Karlsruhe Institute of Technology

Module Handbook
Bachelor Course Mechanical Engineering (B.Sc.)

Winter term 2010/2011
Long version
Date: 29.06.2011

Faculty of Mechanical Engineering

KIT - University of the State of Baden-Wuerttemberg and
National Research Center of the Helmholtz Association

www.kit.edu

Publisher:

Faculty of Mechanical Engineering
Karlsruhe Institute of Technology (KIT)
76128 Karlsruhe
www.mach.kit.edu

Frontpage Image: Rolls-Royce plc

Contact: rainer.schwarz@kit.edu

For informational use only. For legally binding information please refer to the german version of the handbook.

Table of Contents

Studienplan der Fakultät Maschinenbau für den Bachelor of Science- und Master of Science-Studiengang Maschinenbau

Fassung vom 29. Juni 2011

Inhaltsverzeichnis

Änderungshistorie (ab 29.10.2008)

29.10.2008	Änderungen im Abschnitt 1.2 Module des Bachelorstudiums „B.Sc.“: - Prüfungen im Modul 1 - Höhere Mathematik: Getrennte Prüfungen zu HM I und HM II - Prüfungen im Modul 3 - Technische Mechanik: Getrennte Prüfungen zu TM I und TM II - Modul "Schwerpunkt": Umfang des Kernbereichs: 8LP, Umfang des Ergänzungsbereichs: 4 LP
10.12.2008	Änderungen im Abschnitt 1.3 Studienplan des 1. Abschnitts des Bachelorstudiums „B.Sc.“ - Informatik: V, Ü und P finden im ersten Semester statt Änderungen im Abschnitt 1.5 Masterstudium mit Vertiefungsrichtungen - „Es stehen folgende Vertiefungsrichtungen zur Auswahl“ Änderungen im Abschnitt 2.1 Wahlpflichtfächer im Bachelor- und Masterstudiengang - Aufnahme von „Informationssysteme“ als Wahlpflichtfach für BSc, MSc, FzgT, M+M, PEK, PT Änderungen im Abschnitt 2.5 - Umbenennung des „Allgemeinen Wahlfachs“ in „Wahlfach“ Änderungen im Abschnitt 3.1 Fachpraktikum - Tabelle wurde durch Fließtext ersetzt Änderungen im Abschnitt 4 Berufspraktikum - Die Abschnitte der Fachpraktika sollen in einem geschlossenen Zeitraum durchgeführt werden Änderungen im Abschnitt 4.3 Sonderbestimmungen zur Anerkennung - Auf Erwerb gerichtete, berufspraktische Tätigkeiten werden nicht mehr erwähnt Änderungen im Abschnitt 6.1 Zuordnung der Schwerpunkte zum Bachelor- und den Vertiefungsrichtungen des Masterstudiengangs - „Informationsmanagement“ als Schwerpunkt für BSc und FzgT zugelassen - „Lifecycle Engineering“ als Schwerpunkt für BSc zugelassen Änderungen im Abschnitt 6.3 Wahlmöglichkeiten für den Schwerpunkt im „Bachelor of Science“ - Aktualisierung des gesamten Schwerpunkt-Angebotes
	Umbenennung der „Wellenphänomene in der Physik“ in Wellenphänomene in der klassischen Physik Abschnitt 2.1: unter (18) : „Moderne Physik für Ingenieure“ anstelle der „Physik für Ingenieure“, in Abschnitt 2.1 keine Nennung der Dozenten Abschnitt 2.3: unter (11) : „Grundlagen der modernen Physik“ anstelle der „Höheren Physik für Maschinenbau-er“ Einfügung einer Zwischenüberschrift 6.4 mit entsprechender Änderung des Inhaltsverzeichnisses
03.02.2010	Änderungen von Veranstaltungen in den Abschnitten 2.1 bis 2.4 Änderung im Punkt 6.1 - Schwerpunkt 50 „Bahnsystemtechnik“ in Tabelle „Schwerpunkte“ eingefügt. Änderung im Punkt 6.2 - 2. Absatz ergänzt um den Satz: „Stehen mehrere Wahlpflichtfächer (WP) als Auswahlmöglichkeit zur Verfü-gung, muss nur ein Wahlpflichtfach belegt werden.“ Änderungen im Punkt 6.4 - Schwerpunkttabellen ergänzt um die Spalten „Veranstaltungsnummer (VNr)“ und „Leistungspunkte (LP)“. Aktuell vorhandene Daten wurden eingefügt. - Einfügungen und Streichungen von Veranstaltungen in den Schwerpunkten - Schwerpunkt 50 „Bahnsystemtechnik“ eingefügt
07.07.2010	Änderungen im Abschnitt 1.1: Ergänzung der Prüfungsmodalitäten Änderungen im Abschnitt 1.2: Umbenennung des „Workshops Teamkonstruktion“ in „Konstruieren im Team“; Bemerkung zu Erfolgskontrollen in Zusatzmoduln im Bachelorstudium Änderungen im Abschnitt 1.4: Die Bachelorarbeit ist im Anschluss an den ersten Abschnitt zu absolvieren. Änderungen im Abschnitt 1.5: Bemerkung zu Erfolgskontrollen in Zusatzmoduln im Masterstudiumj Änderungen im Abschnitt 2.1: Für manche Schwerpunkte kann die Wahl eines Wahlpflichtfachs empfohlen sein. Aktualisierung der wählbaren Wahlpflichtfächer Änderungen im Abschnitt 2.3 und 2.4: Aktualisierung der wählbaren Wahlfächer Änderungen im Abschnitt 4.1: Grundpraktikum auch an Universitäten und vergleichbaren Einrichtungen möglich Änderungen im Abschnitt 6.1 und 6.2: Zusätzliche Erläuterung zur vertiefungsrichtungsspezifischen Schwerpunktwahl; Maximaler Umfang des Schwerpunkts im Bachelorstudium: 16 statt 14 LP Änderungen im Abschnitt 6.3 und 6.4: Überarbeitung der Formulierungen und Anpassung von SWS an LP Aktualisierung der wählbaren Wahlpflichtfächer Änderungen im Abschnitt 6.4: Aktualisierung des Schwerpunktangebotes
29.06.2011	Änderungen im Abschnitt 1.4.: Ergänzung zu Durchführung Änderungen im Abschnitt 1.5.: Anpassung der Module Änderungen im Abschnitt 2.1.: Aktualisierung der Wahlpflichtfächer Änderungen im Abschnitt 2.3.: Aktualisierung der wählbaren Wahlpflichtfächer Änderungen im Abschnitt 4: Inhaltliche Anpassungen Änderungen im Abschnitt 4.1.: Inhaltliche Anpassung Änderungen im Abschnitt 4.2.: Inhaltliche Anpassung Änderungen im Abschnitt 6.4: Aktualisierung des Schwerpunktangebotes

0 Abkürzungsverzeichnis

Vertiefungsrichtungen:	MSc	Master Maschinenbau (ohne Vertiefung)
	E+U	Energie- und Umwelttechnik
	FzgT	Fahrzeugtechnik
	M+M	Mechatronik und Mikrosystemtechnik
	PEK	Produktentwicklung und Konstruktion
	PT	Produktionstechnik
	ThM	Theoretischer Maschinenbau
	W+S	Werkstoffe und Strukturen für Hochleistungssysteme
Fakultäten:	mach	Fakultät für Maschinenbau
	inf	Fakultät für Informatik
	etit	Fakultät für Elektrotechnik und Informationstechnik
	ciw	Fakultät für Chemieingenieurwesen und Verfahrenstechnik
	phys	Fakultät für Physik
	wiwi	Fakultät für Wirtschaftsingenieurwesen
Semester:	WS	Wintersemester
	SS	Sommersemester
	ww	wahlweise (Angebot im Sommer- und Wintersemester)
Schwerpunkte:	Kat	Kategorie der Fächer im Schwerpunkt
	K, KP	**K**ernmodulfach, ggf. **P**flicht im Schwerpunkt
	E	**E**rgänzungsfach im Schwerpunkt
	EM	**E**rgänzungsfach ist nur im **M**asterstudiengang wählbar
Leistungen:	V	Vorlesung
	Ü	Übung
	P	Praktikum
	LP	Leistungspunkte
	mPr	mündliche Prüfung
	sPr	schriftliche Prüfung
	Gew	Gewichtung einer Prüfungsleistung im Modul bzw. in der Gesamtnote
Sonstiges:	B.Sc.	Studiengang Bachelor of Science
	M.Sc.	Studiengang Master of Science
	SPO	Studien- und Prüfungsordnung
	SWS	Semesterwochenstunden
	WPF	**W**ahlpflichtfach
	w	wählbar
	p	verpflichtend

1 Studienpläne, Module und Prüfungen

Die Angabe der Leistungspunkte (LP) erfolgt gemäß dem „European Credit Transfer and Accumulation System“ (ECTS) und basiert auf dem von den Studierenden zu absolvierenden Arbeitspensum.

1.1 Prüfungsmodalitäten

In jedem Semester sind für schriftliche Prüfungen mindestens ein Prüfungstermin und für mündliche Prüfungen mindestens zwei Termine anzubieten. Prüfungstermine sowie Termine, zu denen die Meldung zu den Prüfungen spätestens erfolgen muss, werden von der Prüfungskommission festgelegt. Die Meldung für die Fachprüfungen erfolgt in der Regel mindestens eine Woche vor der Prüfung. Melde- und Prüfungstermine werden rechtzeitig durch Anschlag bekanntgegeben, bei schriftlichen Prüfungen mindestens 6 Wochen vor der Prüfung.
Über Hilfsmittel, die bei einer Prüfung benutzt werden dürfen, entscheidet der Prüfer. Eine Liste der zugelassenen Hilfsmittel ist gleichzeitig mit der Ankündigung des Prüfungstermins bekanntzugeben.

Für die Erfolgskontrollen in den Schwerpunkt-Modulen gelten folgende Regeln:
Die Fachprüfungen sind grundsätzlich mündlich abzunehmen, bei unvertretbar hohem Prüfungsaufwand kann eine mündlich durchzuführende Prüfung auch schriftlich abgenommen werden.
Die Prüfung im Kernbereich eines Schwerpunkts ist an einem einzigen Termin anzulegen. Erfolgskontrollen im Ergänzungsbereich können separat erfolgen. Bei mündlichen Prüfungen in Schwerpunkten bzw. Schwerpunkt-Teilmodulen soll die Prüfungsdauer 5 Minuten pro Leistungspunkt betragen. Erstreckt sich eine mündliche Prüfung über mehr als 12 LP soll die Prüfungsdauer 60 Minuten betragen.

1.2 Module des Bachelorstudiums „B.Sc.“

Voraussetzung für die Zulassung zu den Fachprüfungen ist der Nachweis über die angegebenen Studienleistungen. Schriftliche Prüfungen werden als Klausuren mit der angegebenen Prüfungsdauer in Stunden abgenommen. Benotete Erfolgskontrollen gehen mit dem angegebenen Gewicht (Gew) in die Modulnote bzw. die Gesamtnote ein.

Das in § 18 Abs. 2 SPO beschriebene Modul „Schlüsselqualifikationen“ bilden die im nachfolgend aufgeführten Block (7) zusammengefassten Veranstaltungen „ Arbeitstechniken im Maschinenbau“ und „MKL - Konstruieren im Team“ mit einem Umfang von 6 Leistungspunkten. Der in seinen fachspezifischen Inhalten dem untenstehenden Block (6) „Maschinenkonstruktionslehre“ zugeordnete und mit insgesamt 4 Leistungspunkten bewertete Workshop „MKL – Konstruieren im Team“ wird wegen den hier integrativ in teamorientierter Projektarbeit vermittelten Lehrinhalten mit 2 Leistungspunkten dem Block (7) „Schlüsselqualifikationen“ zugerechnet.

