Modulhandbuch
für den
Masterstudiengang
Technology and Application of Inorganic Engineering Materials

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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:	CerEngRef. MA.Nr. (for TAIEM and MKGT only) / Examination number: 40917	Version: 20.06.2024	Start Year: WiSe 2024
Module Name:	**Ceramic Engineering and Refractory Ceramics**		
(English):			
Responsible:	Aneziris, Christos G. / Prof. Dr.-Ing. habil.		
Lecturer(s):	Aneziris, Christos G. / Prof. Dr.-Ing. habil.		
Institute(s):	Institute of Ceramics, Refractories and Composite Materials		
Duration:	1 Semester(s)		
Competencies:	Students will understand, apply, improve and generate both fine-grained ceramics and coarse grained refractory materials: • in micro and macro structural design, • ceramic processing, • refractories processing, • testing and • application.		
Contents:	Most important ingredients are: Lecture Ceramic Engineering: • definition, bonding • micro structure, density, porosity • mechanical properties • thermal and thermo-mechanical properties • chemical properties • sintering • basics in ceramic technology, theoretical • ceramic technology pressing/extruding/casting/3D, experimental • engineering ceramics, alumina/zirconia • engineering ceramics, silicon carbide • functional ceramics, non-linear dielectric/piezoelectric properties - barium titanate • carbon bonded materials • silicate ceramics Exercise: theoretical density / Enthalpy Lecture Refractory Ceramics: • definition, bonding, • micro structure design, density, porosity • mechanical properties, • thermal and thermo-mechanical properties • chemical properties • basics in refractory coarse grained technology, coarse- and fine-grained refractories • dense shaped products, silica bricks and fused silica ceramics, fireclay and high alumina bricks, basic bricks, zircon- and zirconia containing bricks, carbon and graphite bricks, carbon and graphite containing refractories, silicon carbide bricks, fine-grained oxide and non-oxide ceramics, fusion cast bricks, ceramics with low thermal expansion • unshaped refractory materials • heat-insulating ceramic materials, applications in iron and steel,		

	applications in non-ferrous • application in cement and chemistry, applications in foundries Visiting of ceramic plant or research institute
Literature:	Introduction to Ceramics, David Kingery Introduction to the Principles of Ceramic Processing, James Reed Physical Ceramics, Yet-Ming Chiang, Dunbar Birnie III, W. David Kingery Refractory Ceramics, Routschka, Granitzki, Wiley Refractory Castables Engineering, Luz, Braulio, Pandolfelli, Göller
Types of Teaching:	S1 (WS): Ceramic Engineering - incl. exercises and practical course / Lectures (2 SWS) S1 (WS): Refractory Ceramics - incl. exercises and practical course / Lectures (2 SWS)
Pre-requisites:	**Mandatory:** For Students of TAIEM and Master Keramik- and Glastechnologie only **Recommendations:** Basic fundamentals of materials science
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: MP/KA (KA if 6 students or more) [MP minimum 30 min / KA 180 min]
	Voraussetzung für die Vergabe von Leistungspunkten ist das Bestehen der Modulprüfung. Die Modulprüfung umfasst: MP/KA (KA bei 6 und mehr Teilnehmern) [MP mindestens 30 min / KA 180 min]
Credit Points:	7
Grade:	The Grade is generated from the examination result(s) with the following weights (w): MP/KA [w: 1]
Workload:	The workload is 210h. It is the result of 60h attendance and 150h self-studies.

Data:	CPEq. MA. Nr. / Examination number: -	Version: 27.11.2024	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 • Design of apparatus / design of process • Analyze of unit operation and process equipment • Conceptual design • Functionality • New principles / parallelizing / serializing Material laws • Suspension Rheology • Agglomerate durability • compression laws Auxiliary equipment • Mixing vessels • Stirrers • Pumps		
Literature:	to be announced in the lecture		
Types of Teaching:	S1 (WS): Lectures (2 SWS) S1 (WS): Exercises (1 SWS)		
Pre-requisites:	**Recommendations:** Module or Microcredential: Training in Particle Technology		
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: KA [150 min]		
	Voraussetzung für die Vergabe von Leistungspunkten ist das Bestehen der Modulprüfung. Die Modulprüfung umfasst: KA [150 min]		
Credit Points:	5		
Grade:	The Grade is generated from the examination result(s) with the following weights (w): KA [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:** 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: KA [90 min] PVL: Aktive Teilnahme an mindestens 80% des Unterrichts 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): 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:** Deutsch A1/ 1. Semester, 2015-08-26 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: KA [90 min] PVL: Aktive Teilnahme an mind. 80% des Unterrichts 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): 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:	EA MA. Nr. 3581 (for students of TAIM only) / Examination number: 40916	Version: 16.01.2018	Start Year: WiSe 2019
Module Name:	**Experimental Assignment (Ceramic and Steel Technology)**		
(English):			
Responsible:	Aneziris, Christos G. / Prof. Dr.-Ing. habil. Volkova, Olena / Prof. Dr.-Ing.		
Lecturer(s):			
Institute(s):	Institute of Ceramics, Refractories and Composite Materials Institute of Iron and Steel Technology		
Duration:	1 Semester(s)		
Competencies:	Analysis of tasks in the field of ceramics and steel technology Derivation of reasonable solutions Planning, implementation, and evaluation of experiments Presentation and written summarization of the problems (task, approach, analysis, results) from an engineering viewpoin		
Contents:	Specification of tasks by means of literature and patent researches, construction/modification of experimental facilities, conducting experimental investiation, interpretation of results and their presentation in the form of a written work, presentation and discussion of the work in a seminar, learning presentation skills		
Literature:	Project-specific		
Types of Teaching:	S1 (WS): Consultations, experimental activities / practical training / Seminar (12 SWS)		
Pre-requisites:	**Recommendations:** Knowledge of ceramic engineering and Technology of Iron and Steel		
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: AP: Script MP: Colloquium [60min]		
	Voraussetzung für die Vergabe von Leistungspunkten ist das Bestehen der Modulprüfung. Die Modulprüfung umfasst: AP: Schriftliche Studienarbeit MP: Kolloquium [60min]		
Credit Points:	10		
Grade:	The Grade is generated from the examination result(s) with the following weights (w): AP: Script [w: 2] MP: Colloquium [60min] [w: 1]		
Workload:	The workload is 300h. It is the result of 180h attendance and 120h self-studies.		

Data:	FFMAT. MA. Nr. 3569 / Examination number: 50930	Version: 17.06.2019	Start Year: WiSe 2018
Module Name:	**Fundamentals of Ferrous Materials**		
(English):			
Responsible:	Volkova, Olena / Prof. Dr.-Ing.		
Lecturer(s):	Wendler, Marco / Dr.-Ing.		
Institute(s):	Institute of Iron and Steel Technology		
Duration:	1 Semester(s)		
Competencies:	The students learn to apply their fundamental knowledge of the materials science and engineering to the class of ferrous materials. Upon successful completion of the module, the students are familiar with the standard designation of steels and the heat treatment conditions associated with different microstructure formation processes. The module enables an understanding of the principles and considerations in the design of steels and the possibilities to adjust the microstructure.		
Contents:	Standard Designation of Steels, Structure and Properties of Pure Iron, Phase Diagrams, Constitution of Steels, Solubility Limit and Precipitation, Cast Irons, Ferrous Alloys under Equilibrium and Non-Equilibrium Conditions, Austenite Transformation Products, Hardenability and Transformation Diagrams		
Literature:	• B.C. De Cooman, J. Speer, Fundamentals of Steel Product Physical Metallurgy, Assn. of Iron and Steel Engineers, 1st Ed., 2011. • H.K.D.H. Bhadeshia and R.W,K. Honeycombe, Steels: Microstructure and Properties, Butterworth-Heinemann, 4th Ed., 2017.04.12 W.		
Types of Teaching:	S1 (WS): Lectures (2 SWS) S1 (WS): Seminar (1 SWS)		
Pre-requisites:	**Recommendations:** Knowledge of the fundamentals of materials science and 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: KA [90 min]		
	Voraussetzung für die Vergabe von Leistungspunkten ist das Bestehen der Modulprüfung. Die Modulprüfung umfasst: KA [90 min]		
Credit Points:	4		
Grade:	The Grade is generated from the examination result(s) with the following weights (w): KA [w: 1]		
Workload:	The workload is 120h. It is the result of 45h attendance and 75h self-studies.		

