Module Guide of the Study Programme

Process Engineering and Energy Technology (PEET)

Master of Science

21.08.2025

Content

Study Plan 3
Preambles 4
1.1 Fundamentals of Simulation 5
1.2 Provision of Material Properties 7
1.3 Flowsheet Simulation 9
1.4 Advanced Energy Conversion 11
1.5 Solar and Wind Energy Technologies 13
1.6 Energy from Biomass 14
2.1 Electrochemical Processes 16
2.2 Students in Science 18
2.3.1 Latest Scientific Topics | Alternative 1 20
2.3.2 Latest Scientific Topics | Alternative 2 22
2.4 Fluid Separation Processes 24
2.5 Environmental Process Technologies 26
2.6 Chemical Reaction Engineering 28
3.1 Final Examination 30

Study Plan

	Module					
1	1.1 Fundamentals of Simulation	1.2 Provision of Material Properties	1.3 Flowsheet Simulation	1.4 Advanced Energy Conversion	1.5 Solar and Wind Energy Technologies	1.6 Energy from Biomass
	5 ECTS	5 ECTS	5 ECTS	5 ECTS	5 ECTS	5 ECTS
	4 SWS	2,133 SWS	3 SWS	2 SWS	4 SWS	4 SWS
2	2.1 Electrochemical Processes	2.2 Students in Science	2.3 Latest Science Topics	2.4 Fluid Separation Processes	2.5 Environmental Process Technologies	2.6 Chemical Reaction Engineering
	5 ECTS	5 ECTS	5 ECTS	5 ECTS	5 ECTS	5 ECTS
	4 SWS	2,067 SWS	4 SWS	4 SWS	4 SWS	4 SWS
3	3.1 Master Thesis					
			30 ECTS			
			0,25 SWS			

Explanatory notes / Module blocks:

	Process Engineering
	Energy Technology
	Simulation
	Science and Research

Preambles

Frequency of modules: All modules are offered annually. "Cycle" indicates whether this is the case in the summer or winter semester.

Duration of a module: A module is usually completed within one semester. Information on the duration can be found in the "Semester" field.

Note on student workload: The Master's program in Process Engineering and Energy Technology comprises a total of 90 credit points (CP), with a workload allocation of 30 hours per credit point. Each academic year has 60 CP, meaning 30 CP are completed in each semester – this corresponds to a total workload of 900 hours per semester.

Detailed and further information can be found in the module descriptions.

1.1 Fundamentals of Simulation

Semester:	1	CP:	5	Language:	E
Teaching methods:	Le, Lab	Student workload:	4 SWS	Frequency:	SoSe
Weight of the module grade:	50% Numerical Mathematics, 50% Simulation of Process Control Systems				Mandatory

Requirements for participation:	none
Person in charge:	Stell

Workload in hours:	Total	Contact hours	Self-Study
	150	56	94

Type of exam:	PF	Non-graded exam:	-

Requirements for the award of CP:	Portfolio examination passed in total, consisting of the following partial examinations: Lecture and Lab. Numerical Mathematics: written examination (2 hours) or oral examination Lab. Simulation of Process Control: practical experiments, report on project work
Learning outcomes:	Students are familiar with the fundamentals and limitations of numerical solution methods for differential equation systems that describe technical processes. This enables them to simulate such processes on a computer. They are able to apply these fundamentals to simple examples. They are familiar with criteria for the applicability of numerical methods. They are familiar with an application of numerical methods in the context of process control technology. They are able to control processes using industrial application software and to simulate both, the control and the processes.

Content:	Lecture and laboratory: Numerical mathematics	SWS
	Computer access to higher mathematics is taught. Using the computer language SciLab as an example, numerical algorithms are developed and compared. The central concept is the machine accuracy of number representation (mantissa). The discretisation of physical model equations is introduced as a basic numerical method and explored in depth in various contexts (interpolation, integration, time step methods, partial differential equations). The solution methods for nonlinear systems of equations lead to	2

	optimisation methods for specific numerical problems in process engineering, including nonlinear constraints.	
	Laboratory: Simulation of process controls	
	Using the PCS7 industrial process control system, a previously established laboratory process is controlled and this control is simulated in various ways. This includes: - Setting up a process on a laboratory scale - Defining input and output signals - Defining control targets - Carrying out control with the process control system, including visualisation with various control parameters. - Simulation of input signals - Simulation of the automation system - Simulation of the process in the process control system - Evaluation of the respective results	2
Usability of the module:	PEET module group simulation	
Further Informationen:	-	
Literature:	Numerical Analysis, Francis Scheid, Schaum's Outlines, McGraw-Hill, ISBN 0070552215, Dokumentation und Tutorial des PCS7-Systems	