Module	Veranstaltung	Koordinator	Studienleistung	LP	Erfolgskontrolle	Pr (h)	Gew
1 Höhere Mathematik	Höhere Mathematik I	Kirsch	ÜSchein	7	sPr	2	7
	Höhere Mathematik II		ÜSchein	7	sPr	2	7
	Höhere Mathematik III		ÜSchein	7	sPr	2	7
2 Naturwissenschaftliche Grundlagen	Grundlagen der Chemie	Deutschmann		3	sPr	2	3
	Wellenphänomene in der klassischen Physik	Weiss		4	sPr	2	4
3 Technische Mechanik	Technische Mechanik I	Böhlke	ÜSchein	6	sPr	1,5	6
	Technische Mechanik II	Böhlke	ÜSchein	5	sPr	1,5	5
	Technische Mechanik III	Seemann	ÜSchein	5	sPr	3	10
	Technische Mechanik IV	Seemann	ÜSchein	5			
4 Werkstoffkunde	Werkstoffkunde I	Wanner		7	mPr		15
	Werkstoffkunde II			5			
	Werkstoffkunde-Praktikum		PSchein	3			

Module	Veranstaltung	Koordinator	Studienleistung	LP	Erfolgskontrolle	Pr (h)	Gew
5 Technische Thermodynamik	Technische Thermodynamik und Wärmeübertragung I	Maas	ÜSchein	6,5	sPr	4	13
	Technische Thermodynamik und Wärmeübertragung II	Maas	ÜSchein	6,5			
6 Maschinenkonstruktionslehre	Maschinenkonstruktionslehre I mit CAD	Albers	ÜSchein	4	sPr	5	18
	Maschinenkonstruktionslehre II		ÜSchein	4			
	Maschinenkonstruktionslehre III		ÜSchein	4			
	MKL – Konstruieren im Team (mkl III)		ÜSchein	1			
	Maschinenkonstruktionslehre IV		ÜSchein	4			
	MKL –Konstruieren im Team (mkl IV)		ÜSchein	1			
7 Schlüsselqualifikationen	Arbeitstechniken im Maschinenbau	Wanner		4	Schein	-	6
	MKL III – Konstruieren im Team	Albers		1	Schein	-	
	MKL IV – Konstruieren im Team			1	Schein	-	
8 Betriebliche Produktionswirtschaft	Betriebliche Produktionswirtschaft	Furmans		5	sPr	3	5
9 Informatik	Informatik im Maschinenbau	Ovtcharova	PSchein	8	sPr	3	8
10 Elektrotechnik	Elektrotechnik und Elektronik			8	sPr	3	8
11 Mess- und Regelungstechnik	Grundlagen der Mess- und Regelungstechnik	Stiller		7	sPr	3	7
12 Strömungslehre	Strömungslehre	Oertel		7	sPr	3	7
13 Maschinen und Prozesse	Maschinen und Prozesse	Spicher	PSchein	7	sPr	3	7
14 Wahlpflichtfach	siehe Kapitel 2.1			5	sPr/ mPr	3	5
15 Schwerpunkt	Schwerpunkt-Kern siehe Kapitel 6	SP-Verantwortlicher		8	mPr		8
	Schwerpunkt-Ergänzung siehe Kapitel 6	SP-Verantwortlicher		4	mPr		4

Erfolgskontrollen in Zusatzmodulen können schriftliche Prüfungen, mündliche Prüfungen oder Erfolgskontrollen anderer Art sein.

Zusätzlich ist ein Berufs-Fachpraktikum im Umfang von 6 Wochen zu absolvieren (8 LP).

1.3 Studienplan des 1. Abschnitts des Bachelorstudiums „B.Sc."

Lehrveranstaltungen 1. bis 4. Semester	WS 1. Sem.			SS 2. Sem.			WS 3. Sem.			SS 4. Sem.		
	V	Ü	P	V	Ü	P	V	Ü	P	V	Ü	P
Höhere Mathematik I-III	4	2		4	2		4	2				
Grundlagen der Chemie	2											
Wellenphänomene in der Physik										2	1	
Technische Mechanik I-IV	3	2		2	2		2	2		2	2	
Werkstoffkunde I, II	4	1		3	1							
Werkstoffkunde-Praktikum[1]						2						
Technische Thermodynamik und Wärmeübertragung I, II							3	2		3	2	
Maschinenkonstruktionslehre I-IV	2	1		2	2		2	2		2	1	
MKL – Konstruieren im Team									1			1
Betriebliche Produktionswirtschaft										3	1	
Informatik im Maschinenbau	2	2	2									
Elektrotechnik und Elektronik							4	2				
Arbeitstechniken Maschinenbau				1		1	(1)		(1)			
Berufliches Grundpraktikum (6 Wochen vor Studienbeginn)												

Lehrveranstaltungen 5. bis 6. Semester	WS 5. Sem.			SS 6. Sem.		
	V	Ü	P	V	Ü	P
Grundlagen der Mess- und Regelungstechnik	3	1				
Strömungslehre	3	1				
Maschinen und Prozesse	2		2			
Wahlpflichtfach (2+1 bzw. 3 SWS)	2	1		(2)	(1)	
Schwerpunkt (6 SWS variabel)	3	()	()	3	()	()
Berufs-Fachpraktikum	(6 Wochen)					

1.4 Studienplan des 2. Abschnitts des Bachelorstudiums „B.Sc."

Die Bachelorarbeit (12 LP) bildet den zweiten Abschnitt des Bachelorstudiums und ist im Anschluss an den ersten Abschnitt zu absolvieren. Die Durchführung und Benotung der Bachelorarbeit ist in § 11 der Studien- und Prüfungsordnung für den Bachelorstudiengang Maschinenbau geregelt.

[1] Das Werkstoffkunde-Praktikum findet in der vorlesungsfreien Zeit zwischen SS und WS statt und beansprucht eine Woche.

1.5 Masterstudium mit Vertiefungsrichtungen

Es stehen folgende Vertiefungsrichtungen zur Auswahl:

Vertiefungsrichtung	Abk.	Verantwortlicher
Unspezifischer Master Maschinenbau	MSc	Furmans
Energie- und Umwelttechnik	E+U	Maas
Fahrzeugtechnik	FzgT	Gauterin
Mechatronik und Mikrosystemtechnik	M+M	Bretthauer
Produktentwicklung und Konstruktion	PEK	Albers
Produktionstechnik	PT	Lanza
Theoretischer Maschinenbau	ThM	Böhlke
Werkstoffe und Strukturen für Hochleistungssysteme	W+S	Wanner

Das Masterstudium kann sowohl zum Winter- als auch zum Sommersemester aufgenommen werden. Wegen der freien Wahl der Module lässt sich für das Masterstudium kein allgemeingültiger Studienplan angeben. Die Wahlmöglichkeiten in den Wahlpflichtfächern und Schwerpunkten richten sich nach der gewählten Vertiefungsrichtung. Schriftliche Prüfungen werden als Klausuren mit der angegebenen Prüfungsdauer in Stunden abgenommen. Benotete Erfolgskontrollen gehen mit dem angegebenen Gewicht (Gew) in die Gesamtnote ein.

Folgende Module sind im Masterstudiengang zu belegen:

Module		Veranstaltung	LP	Erfolgs-kontrolle	Pr. (h)	Gew
1.	Wahlpflichtfach 1	siehe Kapitel 2.1	5	sPr/mPr	3/	5
2.	Wahlpflichtfach 2	siehe Kapitel 2.1	5	sPr/mPr	3/	5
3.	Wahlpflichtfach 3	siehe Kapitel 2.1	5	sPr/mPr	3/	5
4.	Wahlfach	siehe Kapitel 2.5	4	mPr		4
5.	Modellbildung und Simulation	Modellbildung und Simulation	7	sPr	3	7
6.	Produktentstehung	Produktentstehung – Entwicklungsmethodik	6	sPr	2	15
		Produktentstehung – Fertigungs- und Werkstofftechnik	9	sPr	3	
7.	Fachpraktikum	Siehe Kapitel 3	3	Schein		
8.	Mathematische Methoden	siehe Kapitel 2.2	6	sPr	3	6
9.	Schwerpunkt 1 – Kern und Ergänzung	siehe Kapitel 6	16	mPr		16
10.	Schwerpunkt 2 – Kern und Ergänzung	siehe Kapitel 6	16	mPr		16
11.	Wahlfach Nat/inf/etit	siehe Kapitel 2.3	6	Schein		
12.	Wahlfach Wirtschaft/Recht	siehe Kapitel 2.4	4	Schein		

Erfolgskontrollen in Zusatzmodulen können schriftliche Prüfungen, mündliche Prüfungen oder Erfolgskontrollen anderer Art sein.
Zusätzlich ist ein Berufspraktikum im Umfang von 6 Wochen zu absolvieren (8 LP).
Im Anschluss an die Modulprüfungen ist eine Masterarbeit (20 LP) zu erstellen.

2 Zugelassene Wahl- und Wahlpflichtfächer

Jedes Fach bzw. jedes Modul kann nur einmal im Rahmen des Bachelorstudienganges und des konsekutiven Masterstudiengangs Maschinenbau gewählt werden.

2.1 Wahlpflichtfächer im Bachelor- und Masterstudiengang

Folgende Wahlpflichtfächer (WPF) sind derzeit vom Fakultätsrat für den Bachelorstudiengang und die Vertiefungsrichtungen des Masterstudiengangs genehmigt.
Im Bachelorstudiengang muss 1 WPF gewählt werden. Im Masterstudiengang werden 3 WPF abhängig von der jeweiligen Vertiefungsrichtung belegt.
In den Vertiefungsrichtungen ist die Wahl der WPF eingeschränkt: Eines der mit „p“ gekennzeichneten WPF muss gewählt werden, die beiden anderen WPF müssen aus dem mit w gekennzeichneten Angebot ausgewählt werden. In einem konsekutiven Masterstudium kann ein solches p-Wahlpflichtfach durch ein w-Wahlpflichtfach ersetzt werden, wenn das entsprechende Wahlpflichtfach bereits im Bachelorstudium belegt wurde. Für manche Schwerpunkte kann die Wahl eines Wahlpflichtfachs empfohlen sein (siehe Hinweis beim jeweiligen Schwerpunkt im aktuellen Modulhandbuch).

