**Amtliche Bekanntmachungen der TU Bergakademie Freiberg**

**Nr. 47, Heft 2 vom 07. Dezember 2023**

# Modulhandbuch

# für den

# Masterstudiengang

# Chemical Engineering

**Inhaltsverzeichnis**

**Abkürzungen**

KA: schriftliche Klausur / written exam
MP: mündliche Prüfung / oral examination
AP: alternative Prüfungsleistung / alternative examination
PVL: Prüfungsvorleistung / prerequisite
MP/KA: mündliche oder schriftliche Prüfungsleistung (abhängig von Teilnehmerzahl) / written or oral examination (dependent on number of students)

SS, SoSe: Sommersemester / sommer semester
WS, WiSe: Wintersemester / winter semester

SX: Lehrveranstaltung in Semester X des Moduls / lecture in module semester x

SWS: Semesterwochenstunden

| | | | |
|---|---|---|---|
| Data: | ARE. MA. Nr. / Examination number: - | Version: 14.09.2023 | Start Year: SoSe 2025 |
| Module Name: | **Advanced Reaction Engineering** | | |
| (English): | Advanced Reaction Engineering | | |
| Responsible: | Kureti, Sven / Prof. Dr. rer. nat | | |
| Lecturer(s): | Kureti, Sven / Prof. Dr. rer. nat<br>Wollmerstädt, Hendrik / Dr.-Ing. | | |
| Institute(s): | Institute of Energy Process Engineering and Chemical Engineering | | |
| Duration: | 1 Semester(s) | | |
| Competencies: | The students understand reaction mechanisms, kinetics, modelling and design of chemical reactors in the fields of catalytic exhaust purification and synthesis of industrial and biological products. The students also are enabled to design, optimise and assess chemical processes. | | |
| Contents: | Advanced Reaction Engineering: The lecture deals with the reaction engineering of technically relevant chemical processes including mechanisms and kinetics of chemical reactions as well as modelling and design of chemical reactors. The main focus lies on the catalytic exhaust purification and the synthesis of industrial products such as ammonia. The lecture addresses the understanding of practical process control as well as technical catalysts.<br><br>Biological Reaction Engineering: The lecture deals with the reaction engineering of technically relevant biochemical processes including reaction mechanisms and kinetics as well as modelling and design of chemical reactors. The main focus lies on the the synthesis of biotechnological products such as enzymes and bioethanol. The lecture addresses the understanding of practical process control as well as enzymatic catalysts.<br><br>In the seminar the knowledge on the modelling of chemical reactors is practically advanced.<br><br>In the practical course the chemical reaction engineering and reactor design strategies are experimentally advanced. | | |
| Literature: | A. Jess, P. Wasserscheid, Chemical Technology, Wiley-VCH, 2020.<br>G. Ertl, H. Knözinger, J. Weitkamp (Eds.): Handbook of heterogeneous catalysis, vol. 1-5, Wiley-VCH, 2007.<br>K. Schügerl, K.-H. Bellgard, Bioreaction engineering: modeling and control, Springer, 2000 . | | |
| Types of Teaching: | S1 (SS): Advanced Reaction Engineering / Lectures (2 SWS)<br>S1 (SS): Biological Reaction Engineering / Lectures (1 SWS)<br>S1 (SS): Chemical Reactor Modelling Seminar / Seminar (1 SWS)<br>S1 (SS): Practical Application (1 SWS) | | |
| Pre-requisites: | **Recommendations:**<br>Basics in Chemical Reaction Engineering and Chemistry. | | |
| Frequency: | yearly in the summer semester | | |
| Requirements for Credit Points: | For the award of credit points it is necessary to pass the module exam.<br>The module exam contains:<br>MP/KA (KA if 10 students or more) [MP minimum 30 min / KA 90 min]<br>PVL: Practical course with attestations and protocols as well as reactor modelling seminar with modelling exercise<br>PVL have to be satisfied before the examination. | | |
| | Voraussetzung für die Vergabe von Leistungspunkten ist das Bestehen der Modulprüfung. Die Modulprüfung umfasst: | | |

| | |
|---|---|
| | MP/KA (KA bei 10 und mehr Teilnehmern) [MP mindestens 30 min / KA 90 min]<br>PVL: Praktikum mit Antestat und Protokollen sowie Reaktormodellierungsseminar mit Modellierungsübung<br>PVL müssen vor Prüfungsantritt erfüllt sein bzw. nachgewiesen werden. |
| Credit Points: | 6 |
| Grade: | The Grade is generated from the examination result(s) with the following weights (w):<br>MP/KA [w: 1] |
| Workload: | The workload is 180h. It is the result of 75h attendance and 105h self-studies. The latter includes the preparation and wrap-up of the module elements, particularly the practical course and seminar, and the preparation for the examination. |

| | | | |
|---|---|---|---|
| Data: | ATST. Ma. Nr. / Examination number: - | Version: 12.09.2023 | Start Year: WiSe 2024 |
| Module Name: | **Advanced Thermal Separation Technology** | | |
| (English): | Advanced Thermal Separation Technology | | |
| Responsible: | Bräuer, Andreas / Prof. Dr.-Ing. | | |
| Lecturer(s): | Bräuer, Andreas / Prof. Dr.-Ing. | | |
| Institute(s): | Institute of Thermal, Environmental and Natural Products Process Engineering | | |
| Duration: | 1 Semester(s) | | |
| Competencies: | Students know and understand in detail important thermal separation tasks in process engineering practice. They understand and can calculate how the interconnection of advanced separation processes affects the energy requirements and product specifications of the separation process. Students know and understand hybrid separation processes that combine different thermal separation methods. Students are familiar with the current research activities and selected past research activities of the institute. | | |
| Contents: | • Advanced and industrially relevant processes for the separation of binary mixtures<br>  ◦ Concentrating sulfuric acid<br>  ◦ Removal of ammonia from waste water<br>  ◦ Removal of hydrogen chloride from inert gases<br>  ◦ Air separation<br>• Advanced and industrially relevant processes for the separation of zeotropic multicompound mixtures<br>  ◦ Different paths for the fractionation of ternary mixtures<br>  ◦ Fractionation with side column<br>  ◦ Processes with thermal column coupling<br>• Advanced and industrially relevant processes for the separation of azeotropic multicompound mixtures<br>• Hybrid separation processes<br>• Reactive distillation processes<br>• High pressure separation technologies (with a focus on processes utilizing near or supercritical fluids)<br><br>The exercise comprises the discussion of OPAL tests and programming exercises.<br>The seminar comprises the active attendance of presentations, which will be presented within the TUN seminar. | | |
| Literature: | Mersmann, A.; Kind, M.; Stichlmair, J.; Thermal Separation Technology; Springer Verlag, Berlin Heidelberg, 2011 | | |
| Types of Teaching: | S1 (WS): Lectures (2 SWS)<br>S1 (WS): Exercises (1 SWS)<br>S1 (WS): Seminar TUN / Seminar (1 SWS) | | |
| Pre-requisites: | **Recommendations:**<br>Participants are expected to be familiar with the basic contents of a sciences or engineering related bachelor studying program. They are expected to be espacially familiar with the basics of thermal separation sciences, the thermodynamics of mixtures and equipment and apparatuses for processes. They are expected to being able to write basic computer codes (Python). | | |
| Frequency: | yearly in the winter semester | | |
| Requirements for Credit Points: | For the award of credit points it is necessary to pass the module exam.<br>The module exam contains:<br>in examination variant 0: | | |

| | |
|---|---|
| | MP/KA (KA if 10 students or more) [MP minimum 30 min / KA 120 min]<br>PVL: OPAL-Test during the lecture term<br>PVL: active and knowledgeable participation in the exercises and the seminar<br>or<br>in examination variant 1:<br>MP [30 to 45 min]<br>PVL: OPAL-Test during the lecture term<br>PVL: active and knowledgeable participation in the exercises and the seminar<br>Examination variant 1 for "TUBAF digital" or when examinations in physical presence are not possible.<br>PVL have to be satisfied before the examination. |
| | Voraussetzung für die Vergabe von Leistungspunkten ist das Bestehen der Modulprüfung. Die Modulprüfung umfasst:<br>in Prüfungsvariante 0:<br>MP/KA (KA bei 10 und mehr Teilnehmern) [MP mindestens 30 min / KA 120 min]<br>PVL: OPAL-Aufgaben während der Vorlesungszeit<br>PVL: Aktive und kompetente (vorbereitete) Teilnahme an der Übung und am Seminar<br>oder<br>in Prüfungsvariante 1:<br>MP [30 bis 45 min]<br>PVL: OPAL-Aufgaben während der Vorlesungszeit<br>PVL: Aktive und kompetente (vorbereitete) Teilnahme an der Übung und am Seminar<br>Prüfungsvariante 1 für "TUBAF digital" oder wenn Präsenz nicht möglich ist.<br>PVL müssen vor Prüfungsantritt erfüllt sein bzw. nachgewiesen werden. |
| Credit Points: | 5 |
| Grade: | The Grade is generated from the examination result(s) with the following weights (w):<br>in examination variant 0:<br>MP/KA [w: 1]<br>or<br>in examination variant 1:<br>MP [w: 1] |
| Workload: | The workload is 150h. It is the result of 60h attendance and 90h self-studies. |

| | | | |
|---|---|---|---|
| Data: | AppPT. MA. Nr. / Examination number: - | Version: 16.08.2023 | Start Year: SoSe 2025 |
| Module Name: | **Applications in Particle Technology** | | |
| (English): | Applications in Particle Technology | | |
| Responsible: | Peuker, Urs Alexander / Prof. Dr.-Ing. | | |
| Lecturer(s): | Peuker, Urs Alexander / Prof. Dr.-Ing. | | |
| Institute(s): | Institute of Mechanical Process Engineering and Mineral Processing | | |
| Duration: | 1 Semester(s) | | |
| Competencies: | Students will be able to analyze and understand the processes of mechanical process engineering using the microprocesses of particle technology. They will be able to apply this knowledge to describe technical issues quantitatively. | | |
| Contents: | Building on the microprocesses of particle technology (c.f. Training in Particle Technology), various technical process and related apparatus or machine technology of mechanical process engineering are introduced and discussed including:<br><br>• Solid-liquid-separation (Filtration)<br>• Solid-liquid-separation (Centrifugal de-watering)<br>• Solid-liquid-Separation (Sedimentation)<br>• Solid-gas-separation (Air filtration)<br>• Agglomeration (Particle size enlargement)<br>• Comminution (Crushing, milling)<br>• 1-2 additional topics<br><br>Practical exercise:<br>Practical course on the determination of central parameters or characteristics of particle systems and microprocesses as well as on the application of parameterized microprocesses for process and apparatus design. | | |
| Literature: | M. Stieß: Mechanische Verfahrenstechnik 1 - Partikeltechnologie, Springer-Verlag, Berlin, Heidelberg, 2009<br><br>M. Stieß: Mechanische Verfahrenstechnik 2, Springer-Verlag, Berlin, Heidelberg, 1997<br>H. Schubert: Handbuch der Mechanischen Verfahrenstechnik, Wiley-VCH, Weinheim, 2003<br>Selected scientific papers | | |
| Types of Teaching: | S1 (SS): Lectures (2 SWS)<br>S1 (SS): Lab Work / Practical Application (2 SWS) | | |
| Pre-requisites: | **Mandatory:**<br>Training in Particle Technology, 2022-09-15 | | |
| Frequency: | yearly in the summer semester | | |
| Requirements for Credit Points: | For the award of credit points it is necessary to pass the module exam.<br>The module exam contains:<br>in examination variant 0:<br>KA [120 to 180 min]<br>PVL: reports lab work<br>or<br>in examination variant 1:<br>MP [20 to 30 min]<br>PVL: reports lab work<br>Examination variant 1 provided for "TUBAF digital"<br>PVL have to be satisfied before the examination. | | |