1.2 Provision of Material Properties

Semester:	1	CP:	5	Language:	E
Teaching methods:	Le, Lab	Student workload:	2,133 SWS	Frequency:	SoSe
Weight of the module grade:	50% Lecture, 50% Laboratory				Mandatory

Requirements for participation:	none
Person in charge:	Gottschalk

Workload in hours:	Total	Contact hours	Self-Study
	150	30	120

Type of exam:	PF	Non-graded exam:	-

Requirements for the award of CP:	Portfolio examination passed in total, consisting of the following partial examinations: Lecture: written examination (3.5 hours) or oral examination Laboratory: practical experiments with evaluation
Learning outcomes:	After successful participation, students will be familiar with - essential material properties of fluid systems and their dimensions, - mathematical methods for approximating functions to measured values, - accuracies and representation ranges - mixture rules and their application, and will be able to identify methods for measuring unknown material data, apply them and, as part of the evaluation, determine and validate parameters for suitable prediction functions for this material data.

Content:	Lecture: Calculation of Material Properties	SWS
	The following content can be considered familiar in subsequent events, even if not conveyed in full detail: - Thermal equations of state and their evaluation - Calorific equations of state, heat capacity - Transport coefficients (viscosity, diffusion coefficient, thermal conductivity, etc.) - mixture rules (linear, mixture parameters) - GE models for vapour-liquid equilibria - activity coefficients - diagram representations (triangle diagram, Jänicke diagram, McCabe-Thiele diagram, etc.)	2

	Laboratory: Measurement of material properties	
	Studierende erarbeiten individuell geeignete Methoden zur Messung und anschließenden Auswertung unbekannter Stoffdaten	0,13 3
Usability of the module:	PEET module group simulation	
Further Informationen:	-	
Literature:	Reid/Prausnitz/Poling: The Properties of Gases and Liquids, McGraw-Hill, ISBN 0-07-051799-1	

1.3 Flowsheet Simulation

Semester:	1	CP:	5	Language:	E
Teaching methods:	Le, Lab	Student workload:	3 SWS	Frequency:	SoSe
Weight of the module grade:	50% Lecture, 50% Laboratory				Mandatory

Requirements for participation:	none
Person in charge:	Stell

Workload in hours:	Total	Contact hours	Self-Study
	150	42	108

Type of exam:	PF	Non-graded exam:	-

Requirements for the award of CP:	Portfolio examination passed in total, consisting of the following partial examinations: Lecture: Written exam (software design) or oral exam Laboratory: Practical experiments (in silico)
Learning outcomes:	After successful participation, students will be familiar with - essential material properties of fluid systems and their dimensions, - mathematical methods for approximating functions to measured values, - accuracies and representation ranges - mixture rules and their application, and will be able to identify methods for measuring unknown material data, apply them and, as part of the evaluation, determine and validate parameters for suitable prediction functions for this material data.

Content:		
	Lecture: Flowsheet Simulation	SWS
	The lecture is divided into the following chapters: 1. Introduction to process simulation 2. Fundamentals of steady-state flow processes 3. Introduction to AspenTech simulation software 4. Material data calculation using AspenProperties 5. Process development and simulation with AspenHYSYS or AspenPlus 6. Dimensioning and cost calculation 7. Dynamic simulation of process engineering processes	1
	Laboratory: Flowsheet Simulation	
	Lecture-accompanying work with the above-mentioned simulation software	2

Usability of the module:	PEET module group simulation
Further Informationen:	-
Literature:	Integrated Design and Simulation of Chemical Processes, Alexandre C. Dimian (ISBN 0-444-82996-2); Process Design Principles, Seider, Seader, Lewin (ISBN 0-471-24312-4)

1.4 Advanced Energy Conversion

Semester:	1	CP:	5	Language:	E
Teaching methods:	Se	Student workload:	2 SWS	Frequency:	SoSe
Weight of the module grade:	33% calculations/simulations, 33% written report, 34% oral examination.				Mandatory