Nr.	Wahlpflichtfächer (WPF)	B.Sc.	M.Sc.	E+U	FzgT	M+M	PEK	PT	ThM	W+S
(1)	Arbeitswissenschaft		w				w	w		
(2)	Einführung in die Mechatronik	w	w	w	w	p	w	w		
(3)	Elektrotechnik II				w					
(4)	Fluidtechnik	w	w	w	w		w	w	w	
(5)	Grundlagen der Statistik und Wahrscheinlichkeitstheorie				w	w			w	
(6)	Einführung in die Mehrkörperdynamik	w	w	w	w	w	w	w	w	w
(7)	Mathematische Methoden der Dynamik	w	w		w	w	w		w	
(8)	Mathematische Methoden der Festigkeitslehre	w	w		w	w	w		w	w
(9)	Mathematische Methoden der Schwingungslehre	w	w		w	w	w		w	
(10)	Mathematische Methoden der Strömungslehre	w	w	w	w				w	
(11)	Mathematische Methoden der Strukturmechanik		w			w	w		w	w
(12)	Grundlagen der Mikrosystemtechnik I <u>oder</u> II		w			w	w			
(13)	Physikalische Grundlagen der Lasertechnik	w	w	w	w	w	w	w		w
(14)	Numerische Mathematik für Informatiker und Ingenieure			w	w	w			w	
(15)	Einführung in die moderne Physik *oder* Physik für Ingenieure	w	w	w	w	w			w	w
(16)	Product Lifecycle Management	w	w		w	w	w	w		
(17)	Simulation von Produktionssystemen und -prozessen	w	w					w		
(18)	Stochastik im Maschinenbau/ Mathematische Modelle von Produktionssystemen		w						w	

Nr.	Wahlpflichtfächer (WPF)	B.Sc.	M.Sc.	E+U	FzgT	M+M	PEK	PT	ThM	W+S
(19)	Systematische Werkstoffauswahl	w	w	w	w	w	w		w	p
(20)	Wärme- und Stoffübertragung	w	w	p	w	w	w		w	
(21)	Technische Informationssysteme	w	w		w	w	w	w		
(22)	Modellierung und Simulation	w	w						w	w
(23)	Wissenschaftliches Programmieren für Ingenieure mit Übung	w	w						w	w
(24)	Mikrostruktursimulation	w	w						w	w
(25)	CAE-Workshop	w	w	w	w	w	p			w
(26)	Grundlagen der technischen Verbrennung I	w	w	w	w	w			w	
(27)	Grundlagen der technischen Logistik	w	w	w	w	w	w	w	w	w
(28)	Virtual Engineering Specific Topics	w								
(29)	Service Operations Management	w								
(30)	Industrial Management Case Study	w								
(31)	Maschinendynamik	w	w	w	w	w	w	w	w	w
(32)	Technische Schwingungslehre	w	w	w	w	w	w	w	w	w

2.2 Mathematische Methoden im Masterstudiengang

Als Wahlmöglichkeiten für die Mathematischen Methoden im Masterstudiengang sind derzeit vom Fakultätsrat genehmigt:

Nr.	Vorlesung	Dozent	Institut/Fak.	Sem.
(1)	Grundlagen der Statistik und Wahrscheinlichkeitstheorie	Kadelka	math	WS
(2)	Mathematische Methoden der Dynamik	Proppe	itm	WS
(3)	Mathematische Methoden der Festigkeitslehre	Böhlke	itm	WS
(4)	Mathematische Methoden der Schwingungslehre	Seemann	itm	SS
(5)	Mathematische Methoden der Strömungslehre	N.N.	isl	SS
(6)	Mathematische Methoden der Strukturmechanik	Böhlke	itm	SS
(7)	Numerische Mathematik für Informatiker und Ingenieure	Neuß	math	SS
(8)	Mathematische Modelle von Produktionssystemen	Furmans/Proppe	ifl/itm	WS

2.3 Wahlfach aus dem Bereich Naturwissenschaften/Informatik/Elektrotechnik im Masterstudiengang

Für das Wahlfach aus dem Bereich der Naturwissenschaften, Informatik und Elektrotechnik sind vom Fakultätsrat derzeit folgende Wahlmöglichkeiten genehmigt:

Nr.	Vorlesung	Dozent	Institut/Fak.	Sem.
(1)	Aerothermodynamik	Seiler	isl	SS
(2)	Hardware/Software Codesign	Hübner	etit	WS
(3)	Kernspintomographie	Kasten	phys	ww
(4)	Methoden in der Signalverarbeitung	Puente	iiit	WS
(5)	Nanotechnologie mit Clustern	Gspann	imt	ww
(6)	Photovoltaik	Powalla	ikr	SS
(7)	Physikalische Grundlagen der Lasertechnik	Schneider	izbs	WS
(8)	Rheologie und Struktur	Hochsein	ciw	WS
(9)	Strömungen mit chemischen Reaktionen	Class	isl	WS
(10)	Technische Informatik	Bretthauer	aia	SS
(11)	Systems and Software Engineering	Müller-Glaser	itiv	WS
(12)	Magnetohydrodynamik	Bühler	isl	WS

2.4 Wahlfach aus dem Bereich Wirtschaft/Recht im Masterstudiengang

Für das Wahlfach aus dem Bereich Wirtschaft und Recht sind vom Fakultätsrat derzeit folgende Wahlmöglichkeiten genehmigt:

Nr.	Vorlesung	Dozent	Institut/Fak.	Sem.
(1)	Arbeitswissenschaft	Zülch	ifab	WS
(2)	F&E Projektmanagement mit Fallstudien	Schmied	wiwi	ww
(3)	Management- und Führungstechniken	Hatzl	ifab	SS
(4)	Öffentliches Recht I	Spieker (Döhmann)	inf	SS
(5)	Leadership and Management Development	Ploch	ipek	WS
(6)	Patentrecht	Geissler	inf	SS
(7)	Qualitätsmanagement	Lanza	wbk	WS
(8)	Unternehmensführung und strategisches Management	Lindstädt, Wolff, Bünn	wiwi	SS

2.5 Wahlfach im Masterstudiengang

Für das zu belegende Wahlfach sind vom Fakultätsrat derzeit alle Vorlesungen des Fächerkataloges der Fakultät für Maschinenbau genehmigt. Fächer anderer Fakultäten müssen von der Prüfungskommission genehmigt werden.

3 Fachpraktikum im Masterstudiengang

3.1 Fachpraktikum

Für das Fachpraktikum (3 LP) bestehen folgende Wahlmöglichkeiten:

Nr.	Praktikum	Dozent	Institut/Fak.	Sem.
(1)	Messtechnisches Praktikum	Stiller	MRT	SS
(2)	Dezentral gesteuerte Intralogistiksysteme	Furmans	IFL	WS
(3)	Schwingungstechnisches Praktikum	Fidlin	ITM	WS
(4)	Mechatronik-Praktikum	Albers *et al.*	IPEK *et al.*	WS

4 Berufspraktikum

Das Berufspraktikum (gemäß SPO § 13) besteht im Bachelorstudiengang aus Grund- und Fachpraktikum (je 6 Wochen) und im Masterstudiengang aus einem Fachpraktikum (6 Wochen). Das Grundpraktikum sollte möglichst in einem geschlossenen Zeitraum vor Beginn des Bachelorstudiums durchgeführt werden. Die Abschnitte der Fachpraktika (im Weiteren Berufs-Fachpraktikum genannt) im Rahmen des Bachelor- und des Masterstudiums sollen in geschlossenen Zeiträumen in beliebiger Reihenfolge durchgeführt werden.

4.1 Inhalt und Durchführung des Berufspraktikums

Nicht das Praktikantenamt, sondern das für den Wohnsitz des Interessenten zuständige Arbeitsamt und mancherorts auch die Industrie- und Handelskammer weisen geeignete und anerkannte Ausbildungsbetriebe nach. Da Praktikantenstellen nicht vermittelt werden, müssen sich die Interessenten selbst mit der Bitte um einen Praktikantenplatz an die Betriebe wenden. Das Praktikantenverhältnis wird rechtsverbindlich durch den zwischen dem Betrieb und dem Praktikanten abzuschließenden Ausbildungsvertrag. Im Vertrag sind alle Rechte und Pflichten des Praktikanten und des Ausbildungsbetriebes sowie Art und Dauer der berufspraktischen Tätigkeit festgelegt. Betrieb steht hier synonym für Firmen, Unternehmen etc., die eine anerkannte Ausbildungsstätte beinhalten.

Um eine ausreichende Breite der berufspraktischen Ausbildung zu gewährleisten, sollen sowohl für das Grundpraktikum als auch für die Berufs-Fachpraktika Tätigkeiten aus verschiedenen Arbeitsgebieten nachgewiesen werden.

Die Tätigkeiten im Grundpraktikum können aus folgenden Gebieten gewählt werden:

- spanende Fertigungsverfahren,
- umformende Fertigungsverfahren,
- urformende Fertigungsverfahren und
- thermische Füge- und Trennverfahren.

Es sollen Tätigkeiten in mindestens drei der o.g. Gebiete nachgewiesen werden.

Die Tätigkeiten im Berufs-Fachpraktikum müssen inhaltlich denen eines Ingenieurs entsprechen und können aus folgenden Gebieten gewählt werden:

- Wärmebehandlung,
- Werkzeug- und Vorrichtungsbau,
- Instandhaltung, Wartung und Reparatur,
- Qualitätsmanagement,
- Oberflächentechnik,
- Entwicklung, Konstruktion und Arbeitsvorbereitung,
- Montage-/Demontage und
- andere fachrichtungsbezogene praktische Tätigkeiten entsprechend den gewählten Schwerpunkten (evtl. in Absprache mit dem Praktikantenamt).

Aus diesen acht Gebieten sollen im Bachelor mindestens drei, im Master mindestens zwei weitere unterschiedliche Gebiete nachgewiesen werden. Dabei wird empfohlen, dass die Tätigkeiten aus dem Gebiet des im Studium gewählten Schwerpunktes bzw. der im Master gewählten Vertiefungsrichtung sind oder damit in Zusammenhang stehen.

Tätigkeiten, die an Universitäten, gleichgestellten Hochschulen oder in vergleichbaren Forschungseinrichtungen durchgeführt wurden, werden grundsätzlich nicht als Berufs-Fachpraktikum anerkannt.

Die vorgeschriebenen 12 bzw. 6 Wochen des Berufspraktikums sind als Minimum zu betrachten. Es wird empfohlen, freiwillig weitere praktische Tätigkeiten in einschlägigen Betrieben durchzuführen.

Fragen der Versicherungspflicht regeln entsprechende Gesetze. Während des Praktikums im Inland sind die Studierenden weiterhin Angehörige der Universität und entsprechend versichert. Versicherungsschutz für Auslandspraktika gewährleistet eine Auslandsversicherung, die vom Praktikanten oder dem Ausbildungsbetrieb abgeschlossen wird.

Ausgefallene Arbeitszeit muss in jedem Falle nachgeholt werden. Bei Ausfallzeiten sollte der Praktikant den auszubildenden Betrieb um eine Vertragsverlängerung ersuchen, um den begonnenen Abschnitt seiner berufspraktischen Tätigkeit im erforderlichen Maße durchführen zu können.

4.2 Anerkennung des Berufspraktikums

Die Anerkennung des Praktikums erfolgt durch das Praktikantenamt der Fakultät für Maschinenbau. Zur Anerkennung ist die Vorlage des Ausbildungsvertrags und eines ordnungsgemäß abgefassten Praktikumsberichts für das Grundpraktikum (von der Firma bestätigt) und eines Original-Tätigkeitsnachweises für das Berufs-Fachpraktikum erforderlich. Art und Dauer der einzelnen Tätigkeitsabschnitte müssen aus den Unterlagen klar ersichtlich sein.

Für das Grundpraktikum muss ein Bericht angefertigt werden, der eine geistige Auseinandersetzung mit dem bearbeiteten Thema erkennen lässt. Eine chronologische Auflistung der Tätigkeiten ist hierfür nicht ausreichend. Die Praktikanten berichten über ihre Tätigkeiten und die dabei gemachten Beobachtungen und holen dazu die Bestätigung des Ausbildungsbetriebes ein. Die Berichterstattung umfasst wöchentliche Arbeitsberichte (Umfang ca. 1 DIN A4-Seite pro Woche) für das Grundpraktikum. Dabei ist die Form frei wählbar (Handschrift, Textsystem, Computergraphik, etc.).