| | |
|---|---|
| | Voraussetzung für die Vergabe von Leistungspunkten ist das Bestehen der Modulprüfung. Die Modulprüfung umfasst:<br>in Prüfungsvariante 0:<br>KA [120 bis 180 min]<br>PVL: Praktikumsprotokolle<br>oder<br>in Prüfungsvariante 1:<br>MP [20 bis 30 min]<br>PVL: reports lab work<br>Prüfungsvariante 1 für "TUBAF digital" vorgesehen<br>PVL müssen vor Prüfungsantritt erfüllt sein bzw. nachgewiesen werden. |
| Credit Points: | 4 |
| Grade: | The Grade is generated from the examination result(s) with the following weights (w):<br>in examination variant 0:<br>KA [w: 1]<br>or<br>in examination variant 1:<br>MP [w: 1] |
| Workload: | The workload is 120h. It is the result of 60h attendance and 60h self-studies. The latter includes the preparation and follow-up of the lecture course, the preparation and follow-up of the practical exercise including reporting, as well as the preparation for the written exam. |

| | | | |
|---|---|---|---|
| Data: | CESem. MA. Nr. / Examination number: - | Version: 18.09.2023 | Start Year: WiSe 2024 |
| Module Name: | **Chemical Engineering Seminar & Skills** | | |
| (English): | Chemical Engineering Seminar & Skills | | |
| Responsible: | Peuker, Urs Alexander / Prof. Dr.-Ing. | | |
| Lecturer(s): | Peuker, Urs Alexander / Prof. Dr.-Ing.<br>Gräbner, Martin / Prof. Dr.-Ing.<br>Kureti, Sven / Prof. Dr. rer. nat<br>Richter, Andreas / Prof. Dr.-Ing.<br>Bräuer, Andreas / Prof. Dr.-Ing. | | |
| Institute(s): | Institute of Mechanical Process Engineering and Mineral Processing<br>Institute of Energy Process Engineering and Chemical Engineering<br>Institute of Thermal, Environmental and Natural Products Process Engineering | | |
| Duration: | 2 Semester(s) | | |
| Competencies: | The students will learn about the Saxonian and German industry landscape in chemical and process engineering. They will learn about established industrial processes and latest industrial developments. They will learn how international, federal and state political boundaries influence the development of process industries in Germany and Saxony. They acquire additional skills in the scientific writing, literature research and reviewing, presenting and intercultural communication which are state of the art and meet the requirements of Saxonian, German and European employers in industry and science. The students will also learn about fundamental aspects in ethics in science and technology. They will be able to reflect that the German and European employers market focuses on additional skills and problem solutions in comparison to those they have already acquired during their bachelor education. | | |
| Contents: | • Companies present their technologies, their products and their employer’s profile. They also present past and future challenges and how they were and will be tackled.<br>• Internationally visible researchers in the field of chemical engineering present their latest developments<br>• Seminar series on essential engineering and scientific skills<br>• Seminar series on business and scientific ethics<br>• Selected publications in chemical engineering journals will be discussed<br>• Internship | | |
| Literature: | Selected scientific papers | | |
| Types of Teaching: | S1 (WS): Chemical Engineering / Lectures (2 SWS)<br>S1 (WS): Chemical Engineering Seminar / Seminar (2 SWS)<br>S2 (SS): Internship - mandatory subject-specific internship of at least 4 weeks in an industrial company or a research institution / Practical Application (4 Wo)<br>The order of the module semesters is flexible. | | |
| Pre-requisites: | | | |
| Frequency: | yearly in the winter semester | | |
| Requirements for Credit Points: | For the award of credit points it is necessary to pass the module exam.<br>The module exam contains:<br>AP: Opal test related to lecture content<br>AP: Modul-Lecturer approved certificate issued by the internship institution<br>PVL: Contributions to the scientific discussions in the Seminar<br>Internship will not be graded. | | |

| | |
|---|---|
| | PVL have to be satisfied before the examination. |
| | Voraussetzung für die Vergabe von Leistungspunkten ist das Bestehen der Modulprüfung. Die Modulprüfung umfasst:<br>AP: Opal-Test zum Inhalt der Vorlesung<br>AP: von einem Moduldozenten anerkannte Praktikumsbescheinigung der Praktikumseinrichtung<br>PVL: Beiträge zu den wissenschaftlichen Diskussionen im Seminar<br>Das Praktikum wird nicht benotet.<br>PVL müssen vor Prüfungsantritt erfüllt sein bzw. nachgewiesen werden. |
| Credit Points: | 8 |
| Grade: | The Grade is generated from the examination result(s) with the following weights (w):<br>AP: Opal test related to lecture content [w: 1] |
| Workload: | The workload is 240h. |

| Data: | ChProz. Ma. Nr. / Examination number: - | Version: 14.09.2023 | Start Year: WiSe 2025 |
|---|---|---|---|
| Module Name: | **Chemical Processes** | | |
| (English): | Chemical Processes | | |
| Responsible: | Kureti, Sven / Prof. Dr. rer. nat | | |
| Lecturer(s): | Kureti, Sven / Prof. Dr. rer. nat<br>Wollmerstädt, Hendrik / Dr.-Ing.<br>Knüpfer, Paul / Dr.-Ing. | | |
| Institute(s): | Institute of Energy Process Engineering and Chemical Engineering | | |
| Duration: | 1 Semester(s) | | |
| Competencies: | The students have knowledge on important processes of inorganic and organic industrial chemistry and can apply and assess this knowledge. | | |
| Contents: | The lecture deals with the production of synthesis gas and products thereof, important organic bulk chemicals (including aromatic hydrocarbons and olefins) as well as the follow-up chemistry (production of surfactants, detergents and plastics). Crucial reaction mechanisms like polyreactions (polycondensation, polyaddition, polymerisation), ionic and radical reactions are covered. Additionally, the lecture addresses the production of important inorganic substances (sulfur and nitrogen compounds, chlorine and alkali, silicon, aluminium and pigments). In particluar, the lecture includes the respective feedstocks, process concepts, follow-up processes and chemicals. | | |
| Literature: | A. Chauvel, G. Lefebvre: Petrochemical Proc., Editions Technip, 1989.<br>A. Jess, P. Wasserscheid, Chemical Technology, Wiley-VCH, 2020. | | |
| Types of Teaching: | S1 (WS): Lectures (4 SWS) | | |
| Pre-requisites: | **Recommendations:**<br>Advanced knowledge in chemical reaction engineering and thermal process engineering, basics in chemistry | | |
| Frequency: | yearly in the winter semester | | |
| Requirements for Credit Points: | For the award of credit points it is necessary to pass the module exam. The module exam contains:<br>MP/KA (KA if 10 students or more) [MP minimum 30 min / KA 180 min] | | |
| | Voraussetzung für die Vergabe von Leistungspunkten ist das Bestehen der Modulprüfung. Die Modulprüfung umfasst:<br>MP/KA (KA bei 10 und mehr Teilnehmern) [MP mindestens 30 min / KA 180 min] | | |
| Credit Points: | 5 | | |
| Grade: | The Grade is generated from the examination result(s) with the following weights (w):<br>MP/KA [w: 1] | | |
| Workload: | The workload is 150h. It is the result of 60h attendance and 90h self-studies. The latter includes the preparation and wrap-up of the lecture and the preparation for the examination. | | |

| | | | |
|---|---|---|---|
| Data: | COMPROE. MA. Nr. 3627 / Examination number: - | Version: 28.07.2023 | Start Year: WiSe 2024 |
| Module Name: | **Computational Process Engineering** | | |
| (English): | | | |
| Responsible: | Richter, Andreas / Prof. Dr.-Ing. | | |
| Lecturer(s): | Richter, Andreas / Prof. Dr.-Ing. | | |
| Institute(s): | Institute of Energy Process Engineering and Chemical Engineering | | |
| Duration: | 1 Semester(s) | | |
| Competencies: | The students learn various approaches for modeling fluid dynamics and chemical processes and sub-processes, covering simple equilibrium approaches as well as advanced techniques such as computational fluid dynamics (CFD). They can compare modeling approaches and point out advantages and disadvantages for various sub-processes of a process plant. With this knowledge, the student is able to identify the most appropriate modeling approach for the solution of specific problems. This involves the necessary accuracy of the model as well as the required modeling and computational costs. The students can further apply the modeling approaches to simple systems and know the possibilities for the analysis and optimization of the respective process. | | |
| Contents: | The course covers various modeling approaches, their physical principles, typical solution methods, and respective advantages and disadvantages. This involves equilibrium and stirred-tank reactor models (0d), reactive and non-reactive plug flows as well as axial dispersion models (1d), computational fluid dynamics (2d and 3d), and network models. Based on industrial applications, the question will be answered, which modeling approach is favorable for the specific question.<br><br>Model-based analyses of different reactors and processes will be conducted in seminars. Finally, in practica the students develop their own numerical models and utilze them for process optimization. | | |
| Literature: | H.K. Versteeg, M. Malalasekera: An Introduction to Computational Fluid Dynamics. The Finite Volume Method. 2nd Ed., Pearson Education Limited, 2007.<br>J. Ingham, I.J. Dunn, E. Heinzle, J.E. Prenosil, J.B. Snape: Chemical Engineering Dynamics: An Introduction to Modelling and Computer Simulation. 3rd Ed., Wiley-VCH, 2007.<br>A.K. Verma: Process Modelling and Simulation in Chemical, Biochemical and Environmental Engineering. CRC Press, 2014. | | |
| Types of Teaching: | S1 (WS): Lectures (2 SWS)<br>S1 (WS): Seminar (1 SWS)<br>S1 (WS): Practical Application (1 SWS) | | |
| Pre-requisites: | **Recommendations:**<br>Basic knowledge in fluid dynamics, thermodynamics, heat and mass transfer, and in chemical processes. | | |
| Frequency: | yearly in the winter semester | | |
| Requirements for Credit Points: | For the award of credit points it is necessary to pass the module exam.<br>The module exam contains:<br>in examination variant 0:<br>MP/KA* (KA if 10 students or more) [MP minimum 20 min / KA 120 min]<br>AP*: model development and presentation<br>or<br>in examination variant 1:<br>MP* [20 to 30 min]<br>AP*: model development and presentation<br>Examination variant 1 provided for "TUBAF digital" | | |

| | |
|---|---|
| | * In modules requiring more than one exam, this exam has to be passed or completed with at least "ausreichend" (4,0), respectively. |
| | Voraussetzung für die Vergabe von Leistungspunkten ist das Bestehen der Modulprüfung. Die Modulprüfung umfasst:<br>in Prüfungsvariante 0:<br>MP/KA* (KA bei 10 und mehr Teilnehmern) [MP mindestens 20 min / KA 120 min]<br>AP*: Modellerstellung und Präsentation<br>oder<br>in Prüfungsvariante 1:<br>MP* [20 bis 30 min]<br>AP*: Modellerstellung und Präsentation<br>Prüfungsvariante 1 für "TUBAF digital" vorgesehen<br><br>* Bei Modulen mit mehreren Prüfungsleistungen muss diese Prüfungsleistung bestanden bzw. mit mindestens "ausreichend" (4,0) bewertet sein. |
| Credit Points: | 5 |
| Grade: | The Grade is generated from the examination result(s) with the following weights (w):<br>in examination variant 0:<br>MP/KA* [w: 4]<br>AP*: model development and presentation [w: 1]<br>or<br>in examination variant 1:<br>MP* [w: 4]<br>AP*: model development and presentation [w: 1]<br><br>* In modules requiring more than one exam, this exam has to be passed or completed with at least "ausreichend" (4,0), respectively. |
| Workload: | The workload is 150h. It is the result of 60h attendance and 90h self-studies. |

