Studiengang: *Program:*	**Master of Science Maschinenbau** *Master of Science in Mechanical Engineering*			FACH HOCHSCHULE LÜBECK University of Applied Sciences
1 Modul: *Module:*	**Material Science** *Werkstoffkunde Metalle*			**English** *Englisch*
	Semester *Semester*	**Dauer** *Duration*	**Status** *Status*	**Turnus** *Regular cycle*
	1. Semester	1 Semester	compulsory	annual
	Kreditpunkte *Credits*	**Aufwand** *Workload*	**Kontaktzeit** *Contact-hours*	**Selbststudium** *Student's efforts*
	5 ECTS	150h	4hrs/week = 60hrs lecture	30h preparation 30h exercises 30h exam preparation

2 Beschreibung
Description

For adequate material selection engineers need the knowhow of material types and properties. In order to develop or optimize materials, engineers also need to understand background theories of materials.
In this course the physical basis for the understanding of metallic materials is presented and brought into a context of typical applications.
This lecture is a portfolio lecture, which comprises two parts: In one part the students capture knowhow in material properties for modern applications on a self-learning base. The second part the students learn important material topics in class room sessions.

3 Lernziele
Learning Outcomes

- The students will improve their theoretical understanding of the mechanical properties and behaviour of metals.
- The students will be able to select materials based on better understanding of the correlation of properties, microstructure and alloy composition.
- The students will have a sound basis for scientific work in the field of improvement of existing materials and the development of new materials.

4 Schlüsselqualifikationen
Key qualifications

Sozialkompetenz *Social Competence*	Methodenkompetenz *Competence in Methods*	Selbstkompetenz / Personenkompetenz *Self-Competence Personal Competence*	Interkulturelle Kompetenz *Intercultural Competence*	Medienkompetenz *Media-Competence*
	X	X	X	X

5 Lehrveranstaltung/ -methoden
Course type and methods

This portfolio lecture comprises two parts:

- Part 1 (40%): Semester accompanied self-depended working on tasks, goal achievement by a semester report
- Part 2 (60%): Class room teaching through the semester with a written exam in the end of the semester

6 Vorbedingungen / Vorkenntnisse
Prerequisites

- Very good knowledge of basic material science (properties, structures and testing) based on Bachelor studies
- Basic course of chemistry, physics, thermodynamics, process technologies

7 Arbeitsmittel / Literatur
Required material / Literature

- U. Täck: Material Science, Script University of Applied Science Lübeck
- W. D. Callister: Materials Science and Engineering, an Introduction, John Wiley & Sons, Inc.
- J. Roesler et.al.: Mechanical Behaviour of Engineering Materials, Springer
- P. Haasen: Physical Metallurgy, Cambridge University Press
- V. Läpple: Werkstofftechnik Maschinenbau, Europa Lehrmittel
- G. Gottstein: Physikalische Grundlagen der Materialkunde, Springer
- R. Bürgel: Festigkeitslehre und Werkstoffmechanik, Bd. 1 und Bd. 2, Vieweg

Detailinformationen

8 Inhalte
Course topics

Portfolio Part 1:
Self depending and semester accompanying literature research (meta study) on modern materials, special properties and actual topics
Possible topics (list is not exclusively): magnetism, super plasticity, shape memory, alloys for special applications: high temperatures (Ni base), super light weight (Mg base), biocompatibility (Ti base), metal matrix composits, at the edge to ceramics (MAX phases)

Portfolio Part 2:
Chapters and topics in class room session
1 Steel
1.1 Fe-C Alloy and its constitution: Atomic structure, meaning of C atom, Fe-C phase diagramm, important microstructures and terms
1.2 Cast Steel and cast Iron: solidification of metals, structures and properties cast steel & iron
1.3 Construction steels: Important types and their applications, processing of construction steels: Forming & heat treatment (cold/hot work, plasticity, dislocations, normalization, fine grain hardening), introduction to welding structures
1.4 Tooling steels: Important types amd their application, heat treatment on example of unalloyed steel: hardening, tempering, TTT diagrams, alloyed steels: influence of alloying elements on martensite and carbide formation, properties
1.5 Non corroding steels: Basics of “rusting”, Prevention of corrosion by Chromium additions: passivation, Effect of carbon on Cr-steels: carbide formation, introduction to intercrystalline corrosion, Effect of Nickel on Cr-steels: austenitic steels, thoughness
2 Aluminium Alloys
2.1 Cast aluminium: main alloys: Al-Si, phase diagramm, structures
2.2 Wrought alloys: effect of cold work and heat treatments: soft annealing, recrystallization, Particle hardening on the examples of AlCu and AlMgSi

9 Prüfungsform
Assessment

Portfolio part 1: Semester Report
Portfolio part 2: Exam at end of semester

10 Voraussetzung für die Vergabe von Kreditpunkten
Requirements for granting of credits

- Semester report: acceptable report, exceeding grade 4,0
- Examen: exceeding grade 4,0
- The total grade calculates out of 40 % semester report and 60 % exam

11 Weiterführende Veranstaltungen
Related courses

Surface Engineering and Tribology, Polymer Science, Composites, Advanced Material Testing

12 Zuordnung
Classification

Mathematik & Naturwissenschaft *Mathematics & Natural Sciences*	Ingenieur-wissenschaften *Engineering Science*	Ingenieur-anwendungen *Engineering Application*	Entwicklung & Konstruktion *Design*	Werkstoffe *Material*	Wirtschaft, Management, Sprachen *General Education*	Anderes *Other*
X	X	X	X	X		

13 Modulbeauftragter / Lehrpersonen
Responsible person / Lecturers

Prof. Dr. U. Täck / Prof. Dr. U. Täck

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