Requirements for participation:	none
Person in charge:	Gottschalk

Workload in hours:	Total	Contact hours	Self-Study
	150	28	122

Type of exam:	PF	Non-graded exam:	-

Requirements for the award of CP:	Portfolio examination passed in total, consisting of the following partial examinations: Calculations/simulations, written report and oral examination (presentation followed by discussion in a workshop setting)
Learning outcomes:	After successfully completing the course, students will have the skills to design energy conversion processes, i.e. to calculate/dimension them with the best possible efficiency for specific applications. They will be familiar with the latest developments in the context of renewable energy use. They will be able to successfully evaluate and optimise selected energy conversion systems.

Content:	Seminar: Advanced Energy Conversion	SWS
	The seminar begins with an introduction to the topic. Specific topics and individual assignments are developed together with the students. Both conventional and innovative technologies are taken into account, for example in the area of combined heat, power and cooling. Self-study is accompanied by individual counselling services for students, either individually and/or in groups. In workshops, students present the results of their individually worked topics and put them up for discussion. Active participation in the workshop as a whole is also expected.	2

Usability of the module:	PEET Module Group Energy Technology

Further Informationen:	-
Literature:	M.C. Potter and C. W. Samerton; Richard A. Zaboransky; Klaus Manny; Karl Strauß

1.5 Solar and Wind Energy Technologies

Semester:	1	CP:	5	Language:	E
Teaching methods:	Le	Student workload:	4 SWS	Frequency:	SoSe
Weight of the module grade:	50% Fundamentals of solar energy utilisation; 50% Fundamentals of wind energy utilisation.				Mandatory

Requirements for participation:	none
Person in charge:	Klobes

Workload in hours:	Total	Contact hours	Self-Study
	150	56	94

Type of exam:	K/M	Non-graded exam:	-

Requirements for the award of CP:	Module examination passed: Written examination (2.5 hours) or oral examination
Learning outcomes:	Acquiring knowledge about the basics of solar and wind energy use. Designing and calculating components for the conversion of renewable energy based on solar and wind energy. Possibilities and limitations of using renewable energies such as wind and solar energy and conditions for use such as geographical location, environmental influences, fluctuations and intensity of energy. Successful students should be able to design and operate renewable energy components themselves after completing the course.

Content:		SWS
	Lecture: Solar Heat and Photovoltaic	
	Physical fundamentals and technical use of solar energy.	2
	Lecture: Wind Turbine Technology	
	Physical fundamentals and technical use of wind energy.	2

Usability of the module:	PEET Module Group Energy Technology
Further Informationen:	-
Literature:	M.C. Potter and C. W. Samerton; Richard A. Zaboransky; Mostofizadeh; Klaus Manny; Karl Strauß; V. Quaschning: Regenerative Energiesysteme; K. Mertens: Photovoltaik

1.6 Energy from Biomass

Semester:	1	CP:	5	Language:	E
Teaching methods:	Le, La	Student workload:	4 SWS	Frequency:	SoSe
Weight of the module grade:	50% lecture; 50% laboratoty.				Mandatory

Requirements for participation:	none
Person in charge:	Haneke

Workload in hours:

Total	Contact hours	Self-Study
150	56	94

Type of exam:	PF	Non-graded exam:	-

Requirements for the award of CP:	Portfolio examination passed in total, consisting of the following partial examinations: Lecture: Written examination (1.5 hours) or oral examination Laboratory: Practical experiments with evaluation or oral examination
Learning outcomes:	Students will gain an overview of the various processes involved in converting biomass into energy, as well as the types and availability of biomass. They will learn about the competition between energy and food production from biomass. Students will gain in-depth knowledge of the fundamentals, process steps and design of biogas, biomethane, biodiesel and bioethanol production. They will gain an overview of thermal processes for biomass utilisation.