| | | | |
|---|---|---|---|
| Data: | CPEq. MA. Nr. / Examination number: - | Version: 31.08.2023 | Start Year: WiSe 2025 |
| Module Name: | **Conception of Process Equipment** | | |
| (English): | | | |
| Responsible: | Peuker, Urs Alexander / Prof. Dr.-Ing. | | |
| Lecturer(s): | Peuker, Urs Alexander / Prof. Dr.-Ing. | | |
| Institute(s): | Institute of Mechanical Process Engineering and Mineral Processing | | |
| Duration: | 1 Semester(s) | | |
| Competencies: | The aim is the teaching of holistic engineering thinking to process engineers. It brings together the approaches of mechanical engineering and the process and material laws of process engineering. It reveals fundamental strategies in conceptual and basic engineering. The students learn to analyze how a unit-operation is set up and executed in an apparatus and how apparatuses and machines are combined to an entire process. Different case studies are used to analyze exemplarily the limitations, differences and strengths of several machine and apparatus concepts. The module further introduces material laws of suspensions, wet and dry powders and particle beds. Auxiliary units like pumps, mixing vessels and stirrers are introduced. | | |
| Contents: | Design strategies<br>• Design of apparatus / design of process<br>• Analyze of unit operation and process equipment<br>• Conceptual design<br>• Functionality<br>• New principles / parallelizing / serializing<br><br>Material laws<br>• Suspension Rheology<br>• Agglomerate durability<br>• compression laws<br><br>Auxiliary equipment<br>• Mixing vessels<br>• Stirrers<br>• Pumps | | |
| Literature: | to be annonced in the lecture | | |
| Types of Teaching: | S1 (WS): Lectures (2 SWS)<br>S1 (WS): Exercises (1 SWS) | | |
| Pre-requisites: | **Recommendations:**<br>Training in Particle Technology, 2022-09-15 | | |
| Frequency: | yearly in the winter semester | | |
| Requirements for Credit Points: | For the award of credit points it is necessary to pass the module exam.<br>The module exam contains:<br>in examination variant 0:<br>KA [150 min]<br>or<br>in examination variant 1:<br>AP<br>Examination variant 1 provided for "TUBAF digital". In this case the type of AP will be communicated to the students at the beginning of the lecture series. | | |
| | Voraussetzung für die Vergabe von Leistungspunkten ist das Bestehen | | |

| | |
|---|---|
| | der Modulprüfung. Die Modulprüfung umfasst:<br>in Prüfungsvariante 0:<br>KA [150 min]<br>oder<br>in Prüfungsvariante 1:<br>AP<br>Prüfungsvariante 1 für "TUBAF digital" vorgesehen. In diesem Fall wird die Art der AP den Studierenden zu Beginn der Vorlesungsreihe kommuniziert. |
| Credit Points: | 5 |
| Grade: | The Grade is generated from the examination result(s) with the following weights (w):<br>in examination variant 0:<br>KA [w: 1]<br>or<br>in examination variant 1:<br>AP [w: 1] |
| Workload: | The workload is 150h. It is the result of 45h attendance and 105h self-studies. |

| | | | |
|---|---|---|---|
| Daten: | DEU A1/ 1.Sem. BA. Nr. 948 / Prüfungs-Nr.: 71101 | Stand: 04.08.2017 | Start: WiSe 2016 |
| Modulname: | **Deutsch A1/ 1. Semester** | | |
| (englisch): | German A 1/ 1st Semester | | |
| Verantwortlich(e): | Polanski, Katja | | |
| Dozent(en): | | | |
| Institut(e): | Internationales Universitätszentrum/ Sprachen | | |
| Dauer: | 1 Semester | | |
| Qualifikationsziele / Kompetenzen: | Im Kurs werden Grundlagen in Phonetik, Orthographie, Grammatik und Lexik vermittelt. Die Teilnehmer erwerben Grundkenntnisse und Grundfertigkeiten im Hören, Sprechen, Lesen und Schreiben auf der Basis der Allgemeinsprache sowie landeskundliche Kenntnisse. | | |
| Inhalte: | Kommunikation im Alltag (Menschen kennen lernen, Einkaufen, Restaurantbesuch, Tagesabläufe, Uhrzeit); Grammatik: zum Beispiel Fragestellungen, Zahlen, Konjugation der Verben, Präsenz und Präteritum, Mengenangaben, Plural der Nomen, Komposita | | |
| Typische Fachliteratur: | Begegnungen A1+, Schubert Verlag | | |
| Lehrformen: | S1 (WS): Übung (4 SWS) | | |
| Voraussetzungen für die Teilnahme: | **Empfohlen:**<br>Keine Vorkenntnisse der deutschen Sprache notwendig | | |
| Turnus: | jährlich im Wintersemester | | |
| Voraussetzungen für die Vergabe von Leistungspunkten: | Voraussetzung für die Vergabe von Leistungspunkten ist das Bestehen der Modulprüfung. Die Modulprüfung umfasst:<br>KA [90 min]<br>PVL: Aktive Teilnahme an mindestens 80% des Unterrichts<br>PVL müssen vor Prüfungsantritt erfüllt sein bzw. nachgewiesen werden. | | |
| Leistungspunkte: | 4 | | |
| Note: | Die Note ergibt sich entsprechend der Gewichtung (w) aus folgenden(r) Prüfungsleistung(en):<br>KA [w: 1] | | |
| Arbeitsaufwand: | Der Zeitaufwand beträgt 120h und setzt sich zusammen aus 60h Präsenzzeit und 60h Selbststudium. | | |

| | | | |
|---|---|---|---|
| Daten: | DEU A1/ 2. Sem. BA. Nr. 949 / Prüfungs-Nr.: 71102 | Stand: 04.08.2017 | Start: SoSe 2017 |
| Modulname: | **Deutsch A1/ 2. Semester** | | |
| (englisch): | German A1/ 2nd Semester | | |
| Verantwortlich(e): | Polanski, Katja | | |
| Dozent(en): | | | |
| Institut(e): | Internationales Universitätszentrum/ Sprachen | | |
| Dauer: | 1 Semester | | |
| Qualifikationsziele / Kompetenzen: | Im Kurs werden Grundlagen in Phonetik, Orthographie, Grammatik und Lexik vermittelt. Die Teilnehmer erwerben Grundkenntnisse und Grundfertigkeiten im Hören, Sprechen, Lesen und Schreiben auf der Basis der Allgemeinsprache sowie landeskundliche Kenntnisse. | | |
| Inhalte: | Orientierung in der Stadt beziehungsweise in der Firma, öffentliche Verkehrsmittel, Wegbeschreibung, Berufe und Arbeitsalltag, Körper und Gesundheit, Wohnungssuche und -einrichtung, Lebenslauf, Kleidung; Grammatik: zum Beispiel Präpositionen, Frageartikel, Modalverben, Possessivartikel, Perfekt, Konjunktionen, Demonstrativpronomen, Graduierung und Komparativ | | |
| Typische Fachliteratur: | Begegnungen A1+, Schubert Verlag | | |
| Lehrformen: | S1 (SS): Übung (4 SWS) | | |
| Voraussetzungen für die Teilnahme: | **Obligatorisch:**<br>Deutsch A1/ 1. Semester, 2015-08-26<br>oder äquivalente Sprachkenntnisse | | |
| Turnus: | jährlich im Sommersemester | | |
| Voraussetzungen für die Vergabe von Leistungspunkten: | Voraussetzung für die Vergabe von Leistungspunkten ist das Bestehen der Modulprüfung. Die Modulprüfung umfasst:<br>KA [90 min]<br>PVL: Aktive Teilnahme an mind. 80% des Unterrichts<br>PVL müssen vor Prüfungsantritt erfüllt sein bzw. nachgewiesen werden. | | |
| Leistungspunkte: | 4 | | |
| Note: | Die Note ergibt sich entsprechend der Gewichtung (w) aus folgenden(r) Prüfungsleistung(en):<br>KA [w: 1] | | |
| Arbeitsaufwand: | Der Zeitaufwand beträgt 120h und setzt sich zusammen aus 60h Präsenzzeit und 60h Selbststudium. Der Zeitaufwand beträgt 120 Stunden und setzt sich zusammen aus 60 Stunden Präsenzzeit und 60 Stunden Selbststudium. | | |

| | | | |
|---|---|---|---|
| Data: | EnPE. MA. Nr. / Examination number: - | Version: 28.07.2023 | Start Year: WiSe 2024 |
| Module Name: | **Energy Process Engineering** | | |
| (English): | Energy Process Engineering | | |
| Responsible: | Gräbner, Martin / Prof. Dr.-Ing. | | |
| Lecturer(s): | Seifert, Peter / Dr.-Ing. | | |
| Institute(s): | Institute of Energy Process Engineering and Chemical Engineering | | |
| Duration: | 1 Semester(s) | | |
| Competencies: | Students will be able to name, describe and evaluate renewable and fossil energy resources, in particular their properties, energy densities, forms of use, as well as their extraction, provision or conversion. They acquire general knowledge of energy conversion, consumption and costs, the basics of balancing and operational control of combustion processes as well as the independent solution of tasks in the field of efficient energy use for processes and systems of process engineering. Students will be familiarized with the principles of energy conservation and will be able to apply these to simple energy management tasks and solve corresponding exemplary tasks. | | |
| Contents: | Renewable and fossil energy feedstocks are presented and their evaluation according to different criteria is discussed. Energy densities, possible refinement processes of the individual raw materials (e.g. wood pellets, granules, natural gas and biogas, etc.) and other essential properties are explained and economic and environmental aspects of the use and conversion of the various energy raw materials are dealt with.<br>It also covers energy quality, energy conversion and efficiency, energy demand and costs, combustion of energy raw materials, balancing of combustion processes and calculation rules for combustion parameters including flame temperatures. Principles of efficient energy use and the possibilities of energy conservation or recovery in thermal and chemical process engineering are covered. This includes in particular: application of energy loss analysis, waste heat utilization (preheating of combustion air, fuel, feedstock, waste heat steam generation), saving effects by vapour recompression, flue gas recirculation, oxygen enrichment, cogeneration. Theoretical knowledge is consolidated through calculation exercises on simple practical tasks. | | |
| Literature: | Internal teaching material for the course<br>Gräbner, M.: Industrial coal gasification technologies covering baseline and high-ash coal. Wiley-VCH Verlag GmbH & Co. KGaA, 2015<br>Ashrafizadeh, S. A.; Tan, Z.: Mass and Energy Balances, Springer 2018;<br>British Gas: Combustion Engineering and Gas utilization, CRC Press, 2014<br>de Souza-Santos, M.L.: Solid Fuel Combustion and Gasification: Modeling, Simulation, and Equipment Operations, Taylor & Francis, 2004 | | |
| Types of Teaching: | S1 (WS): Energy raw materials and conversion / Lectures (2 SWS)<br>S1 (WS): Industrial energy efficiency / Lectures (2 SWS)<br>S1 (WS): Industrial energy efficiency / Exercises (2 SWS) | | |
| Pre-requisites: | **Recommendations:**<br>Knowledge of upper secondary school, solid basic knowledge of inorganic and organic chemistry as well as technical and chemical thermodynamics. | | |
| Frequency: | yearly in the winter semester | | |
| Requirements for Credit Points: | For the award of credit points it is necessary to pass the module exam.<br>The module exam contains:<br>KA [240 min] | | |