Zur Anerkennung des Berufs-Fachpraktikums wird ein Zertifikat des Ausbildungsbetriebes („Praktikantenzeugnis“) benötigt, das Art und Dauer der Tätigkeiten während des Berufs-Fachpraktikums beschreibt. Eventuelle Fehltage sind zu vermerken.

Das Praktikantenamt entscheidet, inwieweit die praktische Tätigkeit der Praktikantenordnung entspricht und daher als Praktikum anerkannt werden kann. Ein Praktikum, über das nur unzureichende (unvollständige oder nicht verständlich abgefasste) Berichte vorliegen, wird nur zu einem Teil der Dauer anerkannt.

Es wird nachdrücklich empfohlen, einen Teil des Berufspraktikums im Ausland abzuleisten. Für das Berufsleben ist es vorteilhaft, Teile insbesondere des Berufs-Fachpraktikums im Ausland durchzuführen. Berufspraktische Tätigkeiten in ausländischen Betrieben werden nur anerkannt, wenn sie den o.a. Richtlinien entsprechen und Berichte in der im Studienplan genannten Form angefertigt werden.

Für Ausländer aus Ländern, die nicht zur europäischen Union gehören, gelten diese Richtlinien ebenfalls.

4.3 Sonderbestimmungen zur Anerkennung

Eine Lehre, die den Anforderungen des Berufspraktikums entspricht, wird anerkannt. Bei der Bundeswehr erbrachte Ausbildungszeiten in Instandsetzungseinheiten sind mit maximal 6 Wochen als Berufspraktikum anrechenbar, wenn Tätigkeiten gemäß Kapitel 4.1 durchgeführt wurden. Zwecks Anerkennung sind die entsprechenden Berichte und Bescheinigungen (Ausbildungs- und Tätigkeitsnummer und Materialerhaltungsstufe) beim Praktikantenamt einzureichen.

Die praktische Ausbildung an Technischen Gymnasien wird entsprechend den nachgewiesenen Schulstunden als Grundpraktikum anerkannt. Hierbei können maximal 6 Wochen (entspricht 240 Vollzeit-Stunden) auf die berufspraktische Tätigkeit angerechnet werden.

Während des Bachelorstudiums erbrachte Berufspraktika können im Masterstudium anerkannt werden, sofern sie nicht bereits als Berufspraktikum für den Bachelorstudiengang anerkannt wurden.

5 Bachelor- und Masterarbeit

Die Bachelorarbeit darf an allen Instituten der Fakultät Maschinenbau absolviert werden.
Für die Betreuung der Masterarbeit stehen je nach Vertiefungsrichtung folgende Institute (●) zur Wahl:

Institut für	Abk.	MSc	E+UT	FzgT	M+M	PEK	PT	ThM	W+S
Angewandte Informatik/ Automatisierungstechnik	AIA	●	●	●	●	●	●	●	●
Angewandte Werkstoffphysik	IAM-AWP	●	●	●	●	●	–	●	●
Arbeitswissenschaft und Betriebsorganisation	ifab	●	●	–	–	●	●	–	–
Fahrzeugsystemtechnik	FAST	●	●	●	●	●	–	●	●
Fördertechnik und Logistiksysteme	IFL	●	–	–	–	●	●	●	–

Institut für	Abk.	MSc	E+UT	FzgT	M+M	PEK	PT	ThM	W+S
Informationsmanagement im Ingenieurwesen	IMI	●	–	●	●	●	●	–	–
Keramik im Maschinenbau	IAM-KM	●	●	–	–	●	–	–	●
Kerntechnik und Reaktorsicherheit	IKR	●	●	–	–	–	–	–	–
Kolbenmaschinen	IFKM	●	●	●	–	●	–	–	–
Mess- und Regelungstechnik mit Maschinenlaboratorium	MRT	●	●	●	●	●	–	●	–
Mikrostrukturtechnik	IMT	●	●	●	●	●	●	–	–
Produktentwicklung	IPEK	●	●	●	●	●	●	–	●
Produktionstechnik	WBK	●	–	●	●	●	●	–	●
Strömungslehre	ISL	●	●	●	–	–	–	●	–
Fachgebiet Strömungsmaschinen	FSM	●	●	●	–	●	–	–	–
Technische Mechanik	ITM	●	●	●	●	●	–	●	●
Thermische Strömungsmaschinen	ITS	●	●	●	–	●	–	●	●
Technische Thermodynamik	ITT	●	●	●	–	–	–	●	–
Werkstoffkunde	IAM-WK	●	●	●	●	●	–	●	●
Zuverlässigkeit von Bauteilen und Systemen	IAM-ZBS	●	●	●	●	●	–	●	●

In interdisziplinär ausgerichteten Vertiefungsrichtungen ist die Beteiligung von Instituten anderer Fakultäten erwünscht. Mit Zustimmung der Vertiefungsrichtungsverantwortlichen kann die Prüfungskommission auch Masterarbeiten an anderen Instituten der Fakultät für Maschinenbau genehmigen. Zustimmung und Genehmigung sind vor Beginn der Arbeit einzuholen.

6 Schwerpunkte im Bachelor- und im Masterstudiengang

Generell gilt, dass jede Lehrveranstaltung und jeder Schwerpunkt nur einmal entweder im Rahmen des Bachelor- oder des Masterstudiengangs gewählt werden kann.

6.1 Zuordnung der Schwerpunkte zum Bachelor- und den Vertiefungsrichtungen des Masterstudiengangs

Folgende Schwerpunkte sind derzeit vom Fakultätsrat für den Bachelor- und den Masterstudiengang genehmigt. In einigen Vertiefungsrichtungen ist die Wahl des **ersten** Masterschwerpunkts eingeschränkt (einer der mit „p" gekennzeichneten Schwerpunkte ist zu wählen).
In einem konsekutiven Master-Studium kann ein solcher p-Schwerpunkt durch einen w-Schwerpunkt ersetzt werden, wenn der p-Schwerpunkt bereits im Bachelorstudium gewählt wurde.

Nr.	Schwerpunkt	B.Sc.	M.Sc.	E+U	FzgT	M+M	PEK	PT	ThM	W+S
(1)	Advanced Mechatronics		w	w	w	p	w	w	w	
(2)	Antriebssysteme	w	w		w		w	w		
(3)	Arbeitswissenschaft		w	w			w	p		
(4)	Automatisierungstechnik		w	w	w	p	w	w	w	
(5)	Berechnungsmethoden im MB	w	w	w	w				w	
(6)	Computational Mechanics		w		w	w	w		p	

Nr.	Schwerpunkt	B.Sc.	M.Sc.	E+U	FzgT	M+M	PEK	PT	ThM	W+S
(7)	Dimensionierung und Validierung mechanischer Konstruktionen	w	w	w	w	w	w		p	w
(8)	Dynamik und Schwingungslehre		w	w	w		w		p	
(9)	Dynamische Maschinenmodelle	w	w						w	
(10)	Entwicklung und Konstruktion	w	w	w	w		w			
(11)	Fahrdynamik, Fahrzeugkomfort und –akustik		w		w	w	w		w	
(12)	Kraftfahrzeugtechnik	w	w		p		w			
(13)	Festigkeitslehre/ Kontinuums-mechanik	w	w	w	w	w	w		p	p
(14)	Fluid-Festkörper-Wechselwirkung		w	w	w		w		w	
(15)	Grundlagen der Energietechnik	w	w	p	w	w	w			
(16)	Industrial Engineering (engl.)		w				w	w		
(17)	Informationsmanagement	w								
(18)	Informationstechnik	w	w	w	w	w	w		w	
(19)	Informationstechnik für Logistiksysteme		w				w	w		
(20)	Integrierte Produktentwicklung		w	w	w		p	w		
(21)	Kerntechnik		w	w					w	
(22)	Kognitive Technische Systeme		w		w	w	w	w	w	
(23)	Kraftwerkstechnik		w	w			w			
(24)	Kraft- und Arbeitsmaschinen	w	w	w	w		w			
(25)	Leichtbau		w	w	w		w			w
(26)	Materialwissenschaft und Werkstofftechnik	w	w	w	w	w	w		w	p
(27)	Modellierung und Simulation in der Energie- und Strömungs-technik		w	w	w	w	w			
(28)	Lifecycle Engineering		w		w	w	p	p		
(29)	Logistik und Materialflusslehre		w				w	p		
(30)	Mechanik und Angewandte Mathematik		w	w	w	w	w		p	w
(31)	Mechatronik	w	w	w	w	p	w	w	w	
(32)	Medizintechnik		w			w	w			
(33)	Mikrosystemtechnik		w	w	w	p	w	w		
(34)	Mobile Arbeitsmaschinen		w		p	w	w			
(35)	Modellbildung und Simulation		w		w	w	w		p	w
(36)	Polymerengineering		w	w	w		w			w
(37)	Produktionsmanagement		w					w		
(38)	Produktionssysteme	w								
(39)	Produktionstechnik		w		w		w	p		

Nr.	Schwerpunkt	B.Sc.	M.Sc.	E+U	FzgT	M+M	PEK	PT	ThM	W+S
(40)	Robotik		w			p	w	w	w	
(41)	Strömungslehre		w	w	w		w		p	
(42)	Technische Akustik		w		w		w	w		
(43)	Technische Keramik und Pulverwerkstoffe		w	w	w		w			w
(44)	Technische Logistik	w	w				w	w		
(45)	Technische Thermodynamik		w	w	w	w	w		w	w
(46)	Thermische Turbomaschinen		w	w	w				w	w
(47)	Tribologie		w	w	w	w	w		w	w
(48)	Verbrennungsmotoren	w	w	w	p		w			
(49)	Zuverlässigkeit im Maschinenbau		w	w	w	w	w		w	p
(50)	Bahnsystemtechnik	w	w		p	w	w			
(51)	Entwicklung innovativer Geräte		w	w	w		p	w		
(52)	Production Management	w								
(53)	Fusionstechnologie		w	w					w	

Im Masterstudiengang Maschinenbau ohne Vertiefungsrichtung dürfen nur zwei Schwerpunkte kombiniert werden, die von zwei verschiedenen Instituten dominiert werden.

6.2 Wahlmöglichkeiten für den Schwerpunkt im „Bachelor of Science“

Für den Schwerpunkt werden mindestens 12 LP gewählt, davon müssen mindestens 8 LP Kernmodulfächer (K) sein, die im Block geprüft werden. „KP“ bedeutet, dass das Fach im Kernmodulbereich Pflicht ist, sofern es nicht bereits belegt wurde. Die übrigen Leistungspunkte können auch aus dem Ergänzungsbereich (E) kommen. Dabei dürfen nicht mehr als 4 LP Praktika belegt werden, die auch mit einer unbenoteten Erfolgskontrolle abgeschlossen werden können. Die Bildung der Schwerpunktnote erfolgt dann anhand der mit einer Benotung abgeschlossenen Teilmodule.
Die als Ergänzungsfächer (E) angegebenen Veranstaltungen verstehen sich als Empfehlung, andere Fächer auch aus anderen Fakultäten, können mit Genehmigung des jeweiligen Schwerpunkt-Verantwortlichen gewählt werden. Dabei ist eine Kombination mit Veranstaltungen aus den Bereichen Informatik, Elektrotechnik und Mathematik in einigen Vertiefungsrichtungen besonders willkommen. Mit „EM“ gekennzeichnete Fächer stehen nur im Masterstudiengang zur Wahl. Für manche Schwerpunkte ist die Belegung von bestimmten Wahlpflichtfächern (WPF) empfohlen.
Es dürfen im Schwerpunkt maximal 16 LP erworben werden. In jedem Fall werden bei der Festlegung der Schwerpunktnote alle Teilmodulnoten gemäß ihrer Leistungspunkte gewichtet. Bei der Bildung der Gesamtnote wird der Schwerpunkt mit 12 LP gewertet.