Content:

Lecture: Energy from Biomass	SWS
- Potential of available biomass from agriculture and waste - Effects of competing land use for food and energy production - Overview of possible processes for the energetic use of biomass - Fundamentals of biological conversion processes - Production of biogas - Production of bioethanol - Production of biodiesel - Conversion of biogas into biomethane - Thermal processes for the utilisation of biomass - Synthetic fuels	2
Laboratory: Energy from Biomass	

	Experimental work on selected topics in bioenergy production, e.g. biogas, biodiesel.	2
Usability of the module:	PEET Module Group Energy Technology	
Further Informationen:	-	
Literature:	Energy from Biomass	

2.1 Electrochemical Processes

Semester:	2	CP:	5	Language:	E
Teaching methods:	Le, La	Student workload:	4 SWS	Frequency:	WiSe
Weight of the module grade:	50% lecture; 50% laboratory.				Mandatory

Requirements for participation:	none
Person in charge:	Gottschalk

Workload in hours:	Total	Contact hours	Self-Study
	150	56	94

Type of exam:	PF	Non-graded exam:	-

Requirements for the award of CP:	Portfolio examination passed in total, consisting of the following partial examinations: Lecture: Written examination (2 hours) or oral examination Laboratory: Practical experiments with evaluation or oral examination
Learning outcomes:	Be able to understand, calculate, record and evaluate electrochemical methods and processes.

Content:		
	Lecture: Electrochemical Processes	SWS
	Fundamentals: equilibrium electrochemistry, electrode kinetics, electrochemical cells, measurement methods. Applications: potentiometry (pH measurement), conductometry, fuel cells, batteries and accumulators, corrosion and corrosion protection (updatable), measurement methods	2
	Laboratory: Electrochemical Processes	
	Selected experiments related to the lecture content	2

Usability of the module:	PEET Module Group Science and Research
Further Informationen:	-

Literature:	(1a) Atkin's Physical Chemistry / P.W. Atkins, J. De Paula; Oxford UP, 2002, (7th ed.); and: Student's solutions manual for Atkin's physical chemistry; Oxford Univ. Press, any release; (1b) Physikalische Chemie / Peter W. Atkins; Weinheim [u.a.] : Wiley-VCH, any release; (2a) Electrochemistry / Carl H. Hamann; Andrew Hamnett; Wolf Vielstich; Weinheim [u.a.]: Wiley-VCH, any release; (2b) Elektrochemie / Carl H. Hamann; Wolf Vielstich; Weinheim [u.a.] : Wiley-VCH, any release.

2.2 Students in Science

Semester:	2	CP:	5	Language:	E
Teaching methods:	Se, La	Student workload:	2,067 SWS	Frequency:	WiSe
Weight of the module grade:	50% seminar, 50% project work.				Mandatory

Requirements for participation:	none
Person in charge:	Klobes

Workload in hours:	Total	Contact hours	Self-Study
	150	28	122

Type of exam:	PF	Non-graded exam:	-

Requirements for the award of CP:	Portfolio examination passed in total, consisting of the following partial examinations: • Seminar: Oral examination (one or more presentations with a total duration of no more than 60 minutes, followed by a discussion) as part of the seminar • Laboratory: Project work with detailed report
Learning outcomes:	After successfully completing the module, students will be able to • independently develop the scientific foundations of a topic related to process or energy engineering, • give a scientific presentation in accordance with standard conference criteria, • engage in constructive scientific discussion, • develop a scientific question with only minimal support or analyse a given question, and • work on this question in a practical manner with finite resources.

Content:	Seminar	SWS
	• Fundamentals of scientific research (tools and strategies) • Fundamentals of scientific presentations (structure, target group specificity, presentation and time management, dealing with questions) • Current research topics at Bremerhaven University of Applied Sciences, e.g. heat recovery (heat to heat), power to X, materials for heterogeneous catalysis and batteries, multiphase flows, and much more. • Current research topics from partners in industry and research institutes, e.g. use of biomass, different battery types, process control, recovery of critical raw materials from process streams, and much more.	2

	Laboratory/Project Work	
	Guided development and implementation of a time-limited, scientifically motivated project, the content of which is based on current research topics at the university and its cooperation partners or the interests of the students. Examples include: • Spectroscopic determination of the iron concentration in the process water of a hydrothermal synthesis for rapid assessment of the synthesis success • Testing of non-linear regression for extrapolating the viscosity of nanofluids at high temperatures • Influence of synthesis conditions on the performance of Prussian blue analogues as cathode material in Li-ion batteries	0,067
Usability of the module:	PEET Module Group Science and Research Together with the 'Research Studies' module, this module enables students to develop their scientific skills. It expands on the 'Research Studies' module by adding the scientific depth of the lecture and concrete laboratory/project experience. The module draws on the content of the subject-specific modules and expands the students' skills in these areas with regard to scientific application. The module also serves as preparation for independent scientific work within the framework of the Master's thesis and its defence in the final presentation.	
Further Informationen:	The module offers students the opportunity to develop and pursue their own research interests while at the same time establishing contacts within and outside the university, particularly in the context of project work.	
Literature:	The literature is based on the projects of the university and external partners, as well as the interests of the students. Lecturers support students in selecting suitable literature.	