| | |
|---|---|
| | Voraussetzung für die Vergabe von Leistungspunkten ist das Bestehen der Modulprüfung. Die Modulprüfung umfasst:<br>KA [240 min] |
| Credit Points: | 8 |
| Grade: | The Grade is generated from the examination result(s) with the following weights (w):<br>KA [w: 1] |
| Workload: | The workload is 240h. It is the result of 90h attendance and 150h self-studies. The latter includes the preparation and follow-up of the lecture material, the preparation for the exercises by solving exercises independently and the preparation for the exam. |

| | | | |
|---|---|---|---|
| Data: | EnvEng. MA. Nr. / Examination number: - | Version: 18.09.2023 | Start Year: WiSe 2025 |
| Module Name: | **Environmental Engineering without Lab Course** | | |
| (English): | Environmental Engineering without Lab Course | | |
| Responsible: | Bräuer, Andreas / Prof. Dr.-Ing. | | |
| Lecturer(s): | Haseneder, Roland / Dr. rer. nat. | | |
| Institute(s): | Institute of Thermal, Environmental and Natural Products Process Engineering | | |
| Duration: | 1 Semester(s) | | |
| Competencies: | The students learn the interrelationships between the environmental compartments air, water and soil, as well as technical realizations for water purification, air pollution control and soil decontamination by means of classical process engineering methods and the use of biological processes. The students will be able to apply the knowledge they have acquired to identify solutions to environmental problems and create processes, taking into account legal environmental aspects. | | |
| Contents: | Introduction: environment, ecology, environmental protection (EP), biocybernetics, climate protection, indicators, sustainability, production-integrated/product-integrated EP, end-of-pipe.<br><br>Environmental law: precautionary principle, polluter pays principle, cooperation principle, BImSchG, BImSchV, WHG, KrWG<br><br>Pollutants: pollutant types, REACH, toxicity, LD50, POPs<br><br>Water: drinking water production, well systems, treatment/fine purification (precipitation, flocculation, flotation, membrane technology, disinfection), municipal wastewater treatment plant, industrial wastewater treatment plant (water quality, COD, BOD5, mechanical-biological and chemical-physical purification processes, biogas production<br><br>Soil: Contaminated sites, old deposits, remediation processes (in-situ, on-site, off-site), main contaminants, chemical, physical, thermal, biological treatment processes<br><br>Waste & recycling: principles of circular economy, environmentally related recycling technologies<br><br>Air: emission, immission, transmission, deposition, primary/secondary air contaminants, main contaminants, air pollution control techniques (dust/aerosol collection, gas separation, absorption/adsorption, thermochemical processes, biofilters/bioscrubbers) | | |
| Literature: | James R. Mihelcic, Julie B. Zimmerman, Environmental Engineering, John Wiley & Sons; 2. Edition<br>Larry W. Mays, Water Resources Engineering, John Wiley & Sons Inc; 3rd Edition<br>Assadi, Amrane, Nguyen, Hybrid and Combined Processes for Air Pollution Control, Elsevier; 1. Edition | | |
| Types of Teaching: | S1 (WS): Lectures (3 SWS)<br>S1 (WS): Exercises (1 SWS) | | |
| Pre-requisites: | **Recommendations:**<br>Participants are expected to be familiar with the basic contents of an sciences or engineering related bachelor studying program. They are expected to be especially familiar with the basics of particle technology, | | |

| | |
|---|---|
| | thermal separation sciences and equipment and apparatuses for processes |
| Frequency: | yearly in the winter semester |
| Requirements for Credit Points: | For the award of credit points it is necessary to pass the module exam.<br>The module exam contains:<br>in examination variant 0:<br>MP/KA (KA if 10 students or more) [MP minimum 30 min / KA 120 min]<br>PVL: OPAL-Tasks during the lecture term<br>or<br>in examination variant 1:<br>MP [30 to 45 min]<br>PVL: OPAL-Tasks during the lecture term<br>Examination variant 1 for "TUBAF digital" or when examinations in physical presence are not possible.<br>PVL have to be satisfied before the examination. |
| | Voraussetzung für die Vergabe von Leistungspunkten ist das Bestehen der Modulprüfung. Die Modulprüfung umfasst:<br>in Prüfungsvariante 0:<br>MP/KA (KA bei 10 und mehr Teilnehmern) [MP mindestens 30 min / KA 120 min]<br>PVL: OPAL-Aufgaben während der Vorlesungszeit<br>oder<br>in Prüfungsvariante 1:<br>MP [30 bis 45 min]<br>PVL: OPAL-Aufgaben während der Vorlesungszeit<br>Prüfungsvariante 1 für "TUBAF digital" oder wenn Präsenz nicht möglich ist.<br>PVL müssen vor Prüfungsantritt erfüllt sein bzw. nachgewiesen werden. |
| Credit Points: | 6 |
| Grade: | The Grade is generated from the examination result(s) with the following weights (w):<br>in examination variant 0:<br>MP/KA [w: 1]<br>or<br>in examination variant 1:<br>MP [w: 1] |
| Workload: | The workload is 180h. It is the result of 60h attendance and 120h self-studies. |

| Data: | HCat. Ma. Nr. / Examination number: - | Version: 14.09.2023 | Start Year: SoSe 2025 |
|---|---|---|---|
| Module Name: | **Heterogeneous Catalysis in Chemical Process Engineering** | | |
| (English): | Heterogeneous Catalysis in Chemical Process Engineering | | |
| Responsible: | Kureti, Sven / Prof. Dr. rer. nat | | |
| Lecturer(s): | Kureti, Sven / Prof. Dr. rer. nat | | |
| Institute(s): | Institute of Energy Process Engineering and Chemical Engineering | | |
| Duration: | 1 Semester(s) | | |
| Competencies: | The students understand the basics of catalysis and assess important catalytic processes in the field of chemical technology. | | |
| Contents: | The lecture deals with the fundamentals and elementary processes of heterogeneous catalysis, chemical kinetics and mechanistic models, transition state theory, structural concepts of heterogeneous catalysts (bare and supported catalysts, redox and acid-base catalysis, SMSI effect). Kinetics, mechanisms and reactor design of catalytic processes relevant for chemical technology such as (1) zeolite-based hydrocarbon conversions, (2) Three Way Catalysis and (3) ammonia synthesis, are addressed in detail. | | |
| Literature: | G. Ertl, H. Knözinger, J. Weitkamp (Eds.): Handbook of heterogeneous catalysis, vol. 1-5, Wiley-VCH, 2007.<br>I. Chorkendorff, J.W. Niemantsverdriet, Concepts of Modern Catalysis and Kinetics, Wiley/VCH, Weinheim, 2003.<br>G.A. Somorjai, Introduction to Surface Chemistry and Catalysis, John Wiley & Sons, Inc., New York, 1994. | | |
| Types of Teaching: | S1 (SS): Lectures (2 SWS)<br>S1 (SS): Seminar (2 SWS) | | |
| Pre-requisites: | **Recommendations:**<br>Basics in Chemical Reaction Engineering and Chemistry | | |
| Frequency: | yearly in the summer semester | | |
| Requirements for Credit Points: | For the award of credit points it is necessary to pass the module exam.<br>The module exam contains:<br>MP/KA (KA if 10 students or more) [MP minimum 30 min / KA 180 min]<br>PVL: Exercises<br>PVL have to be satisfied before the examination. | | |
| | Voraussetzung für die Vergabe von Leistungspunkten ist das Bestehen der Modulprüfung. Die Modulprüfung umfasst:<br>MP/KA (KA bei 10 und mehr Teilnehmern) [MP mindestens 30 min / KA 180 min]<br>PVL: Übungsaufgaben<br>PVL müssen vor Prüfungsantritt erfüllt sein bzw. nachgewiesen werden. | | |
| Credit Points: | 5 | | |
| Grade: | The Grade is generated from the examination result(s) with the following weights (w):<br>MP/KA [w: 1] | | |
| Workload: | The workload is 150h. It is the result of 60h attendance and 90h self-studies. The latter includes the preparation and wrap-up of the module elements, particularly the seminar and seminar exercises, and the preparation for the examination. | | |

| Data: | LTCE. Ma. Nr. / Examination number: - | Version: 29.08.2023 | Start Year: WiSe 2025 |
|---|---|---|---|
| Module Name: | **Lab Training in Chemical Engineering** | | |
| (English): | Lab Training in Chemical Engineering | | |
| Responsible: | Gräbner, Martin / Prof. Dr.-Ing. | | |
| Lecturer(s): | Peuker, Urs Alexander / Prof. Dr.-Ing.<br>Gräbner, Martin / Prof. Dr.-Ing.<br>Kureti, Sven / Prof. Dr. rer. nat<br>Bräuer, Andreas / Prof. Dr.-Ing. | | |
| Institute(s): | Institute of Mechanical Process Engineering and Mineral Processing<br>Institute of Energy Process Engineering and Chemical Engineering<br>Institute of Thermal, Environmental and Natural Products Process Engineering | | |
| Duration: | 1 Semester(s) | | |
| Competencies: | Students will learn the operation, start-up and shut-down of practical experiments, which represent the scale from laboratory to pilot plant scale. The students deepen the evaluation of experimental programs and place their experimental results in the context of the knowledge they have previously acquired in other modules of the Masters in Chemical Engineering and in the context of the state of the art as known from the literature. | | |
| Contents: | Practical Application: Various experiments in chemical engineering (reaction engineering, particle technology, thermal separation, energy process engineering)<br>Seminar: Interactive introductory course on the basic principles of laboratory work, evaluation techniques and scientific reporting. | | |
| Literature: | | | |
| Types of Teaching: | S1 (WS): Practical Application (8 SWS)<br>S1 (WS): Seminar (1 SWS) | | |
| Pre-requisites: | **Mandatory:**<br>Energy Process Engineering, 2023-07-28<br>Training in Particle Technology, 2017-08-21<br>Advanced Thermal Separation Technology, 2023-09-12<br>Heterogeneous Catalysis in Chemical Process Engineering, 2023-09-14 | | |
| Frequency: | yearly in the winter semester | | |
| Requirements for Credit Points: | For the award of credit points it is necessary to pass the module exam. The module exam contains:<br>AP: Eight laboratory experiments, each involving: (a) pre-experiment interview, (b) conducting the laboratory experiments themselves, (c) timely submission and acceptance of the evaluation report. The final grade is the average of all laboratory experiment grades. | | |
| | Voraussetzung für die Vergabe von Leistungspunkten ist das Bestehen der Modulprüfung. Die Modulprüfung umfasst:<br>AP: Acht Laborversuche, jeweils bestehend aus: (a) Antestat, (b) Versuchsdurchführung, (c) Protokoll. Die Endnote ergibt sich aus dem Durchschnitt aller Laborversuchsnoten. | | |
| Credit Points: | 8 | | |
| Grade: | The Grade is generated from the examination result(s) with the following weights (w):<br>AP: Eight laboratory experiments, each involving: (a) pre-experiment interview, (b) conducting the laboratory experiments themselves, (c) timely submission and acceptance of the evaluation report. The final grade is the average of all laboratory experiment grades. [w: 1] | | |
| Workload: | The workload is 240h. It is the result of 135h attendance and 105h self-studies. | | |