Data:	FPD. MA. Nr. 3562 / Examination number: 50329	Version: 24.06.2022	Start Year: SoSe 2023
Module Name:	**Fundamentals of Metal Forming**		
(English):			
Responsible:	Prahl, Ulrich / Prof. Dr.-Ing.		
Lecturer(s):	Prahl, Ulrich / Prof. Dr.-Ing.		
Institute(s):	Institute of Metal Forming		
Duration:	1 Semester(s)		
Competencies:	Consolidated knowledge on the basics of plastic deformation (deformation mechanisms, flow stress, influences on flow stress, classification of forming processes, flow conditions). Students will be capacitated to understand and define strain and tension conditions in forming processes, geometric and kinematic conditions as well as calculating required force and work.		
Contents:	• Introduction into the subject field • Mechanisms of plastic deformation • Definition of forming specific characteristics • Flow stress behavior during hot and cold forming (including influences on flow stress) • Softening and hardening behavior • Methods to determine of flow stress • Constitutive equations in forming • Analytic determination of force and work • Introduction of several forming processes		
Literature:	Gottstein, Günter: Physical Foundation of Materials Science. Springer, 2004 Kachanov, L.M.: Fundamentals of the Theory of Plasticity, Dover Publications Dixit, P.M.: Plasticity Fundamentals and Application, CRC Press, Taylor&Francis Group		
Types of Teaching:	S1 (SS): Lectures (3 SWS)		
Pre-requisites:			
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: KA [90 min]		
	Voraussetzung für die Vergabe von Leistungspunkten ist das Bestehen der Modulprüfung. Die Modulprüfung umfasst: KA [90 min]		
Credit Points:	5		
Grade:	The Grade is generated from the examination result(s) with the following weights (w): KA [w: 1]		
Workload:	The workload is 150h. It is the result of 45h attendance and 105h self-studies.		

Data:	ILRET.MA / Examination number: 61520	Version: 03.06.2024	Start Year: WiSe 2024
Module Name:	**International Law of Resources, Environment and Trade**		
(English):	International Law of Resources, Environment and Trade		
Responsible:	Frau, Robert / Prof. Dr.		
Lecturer(s):	Frau, Robert / Prof. Dr.		
Institute(s):	Professor of Public and Environmental Law		
Duration:	1 Semester(s)		
Competencies:	The purpose of the cluster is to give an introduction to the basic terms of law and to legal problems related to resources, environment and trade. Students without a law background will be enabled to understand the characteristics of these fields as such, before turning to a range of more specific questions. Students will be able to analyze international environmental law and trade law as well as be in a position to solve clashes between these two fields of law.		
Contents:	1. General Introduction to Law This part contents the basic legal terms, the introduction to the different fields of law and the interpretation of law. 2. Introduction to International Environmental Law The second parts addresses general principles of environmental law as well as specific treaty regimes related to resources. 3. Introduction to International Trade Law Lastly, the WTO will stand in the center of attention. The lecture will focus on the GATT and the relationship between trade law and environmental law.		
Literature:	Birnie/Boyle/Redgwell, International Law and the Environment, Oxford University Press		
Types of Teaching:	S1 (WS): Lectures / Lectures (2 SWS) S1 (WS): Exercises / Exercises (2 SWS) 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. The module exam contains: KA [120 to 120 min]		
	Voraussetzung für die Vergabe von Leistungspunkten ist das Bestehen der Modulprüfung. Die Modulprüfung umfasst: KA [120 bis 120 min]		
Credit Points:	6		
Grade:	The Grade is generated from the examination result(s) with the following weights (w): KA [w: 1]		
Workload:	The workload is 180h. It is the result of 60h attendance and 120h self-studies. Self-studies include assignments, preparation and wrapping-up of lectures as well as preparations for examinations.		

Data:	LabWorkCer. MA. Nr. / Examination number: 40915	Version: 29.09.2017	Start Year: WiSe 2017
Module Name:	**Laboratory Ceramic Courses**		
(English):			
Responsible:	Aneziris, Christos G. / Prof. Dr.-Ing. habil.		
Lecturer(s):	Schmidt, Gert / Dr.-Ing. Aneziris, Christos G. / Prof. Dr.-Ing. habil. Hubálková, Jana / Dr.-Ing.		
Institute(s):	Institute of Ceramics, Refractories and Composite Materials		
Duration:	1 Semester(s)		
Competencies:	Students will understand and apply ceramic materials: • ceramic materials in micro structural design, • ceramic processing, • testing and (iv) application		
Contents:	6 experimental works with following topics: • Raw material assessment, • Slip casting, • Press forming, • Plastic forming, • Sintering and evaluation of the physical properties, • High-temperature properties		
Literature:	Introduction to the Principles of Ceramic Processing, James Reed Physical Ceramics, Yet-Ming Chiang, Dunbar Birnie III, W. David Kingery		
Types of Teaching:	S1 (WS): Laboratory work / Practical Application (5 SWS)		
Pre-requisites:	**Recommendations:** Ceramic Engineering, 2016-06-15 Basic fundamentals of materials science		
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: AP: Preparation and execution of the experiments incl. lab report		
	Voraussetzung für die Vergabe von Leistungspunkten ist das Bestehen der Modulprüfung. Die Modulprüfung umfasst: AP: Vorbereitung und Durchführung der Experimente incl. Laborbericht		
Credit Points:	5		
Grade:	The Grade is generated from the examination result(s) with the following weights (w): AP: Preparation and execution of the experiments incl. lab report [w: 1]		
Workload:	The workload is 150h. It is the result of 75h attendance and 75h self-studies. The self-studies encompass: preliminary preparation, post-processing of experimental data, drafting of the 6 reports.		

Data:	MTAIEM. MA. Nr. 3602 / Examination number: -	Version: 10.07.2024	Start Year: SoSe 2024
Module Name:	**Master Thesis (Technology and Application of Inorganic Engineering Materials)**		
(English):			
Responsible:	Aneziris, Christos G. / Prof. Dr.-Ing. habil. Volkova, Olena / Prof. Dr.-Ing.		
Lecturer(s):			
Institute(s):	Institute of Ceramics, Refractories and Composite Materials Institute of Iron and Steel Technology		
Duration:	6 Month(s)		
Competencies:	The objective of the master thesis is to give the students the opportunity to apply the knowledge acquired during the studies on a research project.		
Contents:			
Literature:	Project specific		
Types of Teaching:	S1: Thesis / Thesis (6 Mon)		
Pre-requisites:	**Mandatory:** - Abschluss aller Pflichtmodule des 1. und 2. Semesters sowie des Moduls „Experimental Assignment (Ceramic and Steel Technology)" und - höchstens drei offene Prüfungsleistungen in noch nicht abgeschlossenen Modulen - Zulassungsvoraussetzungen des Kolloquiums: Abschluss aller übrigen Module des Masterstudienganges TAIEM (- all modules of the first and second term as well as the Modul of „Experimental Assignment (Ceramic and Steel Technology) have to be passed and - only three examinations have not been taken - Admission requirements for the colloquium: Completion of all other modules of the Master's degree program TAIEM)		
Frequency:	constantly		
Requirements for Credit Points:	For the award of credit points it is necessary to pass the module exam. The module exam contains: AP*: Script MP*: Colloquium [60 min] * 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: AP*: Masterarbeit MP*: Kolloquium [60 min] * 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): AP*: Script [w: 2] MP*: Colloquium [w: 1] * 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. It is the result of 0h attendance and 900h self-studies.		