6.3 Wahlmöglichkeiten in den einzelnen Schwerpunkten im „Master of Science Studiengang“

Für jeden Schwerpunkt werden mindestens 16 LP gewählt, davon müssen mindestens 8 LP Kernmodulfächer (K) sein, die im Block geprüft werden. „KP“ bedeutet, dass das Fach im Kernmodulbereich Pflicht ist, sofern es nicht bereits belegt wurde. Die übrigen Leistungspunkte können auch aus dem Ergänzungsbereich (E) kommen. Dabei dürfen nicht mehr als 4 LP Praktika belegt werden, die auch mit einer unbenoteten Erfolgskontrolle abgeschlossen werden können. Die Bildung der Schwerpunktnote erfolgt dann anhand der mit einer Benotung abgeschlossenen Teilmodule.
Die als Ergänzungsfächer (E) angegebenen Veranstaltungen verstehen sich als Empfehlung, andere Fächer auch aus anderen Fakultäten, können mit Genehmigung des jeweiligen Schwerpunkt-Verantwortlichen gewählt werden. Dabei ist eine Kombination mit Veranstaltungen aus den Bereichen Informatik, Elektrotechnik und Mathematik in einigen Vertiefungsrichtungen besonders willkommen. Mit „EM“ gekennzeichnete Fächer stehen nur im Masterstudiengang zur Wahl. Für manche Schwerpunkte ist die Belegung von bestimmten Wahlpflichtfächern (WPF) empfohlen.
Es dürfen in jedem Schwerpunkt maximal 20 LP erworben werden. In jedem Fall werden bei der Festlegung der Schwerpunktnote alle Teilmodulnoten gemäß ihrer Leistungspunkte gewichtet. Bei der Bildung der Gesamtnote wird jeder Schwerpunkt mit 16 LP gewertet.

6.4 Veranstaltungen der Schwerpunkte zum Bachelor- und den Vertiefungsrichtungen des Masterstudiengangs

Die Beschreibung der Schwerpunkte hinsichtlich der jeweils darin enthaltenen Lehrveranstaltungen sind in den aktuellen Modulhandbüchern des Bachelor- und Masterstudiengangs nachzulesen.

Schwerpunkte und Schwerpunkt-Verantwortliche:
SP 1: Advanced Mechatronics (Bretthauer)

SP 2: Antriebssysteme (Albers)

SP 3: Arbeitswissenschaft (Zülch)

SP 4: Automatisierungstechnik (Bretthauer)

SP 5: Berechnungsmethoden im MB (Seemann)

SP 6: Computational Mechanics (Proppe)

SP 7: Dimensionierung und Validierung mechanischer Konstruktionen (Böhlke)

SP 8: Dynamik und Schwingungslehre (Seemann)

SP 9: Dynamische Maschinenmodelle (Seemann)

SP 10: Entwicklung und Konstruktion (Albers)

SP 11: Fahrdynamik, Fahrzeugkomfort und -akustik (Gauterin)

SP 12: Kraftfahrzeugtechnik (Gauterin)

SP 13: Festigkeitslehre/ Kontinuumsmechanik (Böhlke)

SP 14: Fluid-Festkörper-Wechselwirkung (Gabi)

SP 15: Grundlagen der Energietechnik (Bauer)

SP 16: Industrial Engineering (engl.) (Zülch)

SP 17: Informationsmanagement (Ovtcharova)

SP 18: Informationstechnik (Stiller)

SP 19: Informationstechnik für Logistiksysteme (Furmans)

SP 20: Integrierte Produktentwicklung (Albers)

SP 21: Kerntechnik (Cheng)

SP 22: Kognitive Technische Systeme (Stiller)

SP 23: Kraftwerkstechnik (Bauer)

SP 24: Kraft- und Arbeitsmaschinen (Gabi)

SP 25: Leichtbau (Henning)

SP 26: Materialwissenschaft und Werkstofftechnik (Wanner)

SP 27: Modellierung und Simulation in der Energie- und Strömungstechnik (Maas)

SP 28: Lifecycle Engineering (Ovtcharova)

SP 29: Logistik und Materialflusslehre (Furmans)

SP 30: Mechanik und Angewandte Mathematik (Böhlke)

SP 31: Mechatronik (Bretthauer)

SP 32: Medizintechnik (Bretthauer)

SP 33: Mikrosystemtechnik (Saile)

SP 34: Mobile Arbeitsmaschinen (Geimer)

SP 35: Modellbildung und Simulation (Proppe)

SP 36: Polymerengineering (Elsner)

SP 37: Produktionsmanagement (Zülch)

SP 38: Produktionssysteme (Schulze)

SP 39: Produktionstechnik (Schulze)

SP 40: Robotik (Bretthauer)

SP 41: Strömungslehre (Gabi)

SP 42: Technische Akustik (Gabi)

SP 43: Technische Keramik und Pulverwerkstoffe (Hoffmann)
SP 44: Technische Logistik (Furmans)
SP 45: Technische Thermodynamik (Maas)
SP 46: Thermische Turbomaschinen (Bauer)
SP 47: Tribologie (Gumbsch)
SP 48: Verbrennungsmotoren (Spicher)
SP 49: Zuverlässigkeit im Maschinenbau (Gumbsch)
SP 50: Bahnsystemtechnik (Gratzfeld)
SP 51: Entwicklung innovativer Geräte (Matthiesen)
SP 52: Production Management (Zülch)
SP 53: Fusionstechnologie (Stieglitz)

2 Actual Changes

Important changes are pointed out in this section in order to provide a better orientation. Although this process was done with great care, other/minor changes may exist.

3 Modules

3.1 All Modules

Module: Advanced Mathematics [BSc-Modul 01, HM]

Coordination: Andreas Kirsch, Tilo Arens, Frank Hettlich
Degree programme: Bachelorstudiengang Maschinenbau (B.Sc.)
Subject:

ECTS Credits	Cycle	Duration
21	Every term	3

Courses in module

ID	Course	Hours per week C/E/T	Term	CP	Responsible Lecturer(s)
1310	Advanced Mathematics I (p. 63)	4	W	7	A. Kirsch, T. Arens, F. Hettlich
1808	Advanced Mathematics II (p. 64)	4	S	7	T. Arens, A. Kirsch
1314	Advanced Mathematics III (p. 65)	4	W	7	A. Kirsch

Learning Control / Examinations
The module grade will be composed by the grades of the lectures of the module weighted by credit points

Conditions
None.

Learning Outcomes
The students should know the basic facts and tools of one dimensional analysis. The student shoud know the basics on vector spaces and multi-dimensional calculus and the basic techniques to solve differential equations. The student shoud know techniques and applications of the multi-dimensional calculus (vector calculus) and should have basic knowledge on partial differential equations and stochastics.

Content
Basic concepts, sequences and convergence, functions and continuity, series, differential calculus of one variable, integral calculus, vector spaces, differential equations, Laplace transform, vector-valued functions of several variables, applications of multi-dimensional calculus, domain integral, vector analysis, partial differential equations, Fourier theory, stochastics

Module: Principles of Natural Science [BSc-Modul 02, NG]

Coordination: Olaf Deutschmann, Bernd Pilawa
Degree programme: Bachelorstudiengang Maschinenbau (B.Sc.)
Subject:

ECTS Credits	Cycle	Duration
7	Every term	2

Courses in module

ID	Course	Hours per week C/E/T	Term	CP	Responsible Lecturer(s)
mach1NA1	Fundamentals of Chemistry (p. 59)	2	W	3	O. Deutschmann
mach1NA2	(p. 119)	2	S	4	B. Pilawa

Learning Control / Examinations
The module grade will be computed by the grades of the lectures of the module weighted by credit points.

Conditions
None.

Learning Outcomes

Content

Module: Engineering Mechanics [BSc-Modul 03, TM]

Coordination: Thomas Böhlke, Wolfgang Seemann
Degree programme: Bachelorstudiengang Maschinenbau (B.Sc.)
Subject:

ECTS Credits	Cycle	Duration
21	Every term	4

Courses in module

ID	Course	Hours per week C/E/T	Term	CP	Responsible Lecturer(s)
2161245	Engineering Mechanics I (p. 96)	3	W	4	T. Böhlke
2161246	Tutorial Engineering Mechanics I (p. 108)	2	W	1	T. Böhlke, Mitarbeiter
2161266	Lab course Engineering Mechanics I (p. 90)	2	W	1	T. Böhlke, T. Langhoff
2162250	Engineering Mechanics II (p. 97)	2	S	3	T. Böhlke
2162251	Tutorial Engineering Mechanics II (p. 109)	2	S	1	T. Böhlke, Mitarbeiter
2162252	Lab course Engineering Mechanics II (p. 91)	2	S	1	T. Böhlke, T. Langhoff
2161203	Engineering Mechanics III (p. 98)	2	W	3	W. Seemann
2161204	Engineering Mechanics III (Tutorial) (p. 110)	2	W	2	W. Seemann, Assistenten
2162231	Engineering Mechanics IV (p. 99)	2	S	3	W. Seemann
2162232	Engineering Mechanics IV (Tutorial) (p. 111)	2	S	2	W. Seemann

Learning Control / Examinations
prerequisite: attestation each semester by weekly homework assignments
"Engineering Mechanics I", written, 90 minutes;
"Engineering Mechanics II", written, 90 minutes;
"Engineering Mechanics III"and
"Engineering Mechanics IV" ,written, 180 Minutes;

Conditions
None.

Learning Outcomes
In EM III the students learn to analyse the motion of points and systems. Based on the axioms of Newton and Euler they know how to derive equations of motion. Besides the synthetic methods they get familiar with analytical methods which are based on energy expressions and can be applied efficiently and formalised. These methods are introduced in the scope of systems of mechanical engineering so that students can determine and analyse motions and the forces which are generated by these motions.

Content
In EM III and EM IV first the kinematics and kinetics of a particle are presented and generalized for systems of particles and the plane motion of rigid bodies. This includes the momentum theorem, the principle of moment of momentum and the principle of work. Kinetic energy and potemtial energies are therefore presented. Impact problems are treated as applications. The second part of dynamics considers the kinematics and kinetics of an arbitrary threedimensional motion of a rigid body. Especially the principle of moment of momentum leads to complicated relations and finally to Euler's equations. For systems of rigid bodies it is shown how the equations of motion can be derived in principle. Afterwards the analytical principles for the derivation of equations of motion are presented. This includes the principle of d'Alembert in Lagranges form and Lagrange's equations of the second kind. At the end simple vibration system with one or two degrees of freedom are analysed.