| | | | |
|---|---|---|---|
| Data: | MThCE. MA. Nr. / Examination number: - | Version: 12.09.2023 | Start Year: SoSe 2026 |
| Module Name: | **Master Thesis Chemical Engineering** | | |
| (English): | | | |
| Responsible: | Bräuer, Andreas / Prof. Dr.-Ing. | | |
| Lecturer(s): | Alle Hochschullehrer der Fakultät | | |
| Institute(s): | All Institutes of the Faculty<br>Institute of Thermal, Environmental and Natural Products Process Engineering | | |
| Duration: | 6 Month(s) | | |
| Competencies: | Students should acquire the ability to apply work tools and methods typical for their profession on the basis of a concrete task from an application or research area of process engineering or chemical engineering. | | |
| Contents: | Preparation of a Master Thesis and defence of the thesis | | |
| Literature: | | | |
| Types of Teaching: | S1: Thesis (22 Wo) | | |
| Pre-requisites: | **Mandatory:**<br>- Completion of all compulsory modules with the exception of the Master's thesis - a maximum of 12 credit points to be earned in not yet completed elective and free elective modules - Admission requirements of the colloquium: Successful completion of all other modules of the Master's program in Chemical Engineering | | |
| Frequency: | constantly | | |
| Requirements for Credit Points: | For the award of credit points it is necessary to pass the module exam.<br>The module exam contains:<br>AP*: Master Thesis (written scientific elaboration, deadline 22 weeks after issue of the topic)<br>AP*: Colloquium (20 min presentation and max. 40 min oral defense of the work) [60 min]<br><br>* In modules requiring more than one exam, this exam has to be passed or completed with at least "ausreichend" (4,0), respectively. | | |
| | Voraussetzung für die Vergabe von Leistungspunkten ist das Bestehen der Modulprüfung. Die Modulprüfung umfasst:<br>AP*: Master Thesis (schriftliche wissenschaftliche Ausarbeitung, Abgabefrist 22 Wochen nach Ausgabe des Themas)<br>AP*: Kolloquium (20 min Präsentation und max. 40 min mündliche Verteidigung der Arbeit)<br><br>* Bei Modulen mit mehreren Prüfungsleistungen muss diese Prüfungsleistung bestanden bzw. mit mindestens "ausreichend" (4,0) bewertet sein. | | |
| Credit Points: | 30 | | |
| Grade: | The Grade is generated from the examination result(s) with the following weights (w):<br>AP*: Master Thesis (written scientific elaboration, deadline 22 weeks after issue of the topic) [w: 4]<br>AP*: Colloquium (20 min presentation and max. 40 min oral defense of the work) [60 min] [w: 1]<br><br>* In modules requiring more than one exam, this exam has to be passed or completed with at least "ausreichend" (4,0), respectively. | | |
| Workload: | The workload is 900h. This includes the evaluation and summary of the results, the transcript of the work and the preparation for the defense. | | |

| | | | |
|---|---|---|---|
| Data: | ModOptCR. MA. Nr. / Examination number: - | Version: 28.07.2023 | Start Year: WiSe 2025 |
| Module Name: | **Modeling and Optimization of Chemical Reactors** | | |
| (English): | | | |
| Responsible: | Richter, Andreas / Prof. Dr.-Ing. | | |
| Lecturer(s): | Richter, Andreas / Prof. Dr.-Ing. | | |
| Institute(s): | Institute of Energy Process Engineering and Chemical Engineering | | |
| Duration: | 1 Semester(s) | | |
| Competencies: | Students are capable of modeling and analyzing multiphase, reactive processes in process engineering with the help of computational fluid dynamics (CFD). In addition, they know different approaches and tools for the mathematical optimization of chemical reactors. With this knowledge, students can reliably and efficiently analyze different process engineering processes and optimize them with regard to selected process variables. | | |
| Contents: | The first part of the module covers CFD-based modeling of chemical reactors. The focus lies on the calculation of fixed-bed processes, syntheses and fluidized-bed processes. The models required for this purpose will be presented, and various approaches to the generation and meshing of bulk materials for fixed-bed processes and syntheses will be discussed.<br><br>The second part of the module focuses on the optimization of chemical reactors. This includes selected fundamentals of process optimization as well as different methods for model reduction. Based on this, software tools are presented that enable efficient, practical and user-friendly optimization of process engineering processes.<br><br>In concurrent exercises and practical courses, students are introduced to various software tools and use them to calculate and optimize simple process engineering processes. | | |
| Literature: | O. Levenspiel: Chemical Reaction Engineering. 3rd Edition, John Wiley & Sons, 1998.<br>H. A. Jakobsen: Chemical Reactor Modeling – Multiphase Reactive Flows, Springer, 2008.<br>H.K. Versteeg, M. Malalasekera: An Introduction to Computational Fluid Dynamics. The Finite Volume Method. 2nd Ed., Pearson Education Limited, 2007.<br>J. Ingham et al.: Chemical Engineering Dynamics: An Introduction to Modelling and Computer Simulation. 3rd Ed., Wiley-VCH, 2007.<br>A.K. Verma: Process Modelling and Simulation in Chemical, Biochemical and Environmental Engineering. CRC Press, 2014. | | |
| Types of Teaching: | S1 (WS): Lectures (1 SWS)<br>S1 (WS): Seminar (2 SWS)<br>S1 (WS): Practical Application (1 SWS) | | |
| Pre-requisites: | **Recommendations:**<br>Computational Process Engineering, 2023-07-28<br>Bachelor with courses in Fluid Mechanics, Technical Thermodynamics, Principles of Heat and Mass Transfer | | |
| Frequency: | yearly in the winter semester | | |
| Requirements for Credit Points: | For the award of credit points it is necessary to pass the module exam.<br>The module exam contains:<br>in examination variant 0:<br>MP/KA (KA if 5 students or more) [MP minimum 20 min / KA 120 min]<br>or | | |

| | |
|---|---|
| | in examination variant 1:<br>MP [20 to 30 min]<br>Examination variant 1 is provided for "TUBAF digital" |
| | Voraussetzung für die Vergabe von Leistungspunkten ist das Bestehen der Modulprüfung. Die Modulprüfung umfasst:<br>in Prüfungsvariante 0:<br>MP/KA (KA bei 5 und mehr Teilnehmern) [MP mindestens 20 min / KA 120 min]<br>oder<br>in Prüfungsvariante 1:<br>MP [20 bis 30 min]<br>Prüfungsvariante 1 für "TUBAF digital" vorgesehen |
| Credit Points: | 5 |
| Grade: | The Grade is generated from the examination result(s) with the following weights (w):<br>in examination variant 0:<br>MP/KA [w: 1]<br>or<br>in examination variant 1:<br>MP [w: 1] |
| Workload: | The workload is 150h. It is the result of 60h attendance and 90h self-studies. |

| | | | |
|---|---|---|---|
| Data: | ModIPhPh. MA. Nr. / Examination number: - | Version: 27.07.2023 | Start Year: SoSe 2025 |
| Module Name: | **Modeling of Interphase Phenomena** | | |
| (English): | | | |
| Responsible: | Richter, Andreas / Prof. Dr.-Ing. | | |
| Lecturer(s): | Richter, Andreas / Prof. Dr.-Ing. | | |
| Institute(s): | Institute of Energy Process Engineering and Chemical Engineering | | |
| Duration: | 1 Semester(s) | | |
| Competencies: | The students know the different physical, mathematical and numerical models for modeling of interphase phenomena in technical applications. They are able to independently develop numerical models for the systems gas-liquid (e.g., bubble columns), liquid-solid (e.g., solidification and melting), and gas-solid (e.g., heterogeneous reactions) and use them to calculate and analyze interphase phenomena. They are also able to derive simple models that can be used for process optimization, for process control, and for improved reactor. | | |
| Contents: | The module focuses on the teaching of basic mathematical and numerical models for the calculation and analysis of interphase phenomena in various chemical and metallurgical processes. Based on this, idealized models are derived for selected applications and used for process analysis and optimization. The applications include:<br><br>**Gas-solid**<br><br>• Heat and mass transfer at reactive single particles in laminar and turbulent flows<br>• Heat and mass transfer in fixed bed processes and syntheses<br>• Pore development and particle shape changes due to interphase phenomena<br><br>**Liquid-solid**<br><br>• Solidification<br>• Melting<br><br>**Gas-liquid**<br><br>• Bubble columns<br>• Gas-liquid interactions in melting baths<br><br>In seminars and practical trainings, the students develop simple numerical models and apply them to the analysis of interphase phenomena and for a first process optimization. | | |
| Literature: | R. B. Bird et al.: Transport Phenomena. 2nd Edition. John Wiley & Sons, 2006.<br>J. A. Dantzig and M. Rappaz: Solidification. 2nd Edition. EPFL Press, 2016. | | |
| Types of Teaching: | S1 (SS): Lectures (2 SWS)<br>S1 (SS): Seminar (1 SWS)<br>S1 (SS): Practical Application (1 SWS) | | |
| Pre-requisites: | **Recommendations:**<br>Bachelor with courses in Fluid Mechanics, Technical Thermodynamics, Principles of Heat and Mass Transfer | | |
| Frequency: | yearly in the summer semester | | |
| Requirements for Credit Points: | For the award of credit points it is necessary to pass the module exam. The module exam contains: | | |

| | |
|---|---|
| | in examination variant 0:<br>MP/KA (KA if 5 students or more) [MP minimum 20 min / KA 120 min]<br>or<br>in examination variant 1:<br>MP [20 to 30 min]<br>Examination variant 1 provided for "TUBAF digital" |
| | Voraussetzung für die Vergabe von Leistungspunkten ist das Bestehen der Modulprüfung. Die Modulprüfung umfasst:<br>in Prüfungsvariante 0:<br>MP/KA (KA bei 5 und mehr Teilnehmern) [MP mindestens 20 min / KA 120 min]<br>oder<br>in Prüfungsvariante 1:<br>MP [20 bis 30 min]<br>Prüfungsvariante 1 für "TUBAF digital" vorgesehen |
| Credit Points: | 5 |
| Grade: | The Grade is generated from the examination result(s) with the following weights (w):<br>in examination variant 0:<br>MP/KA [w: 1]<br>or<br>in examination variant 1:<br>MP [w: 1] |
| Workload: | The workload is 150h. It is the result of 60h attendance and 90h self-studies. |