Data:	MFALCA. MA. Nr. / Examination number: 62402	Version: 15.07.2016	Start Year: SoSe 2017
Module Name:	**Material Flow Analysis and Life Cycle Assessment**		
(English):	Material Flow Analysis and Life Cycle Assessment		
Responsible:	Glöser-Chahoud, Simon / Prof.		
Lecturer(s):	Glöser-Chahoud, Simon / Prof.		
Institute(s):	Corporate Sustainability and Environmental Management		
Duration:	1 Semester(s)		
Competencies:	The students • analyse material and energy flows from a system's and from a product/service perspective, • use the standardized terminology, • name and describe the steps for conducting MFA & LCA studies, • discuss the achievements and shortcomings of common methodological toolsets and data bases in the field, • gather necessary information, choose suitable methods, and apply these for simple MFA & LCA studies, and • discuss the quality of material flow analysis studies and life cycle assessment studies.		

Contents:	• Systems and life cycle thinking
	• Material flow networks
	• Material and energy flow balancing
	• Material flow modelling
	• Life Cycle Assessment
	  ◦ Goal and Scope definition
	  ◦ Life Cycle Inventories (LCI)
	  ◦ Life Cycle Impact Assessment (LCIA)
	  ◦ Interpretation and Disclosure
	• Current trends and developments
	• Software systems and data bases for material flow analysis and life cycle assessment
	• Case studies		

Literature:	1. Baccini & Brunner (2012): Metabolism of the Anthroposphere: Analysis, Evaluation, Design, MIT Press
	2. Brunner/Rechberger (2004): Practical handbook of material flow analysis, Lewis
	3. Guinée (2002): Handbook on Life Cycle Assessment, Kluwer
	4. Hauschild/ Huijbregts (2015): Life Cycle Impact Assessment (LCA Compendium - The Complete World of Life Cycle Assessment), Springer
	5. Klöpfer, W. (2014): Background and Future Prospects in Life Cycle Assessment, Springer
	6. EU International Reference Life Cycle Data System (ILCD) Handbook Series
	7. Journals:
	  a. International Journal of Life Cycle Assessment
	  b. Journal of Cleaner Production
	  c. Journal of Industrial Ecology
	
	Further literature recommendations will be given in the lecture.		

Types of Teaching:	S1 (SS): Lectures (2 SWS) S1 (SS): Exercises (2 SWS)		

Pre-requisites:	
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: AP*: Assignment KA [90 min] * 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: AP*: Aufgabe KA [90 min] * Bei Modulen mit mehreren Prüfungsleistungen muss diese Prüfungsleistung bestanden bzw. mit mindestens "ausreichend" (4,0) bewertet sein.
Credit Points:	6
Grade:	The Grade is generated from the examination result(s) with the following weights (w): AP*: Assignment [w: 1] KA [w: 4] * 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 180h. It is the result of 60h attendance and 120h self-studies.

Data:	Examination number: 50120	Version: 11.06.2024	Start Year: SoSe 2025
Module Name:	**Materials Science and Mechanical Properties of Metals**		
(English):			
Responsible:	Biermann, Horst / Prof. Dr.-Ing. habil Leineweber, Andreas / Prof. Dr. rer. nat. habil.		
Lecturer(s):	Weidner, Anja / Dr.-Ing. habil. Martin, Stefan / Dr.-Ing.		
Institute(s):	Institute of Materials Engineering Institute of Materials Science		
Duration:	1 Semester(s)		
Competencies:	The student is able to relate problems from engineering practice to fundamental concepts from Materials Science. Further the student is able to relate technological aspects of processing of metallic materials to changes in microstructure, the mechanical parameters and further properties.		
Contents:	The first part of the lectures deals with the basics of materials science (structure, classes of materials), the main properties and the application of materials. The second part of the lecture deals with the (micro-)structure - properties relations of metallic materials. Focus is given to plastic deformation and failure, particularly to following metal alloy types: • Ferrous metals (plain carbon steels, high-alloyed steels, cast irons); • Non-ferrous metals (e.g. copper, nickel) • Light metals (aluminum, titanium, magnesium) • High-temperature alloys (superalloys, intermetallic alloys)		
Literature:	Askeland, D.R., The Science and Engineering of Materials, Chapman and Hall, London etc.Schatt, W.; Worch, H., Werkstoffwissenschaft, Deutscher Verlag für Grundstoffindustrie.W. D. Callister, jr. Materials Science and Engineering – An Introduction, New York etc.: John Wiley & Sons. Inc. M. F. Ashby, D.R.H. Jones, Engineering materials 2, 2nd ed., Butterworth-Heinemann, Oxford, 1998 James F. Shackelford, Introduction to Materials Science for Engineers, 7th ed. Addison Wesley., 2009		
Types of Teaching:	S1 (SS): Lectures (4 SWS) S1 (SS): Exercises (1 SWS)		
Pre-requisites:	**Recommendations:** Basic fundamentals of physics, chemistry and solid materials		
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: KA [120 min]		
	Voraussetzung für die Vergabe von Leistungspunkten ist das Bestehen der Modulprüfung. Die Modulprüfung umfasst: KA [120 min]		
Credit Points:	7		
Grade:	The Grade is generated from the examination result(s) with the following weights (w): KA [w: 1]		
Workload:	The workload is 210h. It is the result of 75h attendance and 135h self-studies.		

Data:	WERKMEC. BA. Nr. 253 / Examination number: 41906	Version: 12.08.2024	Start Year: WiSe 2018
Module Name:	**Mechanics of Materials**		
(English):			
Responsible:	Eidel, Bernhard / Prof. Dr.-Ing. habil.		
Lecturer(s):	Eidel, Bernhard / Prof. Dr.-Ing. habil.		
Institute(s):	Institute of Mechanics and Fluid Dynamics		
Duration:	1 Semester(s)		
Competencies:	Development of an understanding of the deformation behavior and failure mechanisms of engineering materials; students will get familiar with elastic, plastic, viscous, viscoelastic and viscoplastic behaviors of materials; students learn to apply tensor algebra as the language of continuum mechanics.		
Contents:	Most important ingredients are: • vector and tensor algebra • continuum mechanics foundations of stress, strain and displacements • rheological models for elastic, plastic, viscous, viscoelastic, and viscoplastic deformation behavior • time integration algorithms for the inelastic constitutive laws • multi-axial continuum laws for anisotropic elasticity and plasticity, extended strength and failure theories / criteria for multiaxial loading		
Literature:	J. Lemaitre and J.-L. Chaboche: Mechanics of Solid Materials, Cambridge University Press,2000		
Types of Teaching:	S1 (WS): Lectures (2 SWS) S1 (WS): Exercises (2 SWS)		
Pre-requisites:	**Recommendations:** Basic knowledge in engineering mechanics		
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: KA [120 min] PVL: Home work assignments PVL have to be satisfied before the examination.		
	Voraussetzung für die Vergabe von Leistungspunkten ist das Bestehen der Modulprüfung. Die Modulprüfung umfasst: KA [120 min] PVL: Hausarbeit 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): KA [w: 1]		
Workload:	The workload is 150h. It is the result of 60h attendance and 90h self-studies.		