2.3.1 Latest Scientific Topics | Alternative 1

Semester:	2	CP:	5	Language:	E
Teaching methods:	Le, La	Student workload:	4 SWS	Frequency:	WiSe
Weight of the module grade:	50% lecture, 50% laboratory / project work.			Elective:	Alternative 1 or 2

Requirements for participation:	none
Person in charge:	Klobes

Workload in hours:	Total	Contact hours	Self-Study
	150	56	94

Type of exam:	PF	Non-graded exam:	-

Requirements for the award of CP:	Portfolio examination passed in total, consisting of the following partial examinations: Lecture: written exam (2 hours) or oral exam Laboratory/project work: experiment with evaluation or graded report
Learning outcomes:	After successfully completing the module, students will be able to • gain an overview of a current field of research in process engineering and discuss its issues, • develop their own research ideas (with support), • select suitable theoretical and/or practical methods for pursuing these ideas and apply them scientifically, and • critically assess the technologies involved and evaluate any potential hazards and risks

Content:	Lecture: Modern Materials in Chemical Engineering	SWS
	• Material-specific problems (not only) in process engineering: environmental impact, toxicity, recyclability, critical raw materials • Current material development in the fields of catalysis, batteries, fuel cells and filter materials • Methods of material development: solid-state synthesis, solvothermal methods, coating processes (CVD, PVD) • Nanotechnology: production of nanoparticles, lithography, printing processes • Methods of material characterisation: X-ray diffraction, electron microscopy, EDX, atomic emission spectroscopy	2

	Laboratory/Project Work: Modern Materials in Chemical Engineering	
	Guided development and implementation of a time-limited project related to the lecture content, the content of which is developed by the students. Examples include: • Synthesis of nanoparticles and size determination using a TEM • Photocatalytic properties of tin oxide nanoparticles • Microcontact printing of a structure in the sub-mm range	2
Usability of the module:	PEET Module Group Science and Research Together with the 'Research Studies' module, this module enables students to develop their scientific skills. It expands on the 'Research Studies' module by adding the scientific depth of the lecture and concrete laboratory/project experience.	
Further Informationen:	The topics covered in the lecture 'Modern Materials in Chemical Engineering' primarily prepare students for future employment in industrial research departments and research institutes, e.g. the Fraunhofer Society or federal/state research institutes.	
Literature:	B.S. Mitchell, "An Introduction to Materials Engineering and Science for Chemical and Materials Engineers", Wiley S. Kobayashi, "Nanoparticles in Catalysis", Springer Z. Wu, "Catalysis by Materials with Well-Defined Structures", Elsevier S. Kulkarni, "Nanotechnology: Principles and Practices", Springer Further literature on specific topics will be provided.	

2.3.2 Latest Scientific Topics | Alternative 2

Semester:	2	CP:	5	Language:	E
Teaching methods:	Le, La	Student workload:	4 SWS	Frequency:	WiSe
Weight of the module grade:	50% lecture, 50% laboratory.				Elective: Alternative 1 or 2

Requirements for participation:	none
Person in charge:	Fichter

Workload in hours:	Total	Contact hours	Self-Study
	150	56	94

Type of exam:	PF	Non-graded exam:	-

Requirements for the award of CP:	Portfolio examination passed in total, consisting of the following partial examinations: Lecture: written exam (2 hours) or oral exam Laboratory: experiment with evaluation (lab report)
Learning outcomes:	The students learn the basics (background, data, potential, sustainability, resource and CO2 footprints) and deeper knowledge in production (e.g. electrolysis, green methanation, green ammonia production) and applications (industry, like steel production, glass, or chemical industry, traffic / transportation sector (e.g. fuel cell), and energy sector (cavern storage) of green energy carriers like green hydrogen, green methanol, green methane, and green Liquefied methane (LNG), green chemicals like green ammonia and power to X technologies in general.