| | | | |
|---|---|---|---|
| Data: | OMTfPE. MA. Nr. / Examination number: - | Version: 28.08.2023 | Start Year: WiSe 2025 |
| Module Name: | **Optical Measurement Techniques for Process Engineering** | | |
| (English): | Optical Measurement Techniques for Process Engineering | | |
| Responsible: | Bräuer, Andreas / Prof. Dr.-Ing. | | |
| Lecturer(s): | Bräuer, Andreas / Prof. Dr.-Ing. | | |
| Institute(s): | Institute of Thermal, Environmental and Natural Products Process Engineering | | |
| Duration: | 1 Semester(s) | | |
| Competencies: | The students understand the physical fundamentals of various optical measurement methods, know and understand the functioning of various components in optical measuring instruments, can identify and design suitable measurement methods for specific measurement tasks. They can process and evaluate raw measurement data and assess their significance. | | |
| Contents: | • Properties of optical measuring methods<br>• Light-matter interaction<br>• Optical components (lenses, mirrors, prisms, gratings...)<br>• Lasers and detectors<br>• Shadow and schlieren measurement techniques<br>• Intrinsic luminescence, Planck radiation, chemiluminescence, soot luminescence<br>• Elastic scattered light techniques<br>• Laser and phase Doppler anemometry<br>• Raman measurement techniques<br>• Fluorescence measurement<br>• Phosphorescence measurement techniques<br>• Data processing | | |
| Literature: | Andreas Bräuer, In situ spectroscopic techniques at high pressure, Elsevier<br>A.C. Eckbreth, Laser Diagnostics for Combustion Temperature and Species, 2nd ed., Gordon and Breach, 1996.<br>J. Eichler, H.J. Eichler, Laser, Springer, 2003.<br>Fahrmeir, L.: Regression: Models, Methods and Applications | | |
| Types of Teaching: | S1 (WS): Lectures (2 SWS)<br>S1 (WS): Exercises (1 SWS)<br>S1 (WS): Practical Application (1 SWS) | | |
| Pre-requisites: | **Mandatory:**<br>Energy Process Engineering, 2023-07-28<br>Training in Particle Technology, 2022-09-15<br>Advanced Thermal Separation Technology, 2023-09-12 | | |
| Frequency: | yearly in the winter semester | | |
| Requirements for Credit Points: | For the award of credit points it is necessary to pass the module exam.<br>The module exam contains:<br>in examination variant 0:<br>MP/KA (KA if 10 students or more) [MP minimum 30 min / KA 120 min]<br>PVL: active and knowledgeable participation in the exercises<br>PVL: OPAL-Tasks during the lecture term<br>or<br>in examination variant 1:<br>MP [30 to 45 min]<br>PVL: active and knowledgeable participation in the exercises<br>PVL: OPAL-Tasks during the lecture term<br>examination variant 1 for "TUBAF digital" or when examinations in physical presence are not possible | | |

| | |
|---|---|
| | PVL have to be satisfied before the examination. |
| | Voraussetzung für die Vergabe von Leistungspunkten ist das Bestehen der Modulprüfung. Die Modulprüfung umfasst:<br>in Prüfungsvariante 0:<br>MP/KA (KA bei 10 und mehr Teilnehmern) [MP mindestens 30 min / KA 120 min]<br>PVL: Aktive und kompetente (vorbereitete) Teilnahme an der Übung<br>PVL: OPAL-Aufgaben während der Vorlesungszeit<br>oder<br>in Prüfungsvariante 1:<br>MP [30 bis 45 min]<br>PVL: Aktive und kompetente (vorbereitete) Teilnahme an der Übung<br>PVL: OPAL-Aufgaben während der Vorlesungszeit<br>Prüfungsvariante 1 für "TUBAF digital" oder wenn Präsenz nicht möglich ist.<br>PVL müssen vor Prüfungsantritt erfüllt sein bzw. nachgewiesen werden. |
| Credit Points: | 5 |
| Grade: | The Grade is generated from the examination result(s) with the following weights (w):<br>in examination variant 0:<br>MP/KA [w: 1]<br>or<br>in examination variant 1:<br>MP [w: 1] |
| Workload: | The workload is 150h. It is the result of 60h attendance and 90h self-studies. |

| Data: | PLANTDS. MA. Nr. 3623 / Examination number: 40416 | Version: 19.04.2021 | Start Year: WiSe 2018 |
|---|---|---|---|
| Module Name: | **Plant Design** | | |
| (English): | | | |
| Responsible: | Gräbner, Martin / Prof. Dr.-Ing. | | |
| Lecturer(s): | Gräbner, Martin / Prof. Dr.-Ing. | | |
| Institute(s): | Institute of Energy Process Engineering and Chemical Engineering | | |
| Duration: | 1 Semester(s) | | |
| Competencies: | This course aims to impart the relevant basic knowledge for planning and design of process plants.<br>Major objectives of the course are to understand planning processes and different kinds of project organization. The students will be enabled to determine and to apply basic conditions of investment calculations, and to read and to create piping & instrumentation diagrams (P&ID). Furthermore, students will get to know design criteria of different plant components, and gain expertise to apply these criteria for dimensioning of pipes, vessels, reactors etc. | | |
| Contents: | Kinds/contents of project phases and project organizations, interests of customers/vendors, contracts, estimation of investment costs and rating of investments, symbols for P&ID, creation of process flow diagrams, dimensioning of plant components based on technical standards. | | |
| Literature: | In-house teaching material;<br>E.B. Nauman: „Chemical Reactor Design, Optimization and Scaleup“, McGraw-Hill;<br>S.M. Walas: „Chemical Process Equipment Selection and Design“, Butterworth-Heinemann. | | |
| Types of Teaching: | S1 (WS): Lectures (2 SWS)<br>S1 (WS): Exercises (1 SWS) | | |
| Pre-requisites: | **Recommendations:**<br>Knowledge in process and systems engineering | | |
| Frequency: | yearly in the winter semester | | |
| Requirements for Credit Points: | For the award of credit points it is necessary to pass the module exam. The module exam contains:<br>KA [120 min] | | |
| | Voraussetzung für die Vergabe von Leistungspunkten ist das Bestehen der Modulprüfung. Die Modulprüfung umfasst:<br>KA [120 min] | | |
| Credit Points: | 4 | | |
| Grade: | The Grade is generated from the examination result(s) with the following weights (w):<br>KA [w: 1] | | |
| Workload: | The workload is 120h. It is the result of 45h attendance and 75h self-studies. | | |

| | | | |
|---|---|---|---|
| Data: | ProcAna. Ma. Nr. / Examination number: - | Version: 14.09.2023 | Start Year: WiSe 2025 |
| Module Name: | **Process Analysis** | | |
| (English): | Process Analysis | | |
| Responsible: | Kureti, Sven / Prof. Dr. rer. nat | | |
| Lecturer(s): | Wollmerstädt, Hendrik / Dr.-Ing. | | |
| Institute(s): | Institute of Energy Process Engineering and Chemical Engineering | | |
| Duration: | 1 Semester(s) | | |
| Competencies: | The students gain knowledge on the fundamentals and techniques of surface, volume and gas analytics in the context of process control and regulation and are able to apply them. | | |
| Contents: | The lecture deals with the fundamentals of surface, volume and gas analytics and the most important analytical techniques, such as spectroscopy (molecular and atomic spectroscopy, nuclear magnetic resonance spectroscopy and mass spectrometry), diffraction techniques, separation techniques (gas/liquid chromatography) and porosimetry. The practical course mainly includes UV/Vis, DRIFTS, FTIR, NDIR, NMR, MS, GC, HPLC, XRD, RFA, BET and Hg porosimetry. The exercise covers the contents of lecture as well as practical course. | | |
| Literature: | U. Ritgen, Analytical Chemistry I, Springer, 2013.<br>J. W. Robinson, E. M. Skelly Frame, G. M. Frame II, Instrumental Analytical Chemistry, CRC Press, 2021. | | |
| Types of Teaching: | S1 (WS): Lectures (2 SWS)<br>S1 (WS): Exercises (1 SWS)<br>S1 (WS): Practical Application (3 SWS) | | |
| Pre-requisites: | **Recommendations:**<br>Basics in chemical reaction engineering, thermal process engineering and energy process engineering | | |
| Frequency: | yearly in the winter semester | | |
| Requirements for Credit Points: | For the award of credit points it is necessary to pass the module exam. The module exam contains:<br>KA [120 min]<br>PVL: Practical course with oral attestations and experimental protocols<br>PVL have to be satisfied before the examination. | | |
| | Voraussetzung für die Vergabe von Leistungspunkten ist das Bestehen der Modulprüfung. Die Modulprüfung umfasst:<br>KA [120 min]<br>PVL: Praktikum mit Antestaten und Protokollen<br>PVL müssen vor Prüfungsantritt erfüllt sein bzw. nachgewiesen werden. | | |
| Credit Points: | 6 | | |
| Grade: | The Grade is generated from the examination result(s) with the following weights (w):<br>KA [w: 1] | | |
| Workload: | The workload is 180h. It is the result of 90h attendance and 90h self-studies. The latter includes the preparation and wrap-up of the module elements, particularly the practical course and exercise, and the preparation for the examination. | | |

| | | | |
|---|---|---|---|
| Data: | ProChSim. MA. Nr. / Examination number: - | Version: 28.07.2023 | Start Year: SoSe 2025 |
| Module Name: | **Process Chain Simulation** | | |
| (English): | Process Chain Simulation | | |
| Responsible: | Gräbner, Martin / Prof. Dr.-Ing. | | |
| Lecturer(s): | Guhl, Stefan / Dr.-Ing.<br>Baitalow, Felix / Dr. | | |
| Institute(s): | Institute of Energy Process Engineering and Chemical Engineering | | |
| Duration: | 1 Semester(s) | | |
| Competencies: | The students are able to simulate process engineering processes and chains of them with the help of computers. They have basic knowledge regarding analysis, modeling and simulation of technical processes and can implement these in current software applications. | | |
| Contents: | The Process Chain Simulation lecture covers the fundamentals of process simulation: An introduction to the simulation programs FactSage and ASPEN Plus, an introduction to the principles of data validation and reconciliation, and application examples for the simulation of process and energy engineering processes and process chains.<br>The exercise in process chain simulation includes a detailed presentation of software solutions (ASPEN Plus, FactSage) for the simulation of process and energy engineering processes. Possible applications of the presented software will be demonstrated and their use will be taught. The creation and solution of application examples for basic process engineering configurations and plant components will be presented. Data validation and reconciliation will be demonstrated on selected cases. | | |
| Literature: | Internal teaching material for the course;<br>B. P. Zeigler, H. Praehofer, T. G. Kim: Theory of Modeling and Simulation. 2. Ausgabe, Academic Press, San Diego, 2000;<br>K. Hack: The SGTE Casebook – Thermodynamics at work. Second Edition, Woodhead Publishing, Cambridge, 2008 | | |
| Types of Teaching: | S1 (SS): Lectures (2 SWS)<br>S1 (SS): Exercises (2 SWS) | | |
| Pre-requisites: | **Recommendations:**<br>Technical Thermodynamics and Principles of Heat and Mass transfer, Fundamentals in Modelling of thermal processes | | |
| Frequency: | yearly in the summer semester | | |
| Requirements for Credit Points: | For the award of credit points it is necessary to pass the module exam.<br>The module exam contains:<br>KA [180 min]<br>Theoretical part and practical part at PC | | |
| | Voraussetzung für die Vergabe von Leistungspunkten ist das Bestehen der Modulprüfung. Die Modulprüfung umfasst:<br>KA [180 min]<br>Theorieteil und Praxisteil am PC | | |
| Credit Points: | 5 | | |
| Grade: | The Grade is generated from the examination result(s) with the following weights (w):<br>KA [w: 1] | | |
| Workload: | The workload is 150h. It is the result of 60h attendance and 90h self-studies. The latter includes the preparation and wrap-up of the course, the wrap-up of the exercises (independent work in the PC pool) and the exam preparations. | | |