Data:	MTF. MA. Nr. 3563 / Examination number: 50225	Version: 21.02.2022	Start Year: WiSe 2023
Module Name:	**Melting Technology in Foundries**		
(English):			
Responsible:	Wolf, Gotthard / Prof. Dr.-Ing.		
Lecturer(s):	Dommaschk, Claudia / Dr.-Ing. Keßler, Andreas / Dr.-Ing.		
Institute(s):	Foundry Institute		
Duration:	1 Semester(s)		
Competencies:	- Acquirement of knowledge of ferrous and nonferrous alloys in views of heat treatment and metallurgy of melt - Students are able to apply the knowledge in the working life.		
Contents:	Metallurgy of cast iron, cast steel and nonferrous alloys; Design and function of melting furnaces; Melt treatment of ductile iron; melt treatment and degasing of aluminium alloys; Quality inspection of melts; Metallurgical caused casting defects		
Literature:	J. Campbell: Castings. Butterworth-Heinemann, 1991		
Types of Teaching:	S1 (WS): Lectures (3 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: KA [90 min]		
	Voraussetzung für die Vergabe von Leistungspunkten ist das Bestehen der Modulprüfung. Die Modulprüfung umfasst: KA [90 min]		
Credit Points:	5		
Grade:	The Grade is generated from the examination result(s) with the following weights (w): KA [w: 1]		
Workload:	The workload is 150h. It is the result of 45h attendance and 105h self-studies.		

Data:	OPMAN. MA. Nr. 2970 / Examination number: 61304	Version: 06.07.2015	Start Year: WiSe 2016
Module Name:	**Operations Management**		
(English):			
Responsible:	Höck, Michael / Prof. Dr.		
Lecturer(s):	Höck, Michael / Prof. Dr.		
Institute(s):	Professor of Industrial Management, Production Management and Logistics		
Duration:	1 Semester(s)		
Competencies:	Foremost, the module aims to convey to the student problem-solving competencies with a view to putting the student in a position to analyse the complex questions in operations management, to structure them, and to develop solution alternatives.		
Contents:	This course addresses the management of operations in manufacturing and service firms. Diverse activities, such as determining the size and type of production process, purchasing the appropriate raw materials, planning and scheduling the flow of materials and the nature and content of inventories, assuring product quality, and deciding on the production hardware and how it gets used, comprise this function of the company. Managing operations well requires both strategic and tactical skills. During the term, we will consider such topics as: process analysis, workforce issues, materials management, quality and productivity, technology, and strategic planning, together with relevant analytical techniques. This course will provide a survey of these issues.		
Literature:	Davis, M. & Heineke, J. (2005): Operations Management, 5/e, McGraw-Hill Cachon & Terwiesch (2006): Matching Supply and Demand, McGraw-Hill Stevenson (2007): Operations Management, 9/e, McGraw-Hill.		
Types of Teaching:	S1 (WS): Lectures (2 SWS) S1 (WS): Exercises (2 SWS)		
Pre-requisites:	**Recommendations:** None		
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: KA [90 min] PVL: Case Studies PVL have to be satisfied before the examination.		
	Voraussetzung für die Vergabe von Leistungspunkten ist das Bestehen der Modulprüfung. Die Modulprüfung umfasst: KA [90 min] PVL: Fallstudien 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): KA [w: 1]		
Workload:	The workload is 180h. It is the result of 60h attendance and 120h self-studies. Self-study consists of preparation and review of the lectures, independent work on case studies, as well as preparation for the written test.		

Data:	PET. MA. Nr. 3361 / Examination number: 62401	Version: 14.07.2016	Start Year: SoSe 2016
Module Name:	**Plant Economics and Technology**		
(English):			
Responsible:	Glöser-Chahoud, Simon / Prof.		
Lecturer(s):	Glöser-Chahoud, Simon / Prof.		
Institute(s):	Corporate Sustainability and Environmental Management		
Duration:	1 Semester(s)		
Competencies:	The students are enabled to understand the techno-economic issues associated with the planning and operation of industrial plants. This comprises also linked topics of technology assessment and management. After completion of this module the students are able to characterise plant economic tasks and apply exemplary methods to fulfill these. Major competences include: estimation of capital expenditure (CAPEX), calculation of operational costs (OPEX), investment appraisal, location planning, project management.		
Contents:	• Introduction to Plant Economics and Technology • Life cycle of industrial plants • Analysis and modelling of industrial production systems • Project management in engineering • Network and facility location planning • Process design • Investment estimation • Cost estimation • Plant and process optimisation • Maintenance and repair • Quality Management • Re-location, dismantling and recycling • Technology assessment and management		
Literature:	Recommended reading: 1. Peters/Timmmerhaus/West (2003): Plant Design and Economic for Chemical Engineers, McGrawHill 2. Chauvel (2003): Manual of Process Economic Evaluation, Edition Technip 3. Couper (2003): Process engineering economics, Marcel Dekker Inc Further literature recommendations will be given in the lecture.		
Types of Teaching:	S1 (SS): Lectures (2 SWS) S1 (SS): Lectures (2 SWS)		
Pre-requisites:			
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: PVL: Assignments KA [90 min] PVL have to be satisfied before the examination.		
	Voraussetzung für die Vergabe von Leistungspunkten ist das Bestehen der Modulprüfung. Die Modulprüfung umfasst: PVL: Aufgaben KA [90 min] 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): KA [w: 1]
Workload:	The workload is 180h. It is the result of 60h attendance and 120h self-studies.

Data:	PATA. MA. Nr. 3536 / Examination number: 51014	Version: 07.10.2015	Start Year: WiSe 2015
Module Name:	**Practical Aspects of Thermodynamic Analysis**		
(English):			
Responsible:	Leineweber, Andreas / Prof. Dr. rer. nat. habil.		
Lecturer(s):	Fabrichnaya, Olga / Dr.		
Institute(s):	Institute of Materials Science		
Duration:	1 Semester(s)		
Competencies:	The module provides the knowledge about the diverse experimental approaches for phase diagram constructions. Students will be able to apply thermodynamic calculations for interpretation of thermal analysis data and perform thermodynamic simulation of non-equilibrium processes. They will learn how to apply phase diagrams for development of ceramic and composite materials.		
Contents:	1. Basics of thermal analysis, DTA/HF-DSC, unary systems – application for temperature and enthalpy calibration. 2. Analysis of DTA data for binary alloys – relations to thermodynamics (equilibrium – Scheil approach), eutectic and peritectic reactions, ternary systems. 3. DSC application for heat capacity measurements, other methods 4. Methods for phase equilibrium studies. Influence of kinetics. 5. Applications of phase diagrams for advanced ceramics and composites: directionally solidified eutectic, TBC etc. Practicums: calculations of latent heat – equilibrium case and Scheil approach, calculations of T-zero lines and para-equilibrium, Scheil with fast diffusing elements		
Literature:	Methods for phase diagram determination, J.-C. Zhao (Ed) Elsevier Science (2007) J. LLorca, V. M. Orera “Directionally solidified eutectic ceramic oxides”, Progress in Materials Science 51 (2006) 711-809. Phase diagrams in advanced ceramics. A volume of the treatise on Materials Science and technology. Ed. A.M. Alper, Academic press, Elsevier (1995) Thermo-Calc Examples, TC AB Stockholm, Sweden (2006)		
Types of Teaching:	S1 (WS): Lectures (2 SWS)		
Pre-requisites:	**Recommendations:** Grundlagen der Werkstoffwissenschaft II, 2015-03-30 Grundlagen der Werkstoffwissenschaft I, 2015-03-30		
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: MP/KA (KA if 10 students or more) [MP minimum 30 min / KA 90 min]		
	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]		
Credit Points:	3		
Grade:	The Grade is generated from the examination result(s) with the following weights (w): MP/KA [w: 1]		
Workload:	The workload is 90h. It is the result of 30h attendance and 60h self-studies.		