Content:		SWS
	• Overview of green energy carriers and power to X technologies • Basics of different green energy carriers • Potential of different green energy carriers • LCA, footprints, and sustainability of green energy carriers • Production methods of green energy carriers • Applications of green energy carriers	2
	Laboratory: Power-2-X	
	Selected experiments in the context of water electrolysis, hydrogen storage, fuel cells and battery storage (accumulators).	2

Usability of the module:	PEET Module Group Science and Research Together with the 'Research Studies' module, this module enables students to develop their scientific skills. It expands on the 'Research Studies' module by adding the scientific depth of the lecture and concrete laboratory/project experience.
Further Informationen:	-
Literature:	• Handbook of Energy Storage - Demand, Technologies, Integration, Sterner, M.; Stadler, I.; Springer 2019 • Energietechnik- Systeme zur Energieumwandlung. Kompaktwissen für Studium und Beruf; Zahoransky, R.; Fichter, C.; et al.; Springer Vieweg; 9. Auflage; 2022 • Energiespeicher - Bedarf, Technologien, Integration; Sterner, M.; Stadler, I.; Springer 2014

2.4 Fluid Separation Processes

Semester:	2	CP:	5	Language:	E
Teaching methods:	Le, La	Student workload:	4 SWS	Frequency:	WiSe
Weight of the module grade:	50% lecture, 50% laboratory.				Mandatory

Requirements for participation:	none
Person in charge:	Gottschalk

Workload in hours:	Total	Contact hours	Self-Study
	150	56	94

Type of exam:	PF	Non-graded exam:	-

Requirements for the award of CP:	Portfolio examination passed in total, consisting of the following partial examinations: Lecture: Written exam (2 hours) or oral exam; Laboratory: Written report (about the experiment, its evaluation and subsequent elaboration)
Learning outcomes:	Graduates of the course have expertise in the calculation and design of multi-stage and combined thermal processes such as evaporation, distillation, rectification, absorption, adsorption, crystallisation and extraction. They are proficient in the optimisation of energy consumption and material flow.

Content:		
	Lecture: Advanced Fluid Separation Processes	SWS
	Selected chapters from the fields of evaporation, crystallisation, sublimation, drying, distillation, rectification, absorption, adsorption and extraction, with particular emphasis on energy aspects, including energy efficiency. In contrast to the bachelor's course, the focus here is on method development (as opposed to method mastery) – students should not simply reproduce given calculations, but develop new calculation methods.	2
	Laboratory: Advanced Fluid Separation Processes	
	Experimental investigations at a pilot-scale test facility; modelling of the test facility and validation of the simulation model using measured data; development and evaluation of measures to improve the test facility and its operation using the simulation model.	2

Usability of the module:	PEET Module Group Environmental and Process Engineering
Further Informationen:	-
Literature:	Perry and Chilton; Philip A. Schweitzer; Warren L. McCabe; Jimmy L. Humphry; Schlünder; Sattler

2.5 Environmental Process Technologies

Semester:	2	CP:	5	Language:	E
Teaching methods:	Le	Student workload:	4 SWS	Frequency:	WiSe
Weight of the module grade:	50% Industrial and municipal environmental technology; 50% Seawater desalination.				Mandatory

Requirements for participation:	none
Person in charge:	Haneke

Workload in hours:

Total	Contact hours	Self-Study
150	56	94

Type of exam:	K/M/H	Non-graded exam:	-

Requirements for the award of CP:	Module examination passed: Written examination (3 hours) or oral examination or term paper
Learning outcomes:	'Industrial and municipal environmental technology': Students are familiar with selected examples of in-depth scientific principles and the design of environmental technology processes. They can apply the theoretical principles together with findings from literature or their own measurements to practical tasks involving the design and optimisation of plants and processes. They have mastered the methods of critical data analysis and critical interpretation of their own results. 'Seawater Desalination': Students are familiar with the essential processes of seawater desalination. Using selected thermal processes and membrane processes, they are familiar with the theoretical principles and can apply them to the design of plants.