| | | | |
|---|---|---|---|
| Data: | RecSRM. MA. Nr. / Examination number: - | Version: 24.07.2023 | Start Year: WiSe |
| Module Name: | **Recycling – Secondary Raw Materials** | | |
| (English): | Recycling – Secondary Raw Materials | | |
| Responsible: | Peuker, Urs Alexander / Prof. Dr.-Ing.<br>Charitos, Alexandros / Prof. | | |
| Lecturer(s): | Peuker, Urs Alexander / Prof. Dr.-Ing.<br>Charitos, Alexandros / Prof. | | |
| Institute(s): | Institute of Mechanical Process Engineering and Mineral Processing<br>Institute for Nonferrous Metallurgy and Purest Materials | | |
| Duration: | 1 Semester(s) | | |
| Competencies: | The students will be able to link the applied module to the engineering and scientific fundamentals they have learned during their education. They will get an overview on selected process designs in the recycling of secondary raw materials. They will be able to analyze and understand the individual process steps of mechanical and metallurgical recycling. They will be aware of the interlink between mechanical and metallurgical recycling approaches. Finally, they be able to apply this knowledge to describe technical issues quantitatively. | | |
| Contents: | There is a theoretical introduction into different quantitative methods / process steps, which are relevant in recycling, e.g.<br>• Waste regulation<br>• Logistics / quality control<br>• Shredding<br>• Mechanical sorting (magnetic, electrostatic, eddy current, density, sensor based, ...)<br>• Metallurgical<br>• Emissions<br><br>Building on the microprocesses of particle technology (c.f. Training in Particle Technology) and fundamental knowledge in chemistry and thermodynamics, various technical process and related apparatus or machine technology of recycling technology are introduced including:<br>• Battery recycling<br>• ELV recycling<br>• Plastics recycling<br>• Non-ferrous metal recycling<br>• Aluminum recycling<br>• Tin recycling<br>• Slag recycling<br>• 1-2 additional topics | | |
| Literature: | H. Martens, D. Goldmann, Recyclingtechnik, Springer, Berlin, 2016<br>H. Schubert: Handbuch der Mechanischen Verfahrenstechnik, Wiley-VCH, Weinheim, 2003<br>Selected scientific papers | | |
| Types of Teaching: | S1 (WS): Lectures (3 SWS)<br>S1 (WS): Seminar (1 SWS) | | |
| Pre-requisites: | **Recommendations:**<br>Training in Particle Technology, 2022-09-15<br>Grundlagen der Mechanischen Verfahrenstechnik, 2020-04-06<br>Mechanische Verfahrenstechnik, 2020-04-07 | | |
| Frequency: | yearly in the winter semester | | |
| Requirements for Credit | For the award of credit points it is necessary to pass the module exam. | | |

| | |
|---|---|
| Points: | The module exam contains:<br>in examination variant 0:<br>MP/KA (KA if 8 students or more) [MP minimum 20 min / KA 150 min]<br>PVL: report<br>or<br>in examination variant 1:<br>MP [20 to 30 min]<br>PVL: report<br>Examination variant 1 provided for "TUBAF digital"<br>PVL have to be satisfied before the examination. |
| | Voraussetzung für die Vergabe von Leistungspunkten ist das Bestehen der Modulprüfung. Die Modulprüfung umfasst:<br>in Prüfungsvariante 0:<br>MP/KA (KA bei 8 und mehr Teilnehmern) [MP mindestens 20 min / KA 150 min]<br>PVL: Bericht<br>oder<br>in Prüfungsvariante 1:<br>MP [20 bis 30 min]<br>PVL: Bericht<br>Prüfungsvariante 1 für "TUBAF digital" vorgesehen<br>PVL müssen vor Prüfungsantritt erfüllt sein bzw. nachgewiesen werden. |
| Credit Points: | 6 |
| Grade: | The Grade is generated from the examination result(s) with the following weights (w):<br>in examination variant 0:<br>MP/KA [w: 1]<br>or<br>in examination variant 1:<br>MP [w: 1] |
| Workload: | The workload is 180h. It is the result of 60h attendance and 120h self-studies. The latter includes the preparation and follow-up of the lecture course, the preparation and follow-up of the seminar including reporting, as well as the preparation for the written exam. |

| | | | |
|---|---|---|---|
| Data: | ResPE. Ma. Nr. / Examination number: - | Version: 28.08.2023 | Start Year: WiSe 2025 |
| Module Name: | **Resource's Process Engineering without Lab Course** | | |
| (English): | Resource's Process Engineering without Lab Course | | |
| Responsible: | Bräuer, Andreas / Prof. Dr.-Ing. | | |
| Lecturer(s): | Herdegen, Volker / Dr.-Ing. | | |
| Institute(s): | Institute of Thermal, Environmental and Natural Products Process Engineering | | |
| Duration: | 1 Semester(s) | | |
| Competencies: | Students learn about the origin and properties of fossil, mineral and renewable natural substances. They understand the relationship between the properties of the respective natural substance and the suitable procedural process of processing. They will be familiar with different uses of natural substances and their ingredients and will be able to compare and evaluate them.<br>Different processes for processing natural products are understood. The apparatus and machines used in the processes as well as their operating principle and their mode of operation are known. | | |
| Contents: | 1. occurrence and availability of natural substances<br>2. material use vs. energetic use<br>3. properties of natural products<br>4. processes and technologies of natural products processing with the help of basic mechanical, thermal, biological and chemical operations<br>5. product evaluation and product use<br>6. environmental aspects (handling of waste and/or residual materials, emissions, legal regulations)<br>7. examples of own research activities with natural products | | |
| Literature: | | | |
| Types of Teaching: | S1 (WS): Lectures (3 SWS)<br>S1 (WS): Exercises (1 SWS) | | |
| Pre-requisites: | **Recommendations:**<br>Participants are expected to be familiar with the basic contents of an sciences or engineering related bachelor studying program. They are expected to be especially familiar with the basics of particle technology, thermal separation sciences and equipment and apparatuses for processes | | |
| Frequency: | yearly in the winter semester | | |
| Requirements for Credit Points: | For the award of credit points it is necessary to pass the module exam.<br>The module exam contains:<br>in examination variant 0:<br>MP/KA (KA if 10 students or more) [MP minimum 30 min / KA 120 min]<br>PVL: OPAL-Tasks during the lecture term<br>or<br>in examination variant 1:<br>MP [30 to 45 min]<br>PVL: OPAL-Tasks during the lecture term<br>examination variant 1 for "TUBAF digital" or when examinations in physical presence are not possible.<br>PVL have to be satisfied before the examination. | | |
| | Voraussetzung für die Vergabe von Leistungspunkten ist das Bestehen der Modulprüfung. Die Modulprüfung umfasst:<br>in Prüfungsvariante 0:<br>MP/KA (KA bei 10 und mehr Teilnehmern) [MP mindestens 30 min / KA 120 min]<br>PVL: OPAL-Aufgaben während der Vorlesungszeit | | |

| | |
|---|---|
| | oder<br>in Prüfungsvariante 1:<br>MP [30 bis 45 min]<br>PVL: OPAL-Aufgaben während der Vorlesungszeit<br>Prüfungsvariante 1 für "TUBAF digital" oder wenn Präsenz nicht möglich ist.<br>PVL müssen vor Prüfungsantritt erfüllt sein bzw. nachgewiesen werden. |
| Credit Points: | 6 |
| Grade: | The Grade is generated from the examination result(s) with the following weights (w):<br>in examination variant 0:<br>MP/KA [w: 1]<br>or<br>in examination variant 1:<br>MP [w: 1] |
| Workload: | The workload is 180h. It is the result of 60h attendance and 120h self-studies. |

| | | | |
|---|---|---|---|
| Data: | SSSE. MA. Nr. 3653 / Examination number: 43112 | Version: 24.09.2018 | Start Year: WiSe 2018 |
| Module Name: | **Selective Separation of Strategic Elements** | | |
| (English): | | | |
| Responsible: | Bräuer, Andreas / Prof. Dr.-Ing. | | |
| Lecturer(s): | Haseneder, Roland / Dr. rer. nat. | | |
| Institute(s): | Institute of Thermal, Environmental and Natural Products Process Engineering | | |
| Duration: | 1 Semester(s) | | |
| Competencies: | On completion of the course the student shall be able to explain membrane technology and the different applications like extraction and membrane assisted processes regarding the separation of value products. Focus is put on strategic elements. They can use their physico-chemical knowledge on membrane separation, development of hybrid operation systems and the influences for practical applications and are familiar with the methods and problems related to separation devices. Due to the seminar the students will be able to dicuss the current literature on the topic. | | |
| Contents: | • membranes, modules, hybrid processes<br>• driving forces, transport resistances<br>• structures, materials<br>• mass transfer<br>• module construction<br>• MF, UF, NF, RO<br>• standard applications<br>• scaling, fouling effects<br>• special applications: mine water treatment, leaching solutions, resourcerecovery<br>• internship to membrane processes | | |
| Literature: | Heinrich Strathmann: Introduction to Membrane Science and Technology, Wiley-VCH, 2011<br>Anil K. Pabby, Syed S.H. Rizvi, Ana Maria Sastre Requena: Handbook of Membrane Separations, CRC-Press 2008 | | |
| Types of Teaching: | S1 (WS): Lectures (2 SWS)<br>S1 (WS): Seminar (1 SWS)<br>S1 (WS): Practical Application (1 SWS) | | |
| Pre-requisites: | | | |
| Frequency: | yearly in the winter semester | | |
| Requirements for Credit Points: | For the award of credit points it is necessary to pass the module exam. The module exam contains:<br>KA [90 min] | | |
| | Voraussetzung für die Vergabe von Leistungspunkten ist das Bestehen der Modulprüfung. Die Modulprüfung umfasst:<br>KA [90 min] | | |
| Credit Points: | 5 | | |
| Grade: | The Grade is generated from the examination result(s) with the following weights (w):<br>KA [w: 1] | | |
| Workload: | The workload is 150h. It is the result of 60h attendance and 90h self-studies. | | |

| | | | |
|---|---|---|---|
| Data: | SusFuel. MA. Nr, / Examination number: - | Version: 14.09.2023 | Start Year: SoSe 2025 |
| Module Name: | **Sustainable Fuels** | | |
| (English): | Sustainable Fuels | | |
| Responsible: | Kureti, Sven / Prof. Dr. rer. nat | | |
| Lecturer(s): | Kureti, Sven / Prof. Dr. rer. nat<br>Wollmerstädt, Hendrik / Dr.-Ing.<br>Knüpfer, Paul / Dr.-Ing. | | |
| Institute(s): | Institute of Energy Process Engineering and Chemical Engineering | | |
| Duration: | 1 Semester(s) | | |
| Competencies: | The students understand the chemical-technological relations of important areas of industrial chemistry, particularly in the field of fuel production from fossil and sustainable feedstocks. The students are able to explain, compare and characterize the different production technologies. | | |
| Contents: | The module deals with properties, characterization and processing of sustainable and fossil feedstocks, chemical and reaction engineering basics as well as process control for the synthesis of fossil and sustainable fuels. A special focus lies on methanol, gasoline, diesel, jet fuel and methane obtained from traditional routes, biogenic resources and PtL technologies. | | |
| Literature: | G. A. Olaf, Beyond oil and gas: the methanol economy, Wiley-VCH, 2018.<br>P. Leprince, Petroleum refining vol. 3, Conversion processes, 2001, Editions Technip.<br>A. Jess, P. Wasserscheid, Chemical Technology, Wiley-VCH, 2020. | | |
| Types of Teaching: | S1 (SS): Lectures (3 SWS)<br>S1 (SS): Seminar (1 SWS) | | |
| Pre-requisites: | **Recommendations:**<br>Basics in chemical reaction engineering and chemistry | | |
| Frequency: | yearly in the summer semester | | |
| Requirements for Credit Points: | For the award of credit points it is necessary to pass the module exam.<br>The module exam contains:<br>MP/KA (KA if 10 students or more) [MP minimum 30 min / KA 90 min]<br>PVL: Oral presentation<br>PVL have to be satisfied before the examination. | | |
| | Voraussetzung für die Vergabe von Leistungspunkten ist das Bestehen der Modulprüfung. Die Modulprüfung umfasst:<br>MP/KA (KA bei 10 und mehr Teilnehmern) [MP mindestens 30 min / KA 90 min]<br>PVL: Vortrag<br>PVL müssen vor Prüfungsantritt erfüllt sein bzw. nachgewiesen werden. | | |
| Credit Points: | 5 | | |
| Grade: | The Grade is generated from the examination result(s) with the following weights (w):<br>MP/KA [w: 1] | | |
| Workload: | The workload is 150h. It is the result of 60h attendance and 90h self-studies. The latter includes the preparation and wrap-up of the module elements as well as the preparation for the oral seminar presentation and the module examination. | | |