Module: Materials Science and Engineering [BSc-Modul 04, WK]

Coordination: Alexander Wanner
Degree programme: Bachelorstudiengang Maschinenbau (B.Sc.)
Subject:

ECTS Credits	Cycle	Duration
15	Every term	2

Courses in module

ID	Course	Hours per week C/E/T	Term	CP	Responsible Lecturer(s)
2173550	Material Science I for mach, mage, phys; Part 1 of class: Letters A-K (p. 121)	5	W	7	A. Wanner, H. Seifert, K. Weidenmann
2173551	Material ScienceI for mach, mage, phys; Part 2 of class: Letters L-Z (p. 120)	5	W	7	A. Wanner, H. Seifert, K. Weidenmann
2173552	Exercises in Material Science I for mach, mage, phys (p. 115)	1	W	0	K. Weidenmann, Gruber
2174560	Material Science II for mach, mage, phys; Part 1 of class: Letters A-K (p. 122)	4	S	5	A. Wanner, H. Seifert, K. Weidenmann
2174561	Material Science II for mach, mage, phys; Part 2 of class: Letters L-Z (p. 123)	4	S	5	A. Wanner, H. Seifert, K. Weidenmann
2174563	Exercises in Material Science II for mach, mage, phys (p. 116)	1	S	0	A. Wanner, Gruber
2174597	Experimental Lab Course in Material Science, mach, mage, part A of class, in groups (p. 56)	2	S	3	A. Wanner, H. Seifert, K. Weidenmann
2174587	Experimental Lab Course in Material Science, mach, mage, part B of class, in groups (p. 57)	2	S	3	A. Wanner, H. Seifert, K. Weidenmann

Learning Control / Examinations
not graded: Participation in 10 lab experiments, Introductory colloquia must be passed and 1 short presentation must be presented. The lab course must be finished successfully prior to the registration for the oral exam;
graded: oral exam covering the whole module, 25 minutes.

Conditions
none

Recommendations
none

Learning Outcomes

- Knowledge of basics about structural and functional materials
- Relationships between atomic structure, microstructure and properties
- assessment of material properties and corresponding applications

Content
The module “Materials Science and engineering” consists of the lectures “Materials Science and Enginnering I and II” with additional tutorials for small groups and a one week materials science laboratory course.

Module: Engineering Thermodynamics [BSc-Modul 05, TTD]

Coordination: Ulrich Maas
Degree programme: Bachelorstudiengang Maschinenbau (B.Sc.)
Subject:

ECTS Credits	Cycle	Duration
13	Every term	2

Courses in module

ID	Course	Hours per week C/E/T	Term	CP	Responsible Lecturer(s)
2165526	Engineering Thermodynamics and Heat Transfer I (p. 101)	3	W	6,5	U. Maas
2166526	Technical Thermodynamics and Heat Transfer II (p. 102)	3	S	6,5	U. Maas
2165527	Tutorial: Engineering Thermodynamics I (p. 112)	2	W	0	U. Maas, Assisitenten
2166527	Excercises in Technical Thermodynamics and Heat Transfer II (p. 113)	2	S	0	U. Maas
2165501	Tutorial: Engineering Thermodynamics II - Repetition (p. 114)	2	W	0	UlrichMaas, Halmer

Learning Control / Examinations
prerequisite: attestation each semester by weekly homework assignments
written examn, graded

Conditions
None.

Learning Outcomes
Thermodynamics represent a crucial fundament in mechanical engineering, in particular in the field of power engineering. The knowledge of the basic principles of thermodynamics and heat transfer is a prerequisite to understand the complex energy conversion processes occurring in power plants and propulsion systems. Furthermore thermodynamics apply in a variety of different other disciplines e. g. refrigeration engineering, chemistry and material science. In the module "Engineering Thermodynamics" the fundamentals essential to this wide range of applications are taught.

Content
Cf. detailed description of the contents of the lectures in "Engineering Thermodynamics and Heat Transfer I and II".

Module: Mechanical Design [BSc-Modul 06, MKL]

Coordination: Albert Albers, Sven Matthiesen
Degree programme: Bachelorstudiengang Maschinenbau (B.Sc.)
Subject:

ECTS Credits	Cycle	Duration
18	Every term	4

Courses in module

ID	Course	Hours per week C/E/T	Term	CP	Responsible Lecturer(s)
2145178	Mechanical Design I (p. 70)	2	W	2	A. Albers, Burkardt
2145185	Tutorials Mechanical Design I (p. 104)	1	W	2	A. Albers
2146178	Mechanical Design II (p. 72)	2	S	2	A. Albers, Burkardt
2146185	Tutorials Mechanical Design II (p. 105)	1	S	2	A. Albers, Divers tutors
2145151	Mechanical Design III (p. 73)	2	W	2	A. Albers, N. Burkardt
2145153	Tutorials Mechanical Design III (p. 106)	1	W	2	A. Albers, diverse
2146177	Mechanical Design IV (p. 75)	2	S	2	A. Albers, N. Burkardt
2146184	Tutorials Mechanical Design IV (p. 107)	1	S	2	A. Albers, diverse
2145154	MD - Team Orientated Mechanical Design (3 + 4) (p. 83)	2	W/S	2	A. Albers, diverse

Learning Control / Examinations
written examination with theoretical and design part concerrning the whole teaching program of Maschinenkonstruktionslehre 1 - 4 (mechanical design 1 - 4)

Conditions
Successful passing of the tutorials/workshops of MD 1 + 2

Learning Outcomes
Main teaching objective is the embodiment design of machine systems according to defined requirterments what means the recognizing of functional interactions and their transfer into a cost efficient and function fullfilling design

Content
see detailed descriptions to the lectures Maschinenkonstruktionslehre 1-4

Module: Key Competences [BSc-Modul 07, SQL]

Coordination: Alexander Wanner
Degree programme: Bachelorstudiengang Maschinenbau (B.Sc.)
Subject:

ECTS Credits	Cycle	Duration
6	Every 2nd term, Summer Term	2

Courses in module

ID	Course	Hours per week C/E/T	Term	CP	Responsible Lecturer(s)
2174970	Working Methods in Mechanical Engineering (lecture) (p. 48)	1	S	2	A. Wanner
2145154	MD - Team Orientated Mechanical Design (3 + 4) (p. 83)	2	W/S	2	A. Albers, diverse
2110968	Workshop 'Working Methods in Mechanical Engineering' (IFAB) (p. 133)	1	S	2	G. Zülch, P. Stock
2118973	Workshop 'Working Methods in Mechanical Engineering' (IFL) (p. 136)	1	S	2	Baur
2142975	Workshop 'Working Methods in Mechanical Engineering' (IMT) (p. 140)	1	S	2	M. Worgull
2162983	Workshop I 'Working Methods in Mechanical Engineering' (ITM) (p. 148)	1	S	2	T. Böhlke, Mitarbeiter
2182981	Workshop II 'Working Methods in Mechanical Engineering' (IZBS) (p. 155)	1	S	2	O. Kraft, P. Gruber, Courty
2182974	Workshop I 'Working Methods in Mechanical Engineering' (IAM-ZBS, Gumbsch) (p. 145)	1	S	2	P. Gumbsch, M. Weber, A. Haug
2106984	Workshop 'Working Methods in Mechanical Engineering' (AIA) (p. 125)	1	S	2	G. Bretthauer
2114450	Workshop 'Working Methods in Mechanical Engineering' (FAST-Leichtbautechnologie) (p. 128)	1	S	2	F. Henning
2114979	Workshop 'Working Methods in Mechanical Engineering' (FAST-MOBIMA) (p. 129)	1	S	2	M. Geimer
2114989	Workshop 'Working Methods in Mechanical Engineering' (FAST - Fahrzeugtechnik) (p. 127)	1	S	2	F. Gauterin, El-Haji, Unrau
2114990	Workshop 'Working Methods in Mechanical Engineering' (FAST - Bahnsystemtechnik) (p. 126)	1	S	2	P. Gratzfeld
2126980	Workshop 'Working Methods in Mechanical Engineering' (IKM) (p. 137)	1	S	2	M. Hoffmann
2128998	Workshop 'Working Methods in Mechanical Engineering' (IMI) (p. 139)	1	S	2	J. Ovtcharova, Mitarbeiter
2130985	Workshop 'Working Methods in Mechanical Engineering' (IKR) (p. 138)	1	S	2	D. Cacuci, Erkan Arslan
2134996	Workshop 'Working Methods in Mechanical Engineering' (IFKM) (p. 135)	1	S	2	U. Spicher

2138997	Workshop 'Working Methods in Mechanical Engineering' (MRT) (p. 144)	1	S	2	C. Stiller
2146971	Workshop I 'Working Methods in Mechanical Engineering' (IPEK) (p. 147)	1	S	2	A. Albers
2146972	Workshop II 'Working Methods in Mechanical Engineering' (IPEK) (p. 152)	1	S	2	S. Matthiesen, Wissenschaftlicher Mitarbeiter des IPEK
2150987	Workshop I 'Working Methods in Mechanical Engineering' (WBK) (p. 150)	1	S	2	V. Schulze
2150988	Workshop II 'Working Methods in Mechanical Engineering' (WBK) (p. 156)	1	S	2	G. Lanza
2150989	Workshop III 'Working Methods in Mechanical Engineering' (WBK) (p. 159)	1	S	2	J. Fleischer
2158978	Workshop 'Working Methods in Mechanical Engineering' (FSM) (p. 130)	1	S	2	M. Gabi
2162994	Workshop II 'Working Methods for Mechanical Engineering' (ITM) (p. 153)	1	S	2	C. Proppe
2162995	Workshop III 'Working Methods in Mechanical Engineering' (ITM) (p. 158)	1	S	2	W. Seemann
2166991	Workshop 'Working Methods in Mechanical Engineering' (ITT) (p. 143)	1	S	2	U. Maas
2170972	Workshop 'Working Methods in Mechanical Engineering' (ITS) (p. 142)	1	S	2	H. Bauer
2174976	Workshop I 'Working Methods in Mechanical Engineering' (IWK I) (p. 149)	1	S	2	K. Poser
2174986	Workshop II 'Working Methods in Mechanical Engineering' (IWK I) (p. 154)	1	S	2	A. Wanner
2174987	Workshop 'Working Methods in Mechanical Engineering' (IAM-AWP) (p. 131)	1	S	2	H. Seifert
2182982	Workshop 'Working Methods in Mechanical Engineering' (IAM-ZBS, Nestler) (p. 132)	1	S	2	B. Nestler
2190497	Workshop I 'Working Methods in Mechanical Engineering' (IFRT) (p. 146)	1	S	2	R. Stieglitz
2190498	Workshop II 'Working Methods in Mechanical Engineering' (IFRT) (p. 151)	1	S	2	K. Ivanov
2190975	Workshop III 'Working Methods in Mechanical Engineering' (IFRT) (p. 157)	1	S	2	X. Cheng
2110969	Working Methods in Mechanical Engineering (Lecture in English) (p. 49)	1	S	2	G. Zülch

Learning Control / Examinations
see submodule descriptions

Conditions
None.

Learning Outcomes
Key competences are trained in project and team work on mechanical engineering problems.

Content

Module: Production Operations Management [BSc-Modul 09, BPW]

Coordination: Kai Furmans
Degree programme: Bachelorstudiengang Maschinenbau (B.Sc.)
Subject:

ECTS Credits	Cycle	Duration
5	Every 2nd term, Summer Term	1

Courses in module

ID	Course	Hours per week C/E/T	Term	CP	Responsible Lecturer(s)
2110085	Production Operations Management (p. 50)	4	S	5	K. Furmans, G. Lanza, G. Zülch, F. Schultmann, Furmans, Lanza, Schultmann, Zülch

Learning Control / Examinations
written examn, 90 min, graded

Conditions
none

Recommendations
none

Learning Outcomes
The student

- knows about the connections between production sience, work scheduling and -design, material flow and basics of econmics,
- is able to differentiate between production systems and knows there characteristics,
- is able to design workplaces according to the requirements,
- is able to create a material flow system to ensure supply and
- has the knowledge to evaluate systems finacially.

Content
The lecture is given in cooperation by the Institute for Conveying Technologies and Logistics (IFL), the Institute for Arbeitswissenschaft und Betriebsorganisation, the Institute of Production Science and the Institute for Industrial Production (IIP). Basic knowledge about the planning and operation of a production business is provided.
Subject areas are production science (production techniques, manufacturing and assembly systems), work scheduling, work control, work design, material flow as well as basics of economics (accounting, reinvestment analysis, legal forms).