Content:	Lecture: Industrial and municipal environmental technology	SWS
	- Mechanical separation processes, filters, cyclones, electrostatic precipitators - Thermal post-treatment, heat recovery - Catalytic post-treatment, oxidation, SCR process - Thermal separation processes, absorption, adsorption - Biological processes, biofilters, activated sludge processes - Chemical processes, precipitation, cyanide reduction - Biogas plants, gas feed-in, gas treatment - Recycling of solid waste	2

	- Integrated processes, environmental management systems - Solar technology and hydrogen technology	
	Lecture: Seawater Desalination	
	- Properties of seawater - Fundamentals of thermal desalination processes - Fundamentals of reverse osmosis - Dimensioning of desalination stages - Pre- and post-treatment of water - Use of renewable energy - Energy recovery	2
Usability of the module:	PEET Module Group Environmental and Process Engineering	
Further Informationen:	-	
Literature:	Reible, D. D.: Fundamentals of Environmental Engineering, Springer and Lewis Publishers, An Engineer's Guide to Desalination	

2.6 Chemical Reaction Engineering

Semester:	2	CP:	5	Language:	E
Teaching methods:	Le, La	Student workload:	4 SWS	Frequency:	WiSe
Weight of the module grade:	50% lecture; 50% laboratory.				Mandatory

Requirements for participation:	none
Person in charge:	Gottschalk

Workload in hours:	Total	Contact hours	Self-Study
	150	56	94

Type of exam:	PF	Non-graded exam:	-

Requirements for the award of CP:	Portfolio examination passed in total, consisting of the following partial examinations: Lecture: Written exam (3 hours) or oral exam Laboratory: Report with computer program and presentation
Learning outcomes:	Upon successful completion of the course, students will be able to evaluate energy technology processes involving chemical reactions, select appropriate solutions and correctly assess the potential of chemical conversion. The lecture teaches the fundamentals of chemical reaction engineering and chemical process engineering, which are then explored in greater depth using the examples of thermal gasification of wood, coal and waste materials, and biological gasification of biomass.

Content:	Lecture: Gasification and chemical reactions	SWS
	Grundlagen der Chemische Reaktionstechnik und Vergasung: - Nomenklatur - Bilanzierung, Schlüsselreaktionen und -komponenten - Chemische Thermodynamik und Massenwirkungsgesetz - Homogene Reaktionen - Grundlegende Reaktortypen (batch STR, PFR, CSTR) - Kaskade, Kurzschluss, Kreislaufreaktor und Kombinationen - Heterogene Reaktionen - Modellvorstellungen (katalysierte und nicht-katalysierte R.) - Reaktoren für heterogene Reaktionen - Vergasungsverfahren	2

	- thermische Vergasung - biologische Vergasung	
	Laboratory: Modelling of reaction systems	
	Modelling and simulation of selected tasks in the context of lecture content (in silico laboratory).	2
Usability of the module:	PEET Module Group Environmental and Process Engineering	
Further Informationen:	-	
Literature:	Skogestad: Chemical and Energy Process Engineering, CRC Press, ISBN 978-1-4200-8755-0	

3.1 Final Examination

Semester:	3	CP:	30	Language:	E
Teaching methods:	Se	Student workload:	0,25 SWS	Frequency:	SoSe
Weight of the module grade:	67% master thesis; 33% colloquium				Mandatory

Requirements for participation:	45 ECTS credits from module examinations in accordance with the PEET curriculum
Person in charge:	Gottschalk

Workload in hours:	Total	Contact hours	Self-Study
	866	3,5	862,5

Type of exam:	MA	Non-graded exam:	-
Requirements for the award of CP:	Overall module examination passed, consisting of the sub-examinations Master's thesis and colloquium		
Learning outcomes:	In the final examination, students must demonstrate their ability to: • independently develop and methodically investigate an engineering topic on a scientific basis within a limited time frame, • and give a 30-minute public lecture on the topic of their master's thesis, followed by a discussion.		

Content:	Final Thesis Project	SWS
	Independent work on a thesis topic chosen and approved by the student. The duration of the thesis, from approval to submission, is 22 weeks (full-time).	2
	Seminar	
	Individual supervision of a student; public colloquium on the topic of the Master's thesis, consisting of a 30-minute presentation followed by up to 30 minutes of discussion, with questions on the Master's thesis, the presentation and closely related topics.	2

Usability of the module:	-
Further Informationen:	-
Literature:	-