen Strukturen zu erfassen. Damit können sie die Hauptpunkte verstehen, wenn eine klare Standardsprache verwendet wird und wenn es um vertraute Dinge aus den Bereichen Arbeit, Studium, Freizeit usw. geht. So können sie die meisten Situationen bewältigen, denen sie bei ihrem Aufenthalt im deutschen Sprachgebiet begegnen. Ziel ist es, sich einfach und zusammenhängend über vertraute Themen und persönliche Interessengebiete zu äußern, über Erfahrungen und Ereignisse zu berichten, Träume, Hoffnungen und Ziele zu beschreiben und zu Plänen und Ansichten kurze Begründungen oder Erklärungen zu geben (vgl. Kann-Beschreibungen des GER B1). **Bei Erreichen der Niveaustufe GER B2** können die Teilnehmenden selbstständig komplexe Texte zu konkreten und abstrakten Themen verstehen. Die Lernenden werden dazu befähigt, sich spontan und fließend zu verständigen, sodass ein normales Gespräch mit kompetenten Sprechenden ohne größere Anstrengung auf beiden Seiten möglich ist. Sie lernen, sich zu einem breiten Themenspektrum klar und detailliert auszudrücken, einen Standpunkt zu einer aktuellen Frage zu erläutern und die Vor- und Nachteile verschiedener Möglichkeiten anzugeben (vgl. Kann-Beschreibungen des GER Niveaustufe B2). **Bei Erreichen der Niveaustufe GER C1** können die Teilnehmenden die deutsche Sprache kompetent verwenden. Sie können ein breites Spektrum anspruchsvoller, längerer Texte verstehen und auch implizite Bedeutungen erfassen. Sie sind in der Lage, sich spontan und fließend ausdrücken, ohne öfter deutlich erkennbar nach Worten

	suchen zu müssen. Sie können die Sprache im gesellschaftlichen und beruflichen Leben oder in Ausbildung und Studium wirksam und flexibel gebrauchen. Sie können sich klar, strukturiert und ausführlich zu komplexen Sachverhalten äußern und dabei verschiedene Mittel zur Textverknüpfung angemessen verwenden (vgl. Kann-Beschreibungen des GER C1). Schließlich reflektieren die Teilnehmenden, im Kontext der vermittelten Inhalte und ihrer eigenen Kultur, die Kultur im deutschsprachigen Raum und werden nach Abschluss des Moduls Grundzüge und Gepflogenheiten der Lebensformen im deutschsprachigen Raum verstehen.
Inhalte	**Handlungsorientierte Aufgaben** zum globalen, selektiven und detaillierten Hör- und Leseverstehen, zur Produktion themen- und situationsbezogener schriftlicher Texte, zum themen- und situationsbezogenen mündlichen Ausdruck sowie **Übungen** zum Verständnis, zur Erweiterung und zur Festigung sprachlicher Strukturen (Wortschatz und Grammatik). Weiterhin werden Lernstrategien und -techniken für das Selbststudium vermittelt und erprobt. **Thematische und grammatische Schwerpunkte** lt. Empfehlungen des Gemeinsamen Europäischen Referenzrahmens (GER) für jede Niveaustufe (Deutsch als Fremdsprache B1; Deutsch als Fremdsprache B2; Deutsch als Fremdsprache C1).
Empfohlene Voraussetzungen	Dringend empfohlen: • Deutschvorkenntnise GER A2 für Sprachlehrveranstaltung Deutsch als Fremdsprache B1.1 • Deutschvorkenntnise GER B1.1 für Sprachlehrveranstaltung Deutsch als Fremdsprache B1.2 • Deutschvorkenntnise GER B1 für Sprachlehrveranstaltung Deutsch als Fremdsprache B2.1 • Deutschvorkenntnise GER B2.1 für Sprachlehrveranstaltung Deutsch als Fremdsprache B2.2 • Deutschvorkenntnise GER B2 für Sprachlehrveranstaltung Deutsch als Fremdsprache C1.1 • Deutschvorkenntnise GER C1.1 für Sprachlehrveranstaltung Deutsch als Fremdsprache C1.2 Die vorhandenen Deutschkenntnisse können zu Semesterbeginn mit einem Eingangstest überprüft oder mittels Zertifikat nachgewiesen werden.
Zwingende Voraussetzungen	keine
Lehrformen und Arbeitsumfang	Übung - 4 SWS Konsultation - 2 SWS Selbststudium - 90 Stunden
Unterrichtsmaterialien und Literaturhinweise	• kurstragendes Lehr- und Übungsmaterial • Zusatzmaterialien
Modulprüfung	Continuous Assessment (MCA)