Remarks
none

Module: Computer Science [BSc-Modul 09, Inf]

Coordination: Jivka Ovtcharova
Degree programme: Bachelorstudiengang Maschinenbau (B.Sc.)
Subject:

ECTS Credits	Cycle	Duration
8	Every 2nd term, Winter Term	1

Courses in module

ID	Course	Hours per week C/E/T	Term	CP	Responsible Lecturer(s)
2121390	Computer Science for Engineers (p. 67)	2	W	8	J. Ovtcharova
3121036	Computer Science for Engineers Lab Course (p. 52)	2	W	0	J. Ovtcharova
2121391	Exercises Computer Science for Engineers (p. 103)	2	W	0	J. Ovtcharova

Learning Control / Examinations
Science for Engineers", 100%, 180 minutes;
prerequisite: Computer Lab Certificate

Conditions
None.

Recommendations
None.

Learning Outcomes
The students have a basic understanding of the fundamental terms of information technology. The students master the essential methods of object-oriented programming (OOP) and OO-modeling with UML. They are acquainted with the most important dynamic data structures (graphs, trees, lists) that use the class concept.
After successfully completing this module, students should be able to develop simple object-oriented programs in Java.

Content
Basics: Information representation- and processing, terms and definitions: alphabet, data, signals, information, numeral systems, propositional logic and Boolean algebra, computer architectures, programming paradigms.
Object Orientation: Definition and important characteristics of object orientation, Object-oriented modeling with UML.
Data Structures: Definition, properties and application of graphs, trees, linked lists, queues and stacks.
Algorithms: Characteristics of algorithms, complexity analysis, design methods, important examples.
Database management systems: Relational data model, relational algebra, declarative language SQL.
Basics and concepts of JAVA. Introduction to programming using JAVA.

Remarks
None.

Module: Electrical Engineering [BSc-Modul 10, ET]

Coordination: Klaus-Peter Becker
Degree programme: Bachelorstudiengang Maschinenbau (B.Sc.)
Subject:

ECTS Credits	Cycle	Duration
8	Every 2nd term, Winter Term	1

Courses in module

ID	Course	Hours per week C/E/T	Term	CP	Responsible Lecturer(s)
23339	Electrical Engineering and Electronics for Mechanical Engineers (p. 55)	4+2	W	8	K. Becker

Learning Control / Examinations
graded, “Electrical Engineering for Mechanical Engineers”, 100%, written exam, 180 minutes.

Conditions
None

Learning Outcomes
Gaining an overview of the physical basics of electrical engineering (electrical field, magnetic field, resistor, capacitor, inductor)
Learning methods for the calculation of electrical DC- and AC-circuits,
Understanding the construction and steady-state performance of the basic electrical machines (transformer, DC-, induction- and synchronous machine),
Getting an overview over the most important semicon-ductor devices and their functionality,
Understanding the basic principles of power electronic circuits and their arrangements to more complex structures (for semiconductor devices which can be switched off or can not be switched off as well),
Learning the basics of the operation mode of operational amplifiers.

Content
Fundamental terms, ohmic resistor, electrical field, magnetic field, oscillations, complex calculation of alternating current circuits, three phase current, measurement technique, drive engineering, DC machine, transformer, induction machine, synchronous machine, semiconductor devices, transistors and thyristors, power electronics, operational amplifiers

Module: Measurement and control systems [BSc-Modul 11, MRT]

Coordination: Christoph Stiller
Degree programme: Bachelorstudiengang Maschinenbau (B.Sc.)
Subject:

ECTS Credits	Cycle	Duration
7	Every 2nd term, Winter Term	1

Courses in module

ID	Course	Hours per week C/E/T	Term	CP	Responsible Lecturer(s)
2137301	Measurement and Control Systems (p. 60)	3	W	7	C. Stiller

Learning Control / Examinations
written exam, 3 hours

Conditions
None.

Learning Outcomes
Measurement and control of physical entities is a vital requirement in most technical applications. Such entities may comprise e.g. pressure, temperature, flow, rotational speed, power, voltage and electrical current, etc.. From a general perspective, the objective of measurement is to obtain information about the state of a system while control aims to influence the state of a system in a desired manner. This module provides an introduction to this field and general systems theory. The control part of the lecture presents classical linear control theory. The measurement part discusses electrical measurement of non-electrical entities.

Content

Module: Fluid mechanics [BSc-Modul 12, SL]

Coordination: Martin Gabi
Degree programme: Bachelorstudiengang Maschinenbau (B.Sc.)
Subject:

ECTS Credits	Cycle	Duration
7	Every 2nd term, Winter Term	1

Courses in module

ID	Course	Hours per week C/E/T	Term	CP	Responsible Lecturer(s)
2153412	Fluid Mechanics (german language) (p. 93)	4	W	7	T. Schenkel

Learning Control / Examinations
written exam, 3 hours

Conditions
None.

Learning Outcomes

Content

Module: Machines and Processes [BSc-Modul 13, MuP]

Coordination: Ulrich Spicher
Degree programme: Bachelorstudiengang Maschinenbau (B.Sc.)
Subject:

ECTS Credits	Cycle	Duration
7	Every 2nd term, Winter Term	1

Courses in module

ID	Course	Hours per week C/E/T	Term	CP	Responsible Lecturer(s)
2185000	Machinery and Processes (p. 68)	4	W	7	H. Kubach, M. Gabi, H. Bauer, U. Maas, Maas, Gabi, Bauer, Spicher, Kubach

Learning Control / Examinations
successful lab course and written exam (2 h)

Conditions
None.

Learning Outcomes
The students get to know the basic energy conversion processes and their applications in different machines.

Content
basics of thermodynamics
thermal fluid machines

- steam turbunes
- gas turbines
- combined-cycle plants
- turbines and compressors
- aircraft engines

hydraulic fluid machines

- oerating performance
- characterization
- control
- cavitation
- wind turbines, propellers

internal combustion engines

- characteristic parameters
- engine parts
- kinematics
- engine processes
- fuels

- emissions
- alternative drive trains

Remarks
Lab course takes place in Summer Semester as well.
English lecture will probably start in SS 2012.

Module: Compulsory optional subject (BSc) [BSc-Modul 14, WPF]

Coordination: Alexander Wanner
Degree programme: Bachelorstudiengang Maschinenbau (B.Sc.)
Subject:

ECTS Credits	Cycle	Duration
5	Every term	1

Courses in module

ID	Course	Hours per week C/E/T	Term	CP	Responsible Lecturer(s)
2105011	Introduction into Mechatronics (p. 53)	3	W	6	G. Bretthauer, A. Albers
2114093	Fluid Technology (p. 58)	2/2	W	4	M. Geimer
2162235	Introduction into the multi-body dynamics (p. 54)	3	S	5	W. Seemann
2161252	Advanced Methods in Strength of Materials (p. 66)	2	W	4	T. Böhlke
2161224	Machine Dynamics (p. 69)	3	W	5	C. Proppe
2161212	Vibration Theory (p. 100)	3	W	5	W. Seemann
2161206	Mathematical Methods in Dynamics (p. 77)	2	W	4	C. Proppe
2161254	Mathematical Methods in Strength of Materials (p. 78)	2	W	4	T. Böhlke
2162241	Mathematical methods of vibration theory (p. 79)	3	S	5	W. Seemann
2154432	Mathematical Methods in Fluid Mechanics (p. 80)	2	S	4	T. Schenkel
2400451	Modern Physics for Engineers (p. 85)	2	S	4	B. Pilawa
2121350	Product Lifecycle Management (p. 88)	4	W	6	J. Ovtcharova
2149605	Simulation of production systems and processes (p. 92)	3	W	5	K. Furmans, V. Schulze, G. Zülch
2174576	Systematic Materials Selection (p. 94)	3	S	5	A. Wanner
22512	Heat and mass transfer (p. 118)	2	W	4	H. Bockhorn
2121001	Integrated Information Systems for engineers (p. 95)	3	W	5	S. Rogalski, J. Ovtcharova
2183703	Modelling and Simulation (p. 84)	2	W/S	4	B. Nestler
2181738	Scientific computing for Engineers (p. 124)	2	W	4	D. Weygand, P. Gumbsch
2183702	Modelling of Microstructures (p. 82)	2	W/S	4	B. Nestler
2105014	Laboratory mechatronics (p. 81)	3	W	4	A. Albers, G. Bretthauer, C. Proppe, C. Stiller
2147175	CAE-Workshop (p. 51)	3	W/S	3	A. Albers, Assistenten
2165515	Fundmentals of Combustion I (p. 62)	2	W	4	U. Maas
2181612	Physical basics of laser technology (p. 87)	2	W	4	J. Schneider
3122031	Virtual Engineering (Specific Topics) (p. 117)	2	S		J. Ovtcharova
2142890	(p. 86)	2	S	4	P. Gumbsch, A. Last, A. Nesterov-Müller
2117095	Basics of Technical Logistics (p. 61)	4	W	6	M. Mittwollen, Linsel

Learning Control / Examinations
graded oral or written exam, duration (depends on the lecture).

Conditions
None.

Learning Outcomes
In the compulsory optional subject the basics of different aspects of mechanical engineering are taught.

Content
see chosen compulsory optional subject

Remarks
In total, four compulsory optional subjects have to be chosen, one in the bachelor´s program and three in the master´s program. For the bachelor´s program, a reduced catalogue exists (see Studienplan).

Module: Major Field [BSc-Modul 15, SP]

Coordination: Alexander Wanner
Degree programme: Bachelorstudiengang Maschinenbau (B.Sc.)
Subject:

ECTS Credits	Cycle	Duration
12	Every term	2

Learning Control / Examinations
graded or not graded, oral or written exam, duration (depends on the lecture)

Conditions
None.

Learning Outcomes
Within the emphasis module a special aspect of the mechanical enginnering are taught.

Content
see chosen emphasis modules

Remarks
In total, three emphasis modules have to be chosen, one in the bachelor´s program and two in the master´s program. For the bachelor´s program, a reduced catalogue exists (see Studienplan).

4 Courses

4.1 All Courses

Course: Working Methods in Mechanical Engineering (lecture) [2174970]

Coordinators: Alexander Wanner
Part of the modules: Key Competences (p. 35)[BSc-Modul 07, SQL]

ECTS Credits	Hours per week	Term	Instruction language
2	1	Summer term	de

Learning Control / Examinations
certificate after active participation in all four workshops

Conditions
none

Learning Outcomes
strengthening of students' skills and abilities in
- scientific writing
- literature research and citation techniques
- time management
- teamwork
- presentation and communication skills

Content
A lecture series deals with:
- scientific working and information skills
- time and project management, teamwork
- presentation skills
In addition to the lecture series workshops take place:
On four afternoons at intervals of 2 weeks the students have to work on a project task in teams of 4. In the last workshop the teams have to present their results orally (presentation) and written (abstract, poster) and get feedback from the teching staff and the students from the other teams.

Course: Working Methods in Mechanical Engineering (Lecture in English) [2110969]

Coordinators: Gert Zülch
Part of the modules: Key Competences (p. 35)[BSc-Modul 07, SQL]

ECTS Credits	Hours per week	Term	Instruction language
2	1	Summer term	en

Learning Control / Examinations
certificate after active participation in all four workshops

Conditions
For students of the Carl Benz School (International Department), study programme "Mechanical Engineering (B.Sc.)".

Location: International Department.

Please refer to the information board of the International Department.