Data:	PCM MA. Nr. 3582 (for students of TAIM only) / Examination number: 50933	Version: 17.06.2019	Start Year: SoSe 2018
Module Name:	**Practical Course Metallurgy**		
(English):			
Responsible:	Volkova, Olena / Prof. Dr.-Ing.		
Lecturer(s):	Heller, Hans-Peter. / Dr.-Ing. Kreschel, Thilo / Dr.-Ing. Gutte, Heiner / Dr.		
Institute(s):	Institute of Iron and Steel Technology		
Duration:	1 Semester(s)		
Competencies:	Upon successful completion of the module, the students will have ready-to-use practical knowledge of iron and steel processing, testing and application, heating, melting, solidification, thermophysical properties of melted steels and slag. This knowledge enables the students to independently evaluate and solve application-oriented engineering problems.		
Contents:	Thermoelectrically temperature measurements, optical temperature measurements, reduction of iron ores, heating and melting by induction, electro slag remelting, solidification of metals, ladle stirring by inert gas, metallurgical analysis I, metallurgical analysis II, metallurgical analysis III, EMF-measurement in liquid steel, thermophysical properties of slag and metals.		
Literature:	• F. Oeters, Metallurgy of steelmaking, Verlag Stahleisen GmbH, Berlin 1994 • A. Babich, D. Senk, H.W. Gudenau, Ironmaking, Verlag Stahleisen GmbH, Duesseldorf, 2016 • S. Seetharaman, TREATISE ON PROCESS METALLURGY, Volume 3: Industrial Processes, Part A, Elsevier, 2014		
Types of Teaching:	S1 (SS): Practical Application (5 SWS)		
Pre-requisites:	**Recommendations:** Knowledge in chemistry, natural science or other relevant areas.		
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: AP: Preparation and execution of the experiments incl. lab report		
	Voraussetzung für die Vergabe von Leistungspunkten ist das Bestehen der Modulprüfung. Die Modulprüfung umfasst: AP: Vorbereitung und Durchführung der Experimente incl. Laborbericht		
Credit Points:	5		
Grade:	The Grade is generated from the examination result(s) with the following weights (w): AP: Preparation and execution of the experiments incl. lab report [w: 1]		
Workload:	The workload is 150h. It is the result of 75h attendance and 75h self-studies.		

Data:	RecSRM. MA. Nr. / Examination number: -	Version: 27.11.2024	Start Year: WiSe 2025
Module Name:	**Recycling – Secondary Raw Materials**		
(English):			
Responsible:	Peuker, Urs Alexander / Prof. Dr.-Ing. Charitos, Alexandros / Prof.		
Lecturer(s):	Peuker, Urs Alexander / Prof. Dr.-Ing. Charitos, Alexandros / Prof.		
Institute(s):	Institute of Mechanical Process Engineering and Mineral Processing Institute of 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. • Waste regulation • Logistics / quality control • Shredding • Mechanical sorting (magnetic, electrostatic, eddy current, density, sensor based, ...) • Metallurgical • Emissions 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: • Battery recycling • ELV recycling • Plastics recycling • Non-ferrous metal recycling • Aluminum recycling • Tin recycling • Slag recycling • 1-2 additional topics		
Literature:	H. Martens, D. Goldmann, Recyclingtechnik, Springer, Berlin, 2016 H. Schubert: Handbuch der Mechanischen Verfahrenstechnik, Wiley-VCH, Weinheim, 2003 Selected scientific papers		
Types of Teaching:	S1 (WS): Lectures (3 SWS) S1 (WS): Seminar (1 SWS)		
Pre-requisites:	**Recommendations:** Module or Microcredential Training in Particle Technology; Grundlagen der Mechanischen Verfahrenstechnik; Mechanische Verfahrenstechnik		
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:		

	MP/KA (KA if 8 students or more) [MP minimum 20 min / KA 150 min] PVL: report 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 8 und mehr Teilnehmern) [MP mindestens 20 min / KA 150 min] PVL: Bericht 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): MP/KA [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:	RESMGT. MA. Nr. 2082 / Examination number: 62407	Version: 31.05.2018	Start Year: WiSe 2016
Module Name:	**Resource Management**		
(English):			
Responsible:	Glöser-Chahoud, Simon / Prof.		
Lecturer(s):	Glöser-Chahoud, Simon / Prof.		
Institute(s):	Corporate Sustainability and Environmental Management		
Duration:	1 Semester(s)		
Competencies:	Students • explain the resource related corporate management tasks, structure these, • use selected tools and methods and • explain the interplay between resource management and related tasks such as operations and supply chain management.		
Contents:	The course deals with the field of resource management from a industrial perspective. This comprises resource related management tasks, methods and tools to solve these and how they are embedded within functions and processes of companies. Thereby the focus lies on repetition factors mineral raw materials and energy carriers, renewable raw materials and energy carriers as well as secondary raw materials and energy carriers.		
Literature:	Bausch (2009): Handbook Utility Management, Springer Thiede (2012): Energy Efficiency in Manufacturing Systems, Springer Thonemann (2015): Operations Management, Pearson Vrat (2014): Materials Management, Springer Wagner, Enzler (2006) Material Flow Management, Physica		
Types of Teaching:	S1 (WS): Lectures (2 SWS) S1 (WS): 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. The module exam contains: AP*: Case study with oral presentation KA* [90 min] * 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: AP*: Fallstudie mit mdl. Präsentation KA* [90 min] * Bei Modulen mit mehreren Prüfungsleistungen muss diese Prüfungsleistung bestanden bzw. mit mindestens "ausreichend" (4,0) bewertet sein.		
Credit Points:	6		
Grade:	The Grade is generated from the examination result(s) with the following weights (w): AP*: Case study with oral presentation [w: 1] KA* [w: 4] * 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 180h. It is the result of 60h attendance and 120h self-studies.

Data:	SciW. BA. Nr. / Examination number: 45403	Version: 11.11.2020	Start Year: SoSe 2022
Module Name:	**Scientific Work: Organization, Management and Reporting**		
(English):			
Responsible:	Fuhrmann, Sindy / Prof. Dr.-Ing.		
Lecturer(s):	Fuhrmann, Sindy / Prof. Dr.-Ing.		
Institute(s):	Institute of Glass Science and Technology		
Duration:	1 Semester(s)		
Competencies:	The students get to know the basic processes of a scientific research activity within the framework of a thesis and to schedule them in accordance within the standard time conditions. They will be able to carry out a literature search independently and to summarize its results. In the field of scientific presentation, the students develop appropriate methodological skills through self-assessment and self-reflection.		
Contents:	During the module, the students are made familiar with the course and process of conducting scientific work. The focus is on research work in a scientific environment. The main topics include literature research including patent research and citing, the structure of a thesis and the presentation of scientific results. The students are introduced step by step and are actively involved (principle of auturgy) in how to develop scientific questions, their relation and classification to the actual state of the art in literature as well as the organizational planning for the preparation of a thesis. In the module associated seminar “Technologies and Applications of Non-Metallic Materials”, the portfolio work enables an experience-based, targeted, independent development of competence on the subject of presenting scientifically.		
Literature:			
Types of Teaching:	S1 (SS): Lectures (1 SWS) S1 (SS): Exercises (2 SWS) S1 (SS): Seminar (2 SWS)		
Pre-requisites:			
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: AP*: Written summary of a literature search AP*: Portfolio evaluating at least eight scientific presentations and summarizing of at least four scientific discussions * 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: AP*: Written summary of a literature search AP*: Portfolio evaluating at least eight scientific presentations and summarizing of at least four scientific discussions * Bei Modulen mit mehreren Prüfungsleistungen muss diese Prüfungsleistung bestanden bzw. mit mindestens "ausreichend" (4,0) bewertet sein.		
Credit Points:	5		
Grade:	The examination results are not rated. The credits are given when the exams are passed successfully.		
Workload:	The workload is 150h. It is the result of 75h attendance and 75h self-studies. The latter includes the preparation and follow-up of the lectures, exercises and the seminar as well as the preparation of the alternative		

	examinations.