Prüfungsleistung/en für Modulprüfung	Pro Sprachlehrveranstaltung 3 themenbezogene Tests oder Abgabeaufgaben à 45 – 60 Minuten (je 1/3 Gewichtung für Modulnote) Außerdem ist für Deutsch als Fremdsprache C1.1 und C1.2 und für Deutsch als Fremdsprache Sprechen und Schreiben für Studium / Beruf (B2) die Teilnahme an einer der folgenden Veranstaltungen obligatorisch: - Sprachtandem - Konversationskurs auf dem Niveau B1+ bis C1 Weitere Informationen finden Sie auf der Website des Sprachenzentrums.
Bewertung der Modulprüfung	Prüfungsleistung - benotet
Teilnehmerbeschränkung	keine
Bemerkungen	• Das Modul richtet sich an internationale Studierende mit Deutschvorkenntnissen mindestens auf dem Niveau GER A2. Ein Einstufungstest kann ihre Vorkenntnisse zu Beginn der Lehrveranstaltung überprüfen. • Eine **zusätzliche und vorherige ANMELDUNG** der Studierenden in der Zentralen Einrichtung Sprachen ist erforderlich (https://www.b-tu.de/sprachen)! • Es können nicht mehr als 25 Teilnehmende in jeder Sprachkursgruppe eingeschrieben werden. • Die Lehrveranstaltungen können in Präsenz oder online durchgeführt werden. • Es können Blockveranstaltungen durchgeführt werden.
Veranstaltungen zum Modul	Teilnehmende können im Rahmen des Moduls entsprechend ihrer Vorkenntnisse eine der folgenden Sprachlehrveranstaltungen (Übung) belegen: • Übung: Deutsch als Fremdsprache B1.1 für Uni, Job und Alltag • Übung: Deutsch als Fremdsprache B1.2 für Uni, Job und Alltag • Übung: Deutsch als Fremdsprache B2.1 für den Beruf • Übung: Deutsch als Fremdsprache B2.2 für den Beruf • Übung: Deutsch als Fremdsprache Fit für den Arbeitsalltag In Kombination mit einer der folgenden Veranstaltungen: • Sprachtandem oder • Konversationskurs (B1+ - C1) können auch folgende Deutschlehrveranstaltungen: • Übung: Deutsch als Fremdsprache C1.1

- Übung: Deutsch als Fremdsprache C1.2
- Übung: Deutsch als Fremdsprache Sprechen und Schreiben für Studium / Beruf (B2)

belegt werden.

Veranstaltungen im aktuellen Semester

019114 Übung
Deutsch als Fremdsprache B1.1 für Uni, Job und Alltag - 4 SWS
019115 Übung
Deutsch als Fremdsprache B1.2 für Uni, Job und Alltag - 4 SWS
019161 Übung
Deutsch als Fremdsprache B2.1 für den Beruf - 4 SWS
019162 Übung
Deutsch als Fremdsprache B2.2 für den Beruf - 4 SWS
019164 Übung
Deutsch als Fremdsprache C1.2 für den Beruf - 4 SWS
019165 Übung
Deutsch als Fremdsprache Fit für den Arbeitsalltag - Teil 2 - 4 SWS
019166 Übung
Deutsch als Fremdsprache Sprechen und Schreiben für Studium/Beruf (B2) - 2 SWS
019180 Tutorium
Konversation - Deutsch als Fremdsprache B1+ - 2 SWS