| Data: | TechAss. Ma. Nr. / Examination number: - | Version: 28.07.2023 | Start Year: SoSe 2025 |
|---|---|---|---|
| Module Name: | **Technology Assessment** | | |
| (English): | Technology Assessment | | |
| Responsible: | Gräbner, Martin / Prof. Dr.-Ing. | | |
| Lecturer(s): | Lee, Roh Pin / Dr. rer. pol. | | |
| Institute(s): | Institute of Energy Process Engineering and Chemical Engineering | | |
| Duration: | 1 Semester(s) | | |
| Competencies: | Students know the essential aspects of technology assessment and their areas of application. The methodology of essential assessment tools of technological, economic and ecological assessment are known and ready for application. | | |
| Contents: | • Motivation and Technology Assessment Aspects<br>• Technology assessment (development status/technical readiness, process balancing & validation, industrial implementation)<br>• Economic assessment<br>• Environmental assessment/life cycle assessment<br>• Socio-political aspects of technology assessment (relevance & benefits, acceptance assessment, political drivers)<br>• Various aspects of technology assessment (integrated assessment, process and product certification, assessment scenarios)<br>• Examples of applications | | |
| Literature: | Internal teaching materials for the courses;<br>M. Hauschild: Life Cycle Assessment - Theory and Practice, Springer, 2018<br>D. Brennan: Process Industry Economics, Elsevier, 2020 | | |
| Types of Teaching: | S1 (SS): Lectures (2 SWS)<br>S1 (SS): Exercises (1 SWS)<br>S1 (SS): Seminar (1 SWS) | | |
| Pre-requisites: | **Recommendations:**<br><br>Technical thermodynamics, Prior knowledge of process engineering and MS Office | | |
| Frequency: | yearly in the summer semester | | |
| Requirements for Credit Points: | For the award of credit points it is necessary to pass the module exam.<br>The module exam contains:<br>KA [90 min]<br>PVL: project work (group work) with presentation<br>PVL have to be satisfied before the examination. | | |
| | Voraussetzung für die Vergabe von Leistungspunkten ist das Bestehen der Modulprüfung. Die Modulprüfung umfasst:<br>KA [90 min]<br>PVL: Projektarbeit (Gruppenarbeit) mit Präsentation<br>PVL müssen vor Prüfungsantritt erfüllt sein bzw. nachgewiesen werden. | | |
| Credit Points: | 5 | | |
| Grade: | The Grade is generated from the examination result(s) with the following weights (w):<br>KA [w: 1] | | |
| Workload: | The workload is 150h. It is the result of 60h attendance and 90h self-studies. The latter includes the preparation and wrap-up of the course, the wrap-up of the exercises, the execution of the project work (group work) and the preparation for the examination. | | |

| | |
|---|---|
| Data: | Examination number: - Version: 28.07.2023 Start Year: WiSe 2024 |
| Module Name: | **Thermochemical Conversion and Chemical Recycling** |
| (English): | Thermochemical Conversion and Chemical Recycling |
| Responsible: | Gräbner, Martin / Prof. Dr.-Ing. |
| Lecturer(s): | Krzack, Steffen / Dr.-Ing. |
| Institute(s): | Institute of Energy Process Engineering and Chemical Engineering |
| Duration: | 1 Semester(s) |
| Competencies: | Students will be able to understand the processes of thermochemical conversion of energy sources theoretically and to assign technological applications in the production of, for example, transport fuels and chemical raw materials, hydrogen or coke, including the chemical recycling of waste.<br>Students will be able to construct appropriate process chains, taking into account aspects of closing technical carbon cycles. |
| Contents: | High-temperature conversion processes convert fossil and renewable energy sources, as well as residual and waste materials, into new products such as coke, hydrocarbons and combustible gases. These can be used in a variety of ways, including as raw materials.<br>Possible uses include the production of fuels, chemical feedstocks and hydrogen, or the production of coke for metallurgy or adsorbents for environmental protection.<br>Based on the structural composition and properties of solid, liquid and gaseous energy sources, the material fundamentals and the technical implementation of thermochemical processes such as pyrolysis/coking, gasification/synthesis gas production including gas treatment are taught and numerous process examples are presented. Process chains, in which the conversion processes are integrated, are used to explain the chemical recycling of carbonaceous residues and waste materials. |
| Literature: | In-house teaching material<br>Gräbner, M.: Industrial coal gasification technologies covering baseline and high-ash coal. Wiley-VCH Verlag GmbH & Co. KGaA, 2015<br>Higman, C. und van der Burgt, M.: Gasification. Elsevier 2008<br>Scheirs J., Kaminsky W. (editors): Feedstock Recycling and Pyrolysis of Waste Plastics. John Wiley & Sons, Ltd, 2006<br>Ciuta S., Tsiamis D., Castaldi M. J.: Gasification of Waste Materials. Elsevier Inc., 2018 |
| Types of Teaching: | S1 (WS): Thermochemical Conversion / Lectures (2 SWS)<br>S1 (WS): Chemical Recycling / Lectures (1 SWS)<br>S1 (WS): Chemical Recycling / Exercises (1 SWS) |
| Pre-requisites: | **Recommendations:**<br>Knowledge in Chemical Reaction Engineering, Technical Thermodynamics, Heat and Mass Transfer, Gas-Solid Systems |
| Frequency: | yearly in the winter semester |
| Requirements for Credit Points: | For the award of credit points it is necessary to pass the module exam.<br>The module exam contains:<br>MP/KA (KA if 5 students or more) [MP minimum 30 min / KA 90 min] |
| | Voraussetzung für die Vergabe von Leistungspunkten ist das Bestehen der Modulprüfung. Die Modulprüfung umfasst:<br>MP/KA (KA bei 5 und mehr Teilnehmern) [MP mindestens 30 min / KA 90 min] |
| Credit Points: | 5 |
| Grade: | The Grade is generated from the examination result(s) with the following weights (w):<br>MP/KA [w: 1] |

| | |
|---|---|
| Workload: | The workload is 150h. It is the result of 60h attendance and 90h self-studies. |

| | | | |
|---|---|---|---|
| Data: | TPT. MA. Nr. / Examination number: 40316 | Version: 15.09.2022 | Start Year: WiSe 2022 |
| Module Name: | **Training in Particle Technology** | | |
| (English): | | | |
| Responsible: | Peuker, Urs Alexander / Prof. Dr.-Ing. | | |
| Lecturer(s): | Mitarbeiter des Institutes MVT/AT<br>Peuker, Urs Alexander / Prof. Dr.-Ing. | | |
| Institute(s): | Institute of Mechanical Process Engineering and Mineral Processing | | |
| Duration: | 1 Semester(s) | | |
| Competencies: | The module aims at recalling the fundamentals of particle technology. It is set up using special exercises to practice scientific and technological calculations of particle size distributions and fundamental micro-processes. The principles of the mechanical micro-processes are introduced.<br>The exercises also apply the fundamental approaches (micro-processes) to describe and to design process equipment. This will be done using case studies. | | |
| Contents: | Particle characterization<br>Particle size distribution<br>Mixing of particle size distributions<br>Separation of particle size distributions (classification)<br>Grade recovery curves<br>Micro processes in particle technology<br>• Particles in flow-fields (i.e. sedimentation)<br>• Flow through porous media<br>• Particle-particle interactions (e.g. van-der-Waals-forces, electrostatic interactions, DLVO-theory, capillary forces)<br>• Breakage laws (i.e. breakage energy)<br>Selected case studies form the fields:<br>• Filtration<br>• Sedimentation<br>• Agglomeration<br>• Classification<br>• Comminution<br>• And others | | |
| Literature: | M. Stieß: Mechanische Verfahrenstechnik 1 - Partikeltechnologie, Springer-Verlag, Berlin, Heidelberg, 2009<br>H. Schubert: Handbuch der Mechanischen Verfahrenstechnik, Wiley-VCH, Weinheim, 2003<br>selected scientific papers | | |
| Types of Teaching: | S1 (WS): Recall of fundamentals - (also digital available every semester - provided as screencasts) / Lectures (1 SWS)<br>S1 (WS): Application of fundamentals - case studies - (also digital available every semester - provided as screencasts with feedback rounds in a virtual classroom) / Exercises (2 SWS) | | |
| Pre-requisites: | | | |
| Frequency: | yearly in the winter semester | | |
| Requirements for Credit Points: | For the award of credit points it is necessary to pass the module exam.<br>The module exam contains:<br>in examination variant 1:<br>MP/KA (KA if 8 students or more) [MP minimum 30 min / KA 120 min]<br>or | | |

| | |
|---|---|
| | in examination variant 2:<br>PVL: Midtermtests (parallel to lectures and excercises)<br>AP: Home work assignment<br>The variant 2 applies only for students of the virtual faculty.<br>PVL have to be satisfied before the examination. |
| | Voraussetzung für die Vergabe von Leistungspunkten ist das Bestehen der Modulprüfung. Die Modulprüfung umfasst:<br>in Prüfungsvariante 1:<br>MP/KA (KA bei 8 und mehr Teilnehmern) [MP mindestens 30 min / KA 120 min]<br>oder<br>in Prüfungsvariante 2:<br>PVL: Testate (veranstaltungsbegleitend)<br>AP: Hausarbeit<br>Die Prüfungsvariante 2 gilt nur für Studierende der virtuellen Fakultät.<br>PVL müssen vor Prüfungsantritt erfüllt sein bzw. nachgewiesen werden. |
| Credit Points: | 4 |
| Grade: | The Grade is generated from the examination result(s) with the following weights (w):<br>in examination variant 1:<br>MP/KA [w: 1]<br>or<br>in examination variant 2:<br>AP: Home work assignment [w: 1] |
| Workload: | The workload is 120h. It is the result of 45h attendance and 75h self-studies. |

Freiberg, den 04. Dezember 2023

gez.
Prof. Dr. Klaus-Dieter Barbknecht
Rektor

Herausgeber: Der Rektor der TU Bergakademie Freiberg

Redaktion: Prorektor für Bildung

Anschrift: TU Bergakademie Freiberg
09596 Freiberg

Druck: Medienzentrum der TU Bergakademie Freiberg