Data:	SSMP MA. / Examination number: 51119	Version: 31.08.2026	Start Year: WiSe 2026
Module Name:	**Simulation of Sustainable Extractive Metallurgical Processes**		
(English):			
Responsible:	Reuter, Markus / Prof. Dr. Charitos, Alexandros / Prof.		
Lecturer(s):	Reuter, Markus / Prof. Dr.		
Institute(s):	Institute of Nonferrous Metallurgy and Purest Materials		
Duration:	1 Semester(s)		
Competencies:	1. Simulation of reactor types • modelling and simulation of hydro- and pyrometallurgical reactors for primary and secondary resources and determination of mass and energy balances as well as minerals processing • determination of ecological and economic footprint of reactors 2. Modelling of processing flowsheets • develop processing flowsheets for non-ferrous metal containing resources • modelling and simulation of hydro- and pyrometallurgical processing plants for primary and secondary non-ferrous resources as well as minerals processing • determination of mass and energy balances of the complete flowsheet and determine optimal processing routes • determination of ecological and economic footprint of complete flowsheets 3. Methods and tools • use of simulation tools such as HSC Sim 9.0, FACTSAGE etc. and environmental software tools such as GaBi to evaluate different processing options • create process designs and communicate results to a client and/or stakeholders e.g. NGOs		
Contents:	Reactor types in process metallurgy and minerals processing (e.g. TSL, Kaldo, flash smelting, QSL, flotation cells etc.) will be compared using simulation cases, evaluated and optimised for metal and minor metal recovery. The environmental footprint as also the economic performance of each reactor type will be compared with each other to establish best options for reactor flotation types as a function of feed types. The student will understand minerals processing and metallurgical reactor technology better and also be in a better position to create more sustainable industry and society. Process design cases will be performed by the students to optimally process different feed types. By using a wider range of reactor types the student will be able to simulate complete flowsheets, provide mass and energy balances at the same time also determine the environmental footprint as well as economic analysis. This course will also examine the impact of product design on the recycling of various end-of-life products such as mobile phones etc. Thus, not only will natural resources be processed in the simulated systems but also materials from the “urban mine”. Therefore, this course will also use this rigorous simulation basis to critically discuss environmental legislation as well as communicate		

	these results to all stakeholders. The course takes place as a 2 week block course in December.
Literature:	• E. Worrell, M.A. Reuter (2014): Handbook of Recycling, Elsevier BV, Amsterdam, 595p. (ISBN 978-0-12-396459-5). • M.A. Reuter, R. Matusewicz, A. van Schaik (2015): Lead, Zinc and their Minor Elements: Enablers of a Circular Economy World of Metallurgy – ERZMETALL 68 (3), 132-146. • M.A. Reuter, A. van Schaik, J. Gediga (2015): Simulation-based design for resource efficiency of metal production and recycling systems, Cases: Copper production and recycling, eWaste (LED Lamps), Nickel pig iron, International Journal of Life Cycle Assessment, 20(5), 671-693. • M.A. Reuter, I. Kojo (2014): Copper: A Key Enabler of Resource Efficiency, World of Metallurgy – ERZMETALL 67 (1), 46-53 (Summary of plenary lecture Copper 2013). • S. Creedy, A. Glinin, R. Matusewicz, S. Hughes, M.A. Reuter (2013): Outotec® Ausmelt Technology for Treating Zinc Residues, World of Metallurgy – ERZMETALL, 66(4), 230-235. • M.A.H. Shuva, M.A. Rhamdhani, G. Brooks, S. Masood, M.A. Reuter (2016): Thermodynamics data of valuable elements relevant to e-waste processing through primary and secondary copper production - a review, J. Cleaner Production, 131, 795-809. • M.A. Reuter (2016): Digitalizing the Circular Economy - Circular Economy Engineering defined by the metallurgical Internet of Things-, 2016 TMS EPD Distinguished Lecture, USA, Metallurgical Transactions B, 47(6), 3194-3220 (http://link.springer.com/article/10.1007/s11663-016-0735-5). • I. Rönnlund, M.A. Reuter, S. Horn, J. Aho, M. Päällysaho, L. Ylimäki, T. Pursula (2016): Sustainability indicator framework implemented in the metallurgical industry: Part 1-A comprehensive view and benchmark & Implementation of sustainability indicator framework in the metallurgical industry: Part 2-A case study from the copper industry, International Journal of Life Cycle Assessment, 21(10), 1473-1500 & 21(12), 1719-1748.
Types of Teaching:	S1 (WS): Block course / Lectures (1 SWS) S1 (WS): Block course / Seminar (2 SWS) S1 (WS): Block course / Practical Application (2 SWS)
Pre-requisites:	**Recommendations:** Basic thermodynamic, thermodynamic and kinetic knowledge in process metallurgy
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: AP: Report of simulation The student should solve a case/example and hand in the computer file as a document.
	Voraussetzung für die Vergabe von Leistungspunkten ist das Bestehen der Modulprüfung. Die Modulprüfung umfasst: AP: Simulationsbeleg Der Student soll einen Fall/Beispiel lösen und die Computerdatei als Dokument einreichen.
Credit Points:	6

Grade:	The Grade is generated from the examination result(s) with the following weights (w): AP: Report of simulation [w: 1]
Workload:	The workload is 180h. It is the result of 75h attendance and 105h self-studies.

Data:	SPST. MA. Nr. 3568 / Examination number: 50927	Version: 17.06.2019	Start Year: SoSe 2018
Module Name:	**Special Steel Technology**		
(English):			
Responsible:	Volkova, Olena / Prof. Dr.-Ing.		
Lecturer(s):	Volkova, Olena / Prof. Dr.-Ing.		
Institute(s):	Institute of Iron and Steel Technology		
Duration:	1 Semester(s)		
Competencies:	Upon successful completion of the module, the students will have in-depth knowledge of the equipment and technology of steel casting and special steel treatment processes. This knowledge enables the students to independently solve engineering problems of relevance.		
Contents:	Secondary Steelmaking, Alloying, Mixing, Gas Stirring, Deoxidation, Desulfurization, Degassing, Hydrogen and Nitrogen, Decarburization, Dephosphorization, Reoxidation, Vacuum Methods, Heating, Chemical Heating, Ladle Furnace, Heat Balance During Ladle Charge, Non-Metallic Inclusions, Control of the Composition of Nonmetallic Inclusions, Removal of Non-Metallic Inclusions, Slag Management, AOD Process for Stainless Steel, Electro Slag Remelting, Slag, Fundamentals of Solidification, Ingot Casting of Steel, Continuous Casting of Steel, Mold, Mold Fluxes, Heat Transfer in the Mold, Tundish, Non-Metallic Inclusions Behavior during Continuous Casting, Near Net Shape Casting		
Literature:	• F. Oeters, Metallurgy of steelmaking, Verlag Stahleisen GmbH, Berlin 1994 • G. Stolte, Secondary Metallurgy, Verlag Stahleisen GmbH, Düsseldorf 2002 • S. Seetharaman, TREATISE ON PROCESS METALLURGY, Volume 3: Industrial Processes, Part A, Elsevier, 2014		
Types of Teaching:	S1 (SS): Lectures (3 SWS) S1 (SS): Seminar (1 SWS)		
Pre-requisites:	**Recommendations:** Knowledge in chemistry, natural science or other relevant areas.		
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: KA [90 min]		
	Voraussetzung für die Vergabe von Leistungspunkten ist das Bestehen der Modulprüfung. Die Modulprüfung umfasst: KA [90 min]		
Credit Points:	6		
Grade:	The Grade is generated from the examination result(s) with the following weights (w): KA [w: 1]		
Workload:	The workload is 180h. It is the result of 60h attendance and 120h self-studies.		