Learning Outcomes

- Knowledge about prerequisites and ethics of scientific work
- Basic knowledge about techniques for time management and team work
- Basic knowledge about literature research
- Basic knowledge about presentation techniques (oral and written)

Content

1. Introduction to the course
2. Scientific working techniques
3. Literature research
4. Project management
5. Time management
6. Scientific elaborations
7. Presentation techniques

Literature
Learning material:
Handout online on: https://ilias.rz.uni-karlsruhe.de

Literature:

- MACKENZIE, Alec: The Time Trap. New York u.a.: Amacom, 3rd edition 1997.
- BARRASS, Robert: Study!: A Guide to Effective Learning, Revision and Examination Techniques. London, New York: Routledge Chapman & Hall , 2nd edition 2002.
- BARRASS, Robert: Scientists Must Write: A guide to better writing for scientists, engineers and students. London, New York: Routledge Chapman & Hall , 2nd edition 2003.
- WELLINGTON, Jerry; BATHMAKER, Ann-Marie; HUNT, Cheryl u.a.: Succeeding with your Doctorate. London u.a.: Sage Publications, 2005.
- MANDEL, Steve: Presentation Skills: A Practical Guide to Better Speaking. Boston, MA: Thomson NETg, 3rd edition 2000.

Please refer to the latest edition.

Course: Production Operations Management [2110085]

Coordinators: Kai Furmans, Gisela Lanza, Gert Zülch, Frank Schultmann, Furmans, Lanza, Schultmann, Zülch
Part of the modules: Production Operations Management (p. 38)[BSc-Modul 09, BPW]

ECTS Credits	Hours per week	Term	Instruction language
5	4	Summer term	de

Learning Control / Examinations
written exam (duration: 1,5 hours)

Conditions
none

Recommendations
none

Learning Outcomes
The student

- knows about the connections between production sience, work scheduling and -design, material flow and basics of econmics,
- is able to differentiate between production systems and knows there characteristics,
- is able to design workplaces according to the requirements,
- is able to create a material flow system to ensure supply and
- has the knowledge to evaluate systems finacially.

Content
The lecture is given in cooperation by the Institute for Conveying Technologies and Logistics (IFL), the Institute for Arbeitswissenschaft und Betriebsorganisation, the Institute of Production Science and the Institute for Industrial Production (IIP). Basic knowledge about the planning and operation of a production business is provided.Subject areas are production science (production techniques, manufacturing and assembly systems), work scheduling, work control, work design, material flow as well as basics of economics (accounting, reinvestment analysis, legal forms).

Media
Presentation and black board

Literature
Lecture notes

Remarks
none

Course: CAE-Workshop [2147175]

Coordinators: Albert Albers, Assistenten
Part of the modules: Compulsory optional subject (BSc) (p. 45)[BSc-Modul 14, WPF]

ECTS Credits	Hours per week	Term	Instruction language
3	3	Winter / Summer Term	de

Learning Control / Examinations
Depending on the manner in which the CAE-Workshop will be credited.

Conditions
compulsory attendance

Recommendations
We suggest this Workshop after 2 years of classes.

Learning Outcomes
In the CAE - Workshops computer-aided tools used in the industrial product development process will be presented and trained. The complete process chain is shown using concrete examples of typical mechanical components. The possibilities and limits of virtual product development will be shown during this course. Here, the students get practical insight into the world of multi-body systems, the finite element method and optimization research questions.

The students receive the theoretical basics and are trained on modern hardware in the use of commercial software. In order to support the students to discuss the calculation and optimization results, the participants of the workshop must discuss their results in small groups and finally present it to all students.

Content
Content in the summer semester:

- introduction to the finite element analysis (FEA)
- stess and modal analysis of finite element models using Abaqus/CAE as a preprocessor and Abaqus solver
- introduction to topology and shape optimization
- creation and calculation of various optimization models with the optimization package TOSCA and the Abaqus solver

Content in the winter semester:

- introduction to the finite element analysis (FEA)
- stress and modal analysis of finite element models using Abaqus/CAE as a preprocessor and Abaqus solver
- introduction to multi-body simulation (MBS)
- preparation and running of multi-body simulation models. Coupling of the MBS and FEA to calculate hyprid multi-body simulation problems.

Literature
The workshop script will be allocated at Ilias.

Course: Computer Science for Engineers Lab Course [3121036]

Coordinators: Jivka Ovtcharova
Part of the modules: Computer Science (p. 39)[BSc-Modul 09, Inf]

ECTS Credits	Hours per week	Term	Instruction language
0	2	Winter term	en

Learning Control / Examinations
Programming assignments, that are to be implemented at the computer, are given every two weeks. The students are supervised by tutors while they work on the assignments, which have to be handed in and explained to the tutors regularly. The aim of the workshop is applying the skills taught in the tutorial. The students prove that they are able to independently implement what they have learned.
All assignments have to be handed in, before they can take part in the written exam at lecture 'Computer Science for Engineers'.

Conditions
None.

Recommendations
None.

Learning Outcomes
In the computer science workshop for the lecture Computer Science in Engineering, students are given several practical assignments, through which they develop a program containing the subject areas covered in the tutorial.

Content
Introduction to programming using JAVA

Course: Introduction into Mechatronics [2105011]

Coordinators: Georg Bretthauer, Albert Albers
Part of the modules: Compulsory optional subject (BSc) (p. 45)[BSc-Modul 14, WPF]

ECTS Credits	Hours per week	Term	Instruction language
6	3	Winter term	de

Learning Control / Examinations
Written examination, oral examination or certification of participation depending on the "Studienplan" resp. "Prüfungs- und Studienordnung (SPO)"

Conditions
None.

Learning Outcomes
Mechatronics is an interdisciplinary field, based on classical mechanical and electrical engineering as well as automation science and technology and computer science. The main activities focus on integral system development with technical components connected via an intelligent control system. In this regard simulation of mechanical and electrical systems becomes important for rapid and efficient development. First part of the lecture provides a survey of mechatronics. Subsequently the architecture of mechatronic systems is described. Furthermore fundamentals of modeling of mechanical, pneumatic, hydraulic, electrical and electronic components are discussed. Finally optimization methods, e. g. adaptive controllers, are presented. In the second part of the lecture basics of development methods as well as the characteristics of the development of mechatronic products are described. A further important item is the presentation of the system concept of mechatronics in comparison to conventional mechanical systems. The contents of the course are explained using examples for mechatronic products in the area of automotive engineering.

Content
Part I: Modeling and optimization (Prof. Bretthauer)

Introduction
Architecture of mechatronic systems
Modeling of mechatronic systems
Optimization of mechatronic systems
Perspective

Part II: Development and design (Prof. Albers)

Introduction
Development method for mechatronic products
Examples

Literature
Heimann, B.; Gerth, W.; Popp, K.: Mechatronik. Leipzig: Hanser, 1998

Isermann, R.: Mechatronische Systeme - Grundlagen. Berlin: Springer, 1999

Roddeck, W.: Einführung in die Mechatronik. Stuttgart: B. G. Teubner, 1997

Töpfer, H.; Kriesel, W.: Funktionseinheiten der Automatisierungstechnik. Berlin: Verlag Technik, 1988

Föllinger, O.: Regelungstechnik. Einführung in die Methoden und ihre Anwendung. Heidelberg: Hüthig, 1994

Bretthauer, G.: Modellierung dynamischer Systeme. Vorlesungsskript. Freiberg: TU Bergakademie, 1997

Course: Introduction into the multi-body dynamics [2162235]

Coordinators: Wolfgang Seemann
Part of the modules: Compulsory optional subject (BSc) (p. 45)[BSc-Modul 14, WPF]

ECTS Credits	Hours per week	Term	Instruction language
5	3	Summer term	de

Learning Control / Examinations
Written exam

Optional subject: oral, 30 min.
Major Subject: oral, 20 min.

Conditions
None.

Learning Outcomes
Mechanisms, vehicles and industrial robots are examples of multibody systems. For dynamics simulations expressions for kinematical quantities and formulations of equations of motion are required which make it easy to switch from one system to another. Efficient methods are described.
The course is mainly divided in two parts: kinematics on the one hand and different possibilities to derive the equations of motion on the other hand.

Content
The role of multibody systems in engineering, kinematics of a single rigid body, Kinematics of multibody systems, rotation matrix, angular velocity, derivatives in different reference systems, holonomic and non-holonomic constraints, Newton-Euler's equations, principle of d'Alembert, principle of virtuel power, Lagrange's equations, Kane's equations, structure of the equations of motion

Literature
Wittenburg, J.: Dynamics of Systems of Rigid Bodies, Teubner Verlag, 1977
Roberson, R. E., Schwertassek, R.: Dynamics of Multibody Systems, Springer-Verlag, 1988
de Jal'on, J. G., Bayo, E.: Kinematik and Dynamic Simulation of Multibody System.
Kane, T.: Dynamics of rigid bodies.

Course: Electrical Engineering and Electronics for Mechanical Engineers [23339]

Coordinators: Klaus-Peter Becker
Part of the modules: Electrical Engineering (p. 40)[BSc-Modul 10, ET]

ECTS Credits	Hours per week	Term	Instruction language
8	4+2	Winter term	de

Learning Control / Examinations
written examination with duration of 3h

Conditions
none

Learning Outcomes
Gaining an overview of the physical basics of electrical engineering (electrical field, magnetic field, resistor, capacitor, inductor)
Learning methods for the calculation of electrical DC- and AC-circuits,
Understanding the construction and steady-state performance of the basic electrical machines (transformer, DC-, induction- and synchronous machine),
Getting an overview over the most important semicon-ductor devices and their functionality,
Understanding the basic principles of power electronic circuits and their arrangements to more complex structures (for semiconductor devices which can be switched off or can not be switched off as well),
Learning the basics of the operation mode of operational amplifiers

Content
Fundamental terms, ohmic resistor, electrical field, magnetic field, oscillations, complex calculation of alternating current circuits, three phase current, measurement technique, drive engineering, DC machine, transformer, induction machine, synchronous machine, semiconductor devices, transistors and thyristors, power electronics, operational amplifiers

Literature
see homepage
download:
script (ca. 600 pages)
powerpoint sheets

Course: Experimental Lab Course in Material Science, mach, mage, part A of class, in groups [2174597]

Coordinators: Alexander Wanner, Hans Jürgen Seifert, Kay Weidenmann
Part of the modules: Materials Science and Engineering (p. 32)[BSc-Modul 04, WK]

ECTS Credits	Hours per week	Term	Instruction language
3	2	Summer term	

Learning Control / Examinations
Oral colloquium at the beginning of each topic; certificate of successful attendance.

Conditions
Materials Science and Engineering I & II

Learning Outcomes
The students are able to describe the relationship between atomic structure, microscopical observations, and properties of solid materials.

The students are familiar with the typical property profies and applications of the most important engineering materials.

The students know about standard materials characterization methods and are able to asses materials on base of the data obtained by these methods.

Content
Performing and evaluating of two laboratory experiments in each of the following topics:

Mechanical testing of materials
Nonmetallic materials
Microstructure and properties
Cyclic loading / fatigue
Influence of manufacturing technique on materials

Literature
Laboratory script;

Shackelford, J.F.
Werkstofftechnologie für Ingenieure
Verlag Pearson Studium, 2005

Course: Experimental Lab Course in Material Science, mach, mage, part B of class, in groups [2174587]

Coordinators: Alexander Wanner, Hans Jürgen Seifert, Kay Weidenmann
Part of the modules: Materials Science and Engineering (p. 32)[BSc-Modul 04, WK]

ECTS Credits	Hours per week	Term	Instruction language
3	2	Summer term	de

Learning Control / Examinations
Oral colloquium at the