Modul 13819 Studierstrategien und Fachsprache Technik

zugeordnet zu: Language Competence

Studiengang Chemistry: Materials, Engineering and Sustainability

Akademischer Grad	Modulnummer	Modulform
Master of Science	13819	Wahlpflicht

Modultitel	**Studierstrategien und Fachsprache Technik** Study Strategies and Language for Specific Purposes - Science and Technology
Einrichtung	ZES - Zentrale Einrichtung Sprachen
Verantwortlich	keine Zuordnung vorhanden
Lehr- und Prüfungssprache	Deutsch
Dauer	1 Semester
Angebotsturnus	sporadisch nach Ankündigung
Leistungspunkte	6
Lernziele	keine
Inhalte	keine
Empfohlene Voraussetzungen	keine
Zwingende Voraussetzungen	keine
Lehrformen und Arbeitsumfang	keine Zuordnung vorhanden
Unterrichtsmaterialien und Literaturhinweise	keine
Modulprüfung	Keine Angabe - Angabe ab Wintersemester 2016/17 erforderlich!
Prüfungsleistung/en für Modulprüfung	keine
Bewertung der Modulprüfung	Prüfungsleistung - benotet
Teilnehmerbeschränkung	keine
Bemerkungen	keine
Veranstaltungen zum Modul	keine
Veranstaltungen im aktuellen Semester	keine Zuordnung vorhanden

Modul 14152 Studierstrategien & Fachdeutsch Nachhaltigkeit

zugeordnet zu: Language Competence

Studiengang Chemistry: Materials, Engineering and Sustainability

Akademischer Grad	Modulnummer	Modulform
Master of Science	14152	Wahlpflicht

Modultitel	**Studierstrategien & Fachdeutsch Nachhaltigkeit** Study Strategies and German for Academic Purposes - Sustainability
Einrichtung	ZES - Zentrale Einrichtung Sprachen
Verantwortlich	keine Zuordnung vorhanden
Lehr- und Prüfungssprache	Deutsch
Dauer	1 Semester
Angebotsturnus	sporadisch nach Ankündigung
Leistungspunkte	6
Lernziele	keine
Inhalte	keine
Empfohlene Voraussetzungen	keine
Zwingende Voraussetzungen	keine
Lehrformen und Arbeitsumfang	keine Zuordnung vorhanden
Unterrichtsmaterialien und Literaturhinweise	keine
Modulprüfung	Keine Angabe - Angabe ab Wintersemester 2016/17 erforderlich!
Prüfungsleistung/en für Modulprüfung	keine
Bewertung der Modulprüfung	Prüfungsleistung - benotet
Teilnehmerbeschränkung	keine
Bemerkungen	keine
Veranstaltungen zum Modul	keine
Veranstaltungen im aktuellen Semester	keine Zuordnung vorhanden

Erläuterungen

Das Modulhandbuch bildet als Teil der Prüfungsordnung die Rechtsgrundlage für ein ordnungsgemäßes Studium. Darüber hinaus soll es jedoch auch Orientierung bei der Gestaltung des Studiums geben.

Dieses Modulhandbuch wurde am 18. März 2026 automatisch für den Master (universitär)-Studiengang Chemistry: Materials, Engineering and Sustainability (universitäres Profil), PO-Version 2025, aus dem Prüfungsverwaltungssystem auf Basis der Prüfungsordnung generiert. Es enthält alle zugeordneten Module einschließlich der ausführlichen Modulbeschreibungen mit Stand vom 18. März 2026. Neben der Zusammensetzung aller Veranstaltungen zu einem Modul wird zusätzlich das Veranstaltungsangebot für das jeweils aktuelle Semester gemäß dem Veranstaltungsverzeichnis der BTU ausgegeben.

The module catalogue is part of the examination regulation and as such establishes the legal basis for studies according to the rules. Furthermore, it should also give orientation for the organisation of the studies.

This module catalogue was generated automatically by the examination administration system on the base of the examination regulation on the 18 March 2026, for the Master (universitär) of Chemistry: Materials, Engineering and Sustainability (research-oriented profile). The examination version is the 2025, Catalogue contains all allocated modules including the detailed module descriptions from 18 March 2026. Apart from the composition of all components of a module, the list of lectures, seminars and events for the current semester according to the catalogue of lectures of the BTU is displayed.