Data:	ST MA. Nr. 3600 / Examination number: 50932	Version: 17.06.2019	Start Year: SoSe 2019
Module Name:	**Steel Application**		
(English):			
Responsible:	Volkova, Olena / Prof. Dr.-Ing.		
Lecturer(s):	Wendler, Marco / Dr.-Ing.		
Institute(s):	Institute of Iron and Steel Technology		
Duration:	1 Semester(s)		
Competencies:	The students acquire the knowledge of the application-related properties, in particular mechanical properties, of steels. Upon successful completion of the module, the students are familiar with the criteria and considerations in the design of the chemical composition and thermomechanical processing for various structural and engineering applications. The student can apply their knowledge to select steels with a broad range of properties from soft formable steels to advanced high-strength steels for more demanding applications.		
Contents:	Classification of steels based on the application area, thermomechanical processing of the following classes of steels to adjust the required properties: formable sheet steels, engineering quenched and tempered steels, structural steels, pearlitic steels, surface-treated steels, tool steels, electrical steels, and high Mn steels		
Literature:	B.C. De Cooman, J. Speer, Fundamentals of Steel Product Physical Metallurgy, Assn. of Iron and Steel Engineers, 1st Ed., 2011. Werkstoffkunde Stahl, Volume 2: Application, Springer Verlag, 1985.		
Types of Teaching:	S1 (SS): Lectures (2 SWS) S1 (SS): Seminar (1 SWS)		
Pre-requisites:	**Recommendations:** Knowledge of the fundamentals of Materials Science and Engineering		
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: KA [90 min]		
	Voraussetzung für die Vergabe von Leistungspunkten ist das Bestehen der Modulprüfung. Die Modulprüfung umfasst: KA [90 min]		
Credit Points:	4		
Grade:	The Grade is generated from the examination result(s) with the following weights (w): KA [w: 1]		
Workload:	The workload is 120h. It is the result of 45h attendance and 75h self-studies.		

Data:	SCM. MA. Nr. 937 / Examination number: 61305	Version: 06.07.2015	Start Year: SoSe 2016
Module Name:	**Supply Chain Management**		
(English):			
Responsible:	Höck, Michael / Prof. Dr.		
Lecturer(s):	Höck, Michael / Prof. Dr.		
Institute(s):	Professor of Industrial Management, Production Management and Logistics		
Duration:	1 Semester(s)		
Competencies:	In this course students will view the supply chain from the point of view of a general manager. Logistics and supply chain management is all about managing the hand-offs in a supply chain - hand-offs of either information or product. The design of a logistics system is critically linked to the objectives of the supply chain. Our goal in this course is to understand how logistical decisions impact the performance of the firm as well as the entire supply chain. The key will be to understand the link between supply chain structures and logistical capabilities in a firm or supply chain.		
Contents:	Supply Chain Management (SCM) deals with the planning, implementing and controlling of efficient flow and storage of raw materials, in-process inventory, finished goods, and related information from point of origin to point of consumption. Issues discussed in the course will include the total logistics cost approach, supply chain network design and optimizing the overall performance. Effective logistics systems aim towards coordination of transportation, inventory positioning and supply contracts to provide quick service efficiently.		
Literature:	Chopra, S.; Meindl, P. (2006): Supply Chain Management, 3rd Ed., Pearson Prentice Hall, New York. Cachon, G.; Terwiesch, C. (2006): Matching Supply with Demand, McGraw-Hill, Boston.		
Types of Teaching:	S1 (SS): Lectures (2 SWS) S1 (SS): Exercises (2 SWS)		
Pre-requisites:			
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: KA [90 min] PVL: Case Studies PVL have to be satisfied before the examination.		
	Voraussetzung für die Vergabe von Leistungspunkten ist das Bestehen der Modulprüfung. Die Modulprüfung umfasst: KA [90 min] PVL: Fallstudien 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): KA [w: 1]		
Workload:	The workload is 180h. It is the result of 60h attendance and 120h self-studies. Letzteres umfasst Vor- und Nachbereitung der Vorlesungen, die selbständige Bearbeitung von Fallstudien sowie die Vorbereitung auf die Klausur.		

Data:	TIS. MA. Nr. 3564 / Examination number: 50926	Version: 22.06.2026	Start Year: WiSe 2026
Module Name:	**Technology of Iron and Steel**		
(English):			
Responsible:	Volkova, Olena / Prof. Dr.-Ing.		
Lecturer(s):	Gutte, Heiner / Dr.		
Institute(s):	Institute of Iron and Steel Technology		
Duration:	1 Semester(s)		
Competencies:	Upon successful completion of the module, the students will have ready-to-use knowledge of the crude iron production, alternative technologies of iron- and steelmaking, and the chemical reactions involved. This knowledge enables the students to independently evaluate and solve application-oriented engineering problems.		
Contents:	Ironmaking, Ore Preparation, Coke, Blast Furnace Process, Blast Furnace Reactions, Injectants, Behavior of Minor Elements and Impurities, Formation of Hot Metal and Slag, Energy and Materials Balance of Blast Furnace, DRI Processes, Smelting Reduction Processes, New Developments of Ironmaking Technologies, Hot Metal Pretreatment, Converter Steelmaking, Process Phenomena in Converter Steelmaking, Slag Formation, Postcombustion, Reactions in Converter Process, Energy and Materials Balance of Converter Process, Electric Furnace Steelmaking, AC and DC Furnaces, Electrodes, Foaming Slag, Energy and Materials Balance of EAF Process, Special Furnace Constructions, Hybrid Process for Steelmaking of Scrap and Hot Metal, Secondary Steelmaking, Continuous Casting of Steel		
Literature:	• F. Oeters, Metallurgy of steelmaking, Verlag Stahleisen GmbH, Berlin 1994 • A. Babich, D. Senk, H.W. Gudenau, Ironmaking, Verlag Stahleisen GmbH, Duesseldorf, 2016 • S. Seetharaman, TREATISE ON PROCESS METALLURGY, Volume 3: Industrial Processes, Part A, Elsevier, 2014		
Types of Teaching:	S1 (WS): Lectures (3 SWS)		
Pre-requisites:	**Recommendations:** Knowledge in chemistry, natural science or other relevant areas.		
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: KA [90 min]		
	Voraussetzung für die Vergabe von Leistungspunkten ist das Bestehen der Modulprüfung. Die Modulprüfung umfasst: KA [90 min]		
Credit Points:	5		
Grade:	The Grade is generated from the examination result(s) with the following weights (w): KA [w: 1]		
Workload:	The workload is 150h. It is the result of 45h attendance and 105h self-studies.		

Data:	THT. MA. Nr. / Examination number: 41215	Version: 29.08.2017	Start Year: WiSe 2018
Module Name:	**Thermodynamics and Heat Transfer**		
(English):			
Responsible:	Fieback, Tobias / Prof. Dr. Ing.		
Lecturer(s):	Fieback, Tobias / Prof. Dr. Ing.		
Institute(s):	Institute of Thermal Engineering		
Duration:	1 Semester(s)		
Competencies:	- knowledge of basic thermodynamic principles - appyling of those principles to beginner level thermodynamic processes - getting a brief understanding of heat and mass transfer processes		
Contents:	- Fundamentals of thermodynamics (equations of state, reversible processes, system boundaries) - First and second law of thermodynamics - Thermodynamic properties of pure fluid substances - Thermodynamic investigation of cycle processes (carnot, clausius-rankine, ...) - Thermodynamics of simple mixtures (humid air) - Basic introductions to heat and mass transfer processes		
Literature:	- The Laws of Thermodynamics: A Very Short Introduction; Peter W. Atkins (just for getting started) - Thermodynamik: Grundlagen und technische Anwendungen; H.D. Baehr / S. Kabelac (German) - VDI-Wärmeatlas (Thermodynamic Properties in German)		
Types of Teaching:	S1 (WS): Lecture / Lectures (1 SWS) S1 (WS): Exercise / 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. The module exam contains: MP/KA (KA if 10 students or more) [MP minimum 40 min / KA 120 min]		
	Voraussetzung für die Vergabe von Leistungspunkten ist das Bestehen der Modulprüfung. Die Modulprüfung umfasst: MP/KA (KA bei 10 und mehr Teilnehmern) [MP mindestens 40 min / KA 120 min]		
Credit Points:	4		
Grade:	The Grade is generated from the examination result(s) with the following weights (w): MP/KA [w: 1]		
Workload:	The workload is 120h. It is the result of 45h attendance and 75h self-studies.		

Data:	TM. MA. Nr. 3222 / Examination number: 51022	Version: 09.07.2024	Start Year: WiSe 2024
Module Name:	**Thermodynamics of Materials**		
(English):			
Responsible:	Leineweber, Andreas / Prof. Dr. rer. nat. habil.		
Lecturer(s):	Fabrichnaya, Olga / Dr.		
Institute(s):	Institute of Materials Science		
Duration:	1 Semester(s)		
Competencies:	The students understand thermodynamic properties of materials and are able to apply calculation methods of phase diagrams.		
Contents:	Most important topics are: Thermodynamic laws and quantities Thermodynamic properties of materials Calculation of complex equilibria in multiphase and multicomponent systems Optimization of phase diagrams		
Literature:	Mats Hillert, “Phase equilibria, phase diagrams and phase transformations”, 2nd Ed., Cambridge (2009) Robert de Hoff, “Thermodynamics in Materials Science", 2nd Ed., Taylor & Francis (2006) Hans Leo Lukas, Suzana Fries, Bo Sundman, “Computational Thermodynamics, the CALPHAD method”, Cambridge (2007)		
Types of Teaching:	S1 (WS): Lectures (2 SWS) S1 (WS): Seminar (1 SWS)		
Pre-requisites:	**Recommendations:** Background in physical chemistry and materials science		
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: MP/KA (KA if 6 students or more) [MP minimum 30 min / KA 120 min] PVL: task exercises (in the seminar) 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 6 und mehr Teilnehmern) [MP mindestens 30 min / KA 120 min] PVL: Übungsaufgaben 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): MP/KA [w: 1]		
Workload:	The workload is 120h. It is the result of 45h attendance and 75h self-studies.		

Data:	TFD. MA. Nr. / Examination number: -	Version: 29.01.2025	Start Year: WiSe 2018
Module Name:	**Training in Fluid Dynamics**		
(English):			
Responsible:	Schwarze, Rüdiger / Prof. Dr.-Ing.		
Lecturer(s):	Schwarze, Rüdiger / Prof. Dr.-Ing. Bauer, Katrin / Dr. Ing. Heinrich, Martin / Dr. Ing.		
Institute(s):	Institute of Mechanics and Fluid Dynamics		
Duration:	1 Semester(s)		
Competencies:	Students shall recapitulate important principles and corresponding fundamental equations of fluid dynamics. They shall learn the ability to apply their knowledge to flow problems of technical importance. Typical solutions strategies for such problems are trained.		
Contents:	A review of the main concepts of fluid dynamics, e.g. streamline flow, laminar and turbulent flow as well as boundary layers are reviewed. The applications of these concepts for the decription and solution of technical flow problems are discussed and trained.		
Literature:	J. F. Douglas et al.: Fluid Mechanics. Harlow: Pearson Education, 2001 M. C. Potter and D. C. Wiggert: Mechanics of Fluids. London: Prentice-Hall, 1997		
Types of Teaching:	S1 (WS): Lectures (1 SWS) S1 (WS): Exercises (2 SWS)		
Pre-requisites:	**Recommendations:** Knowledge in physics for engineers and fundamentals of fluid dynamics		
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: KA [90 min]		
	Voraussetzung für die Vergabe von Leistungspunkten ist das Bestehen der Modulprüfung. Die Modulprüfung umfasst: KA [90 min]		
Credit Points:	4		
Grade:	The Grade is generated from the examination result(s) with the following weights (w): KA [w: 1]		
Workload:	The workload is 120h. It is the result of 45h attendance and 75h self-studies.		

Data:	TPT. MA. Nr. / Examination number: 40316	Version: 05.03.2024	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 Peuker, Urs Alexander / Prof. Dr.-Ing.		
Institute(s):	Institute of Mechanical Process Engineering and Mineral Processing		
Duration:	1 Semester(s)		
Competencies:	This module is designed to introduce or review the core principles of particle technology. It utilizes specialized exercises aimed at honing scientific and technological skills in calculating particle size distributions and understanding fundamental micro-processes. Furthermore, the module introduces the physical principles governing mechanical micro-processes. Through a series of exercises and case studies, students will learn to apply these fundamental approaches in describing and designing process equipment on a level of conceptional engineering.		
Contents:	Particle characterization Particle size distribution Mixing of particle size distributions Separation of particle size distributions (classification) Micro processes in particle technology • Particles in flow-fields (i.e. sedimentation) • Flow through porous media • Particle-particle interactions (e.g. van-der-Waals-forces, electrostatic interactions, DLVO-theory, capillary forces) • Breakage laws (i.e. breakage energy) Selected case studies form the fields: • Filtration • Sedimentation • Agglomeration • Classification • Comminution • And others		
Literature:	M. Stieß: Mechanische Verfahrenstechnik 1 - Partikeltechnologie, Springer-Verlag, Berlin, Heidelberg, 2009 H. Schubert: Handbuch der Mechanischen Verfahrenstechnik, Wiley-VCH, Weinheim, 2003 selected scientific papers		
Types of Teaching:	S1 (WS): Recall of fundamentals - (lecture also digital available every semester - provided as screencasts) / Lectures (1 SWS) S1 (WS): Application of fundamentals - case studies - corresponding excercise to apply the theoretical equations and solutions / 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. The module exam contains: KA: written exam [120 min] PVL: test (midterm) The PVL is integrated in the lecture / excercise in the midterm of the lecture series.		

	PVL have to be satisfied before the examination.
	Voraussetzung für die Vergabe von Leistungspunkten ist das Bestehen der Modulprüfung. Die Modulprüfung umfasst: KA: written exam [120 min] PVL: Testat Die PVL wird in die Übungen innerhalb des Semesters integriert. 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): KA: written exam [w: 1]
Workload:	The workload is 120h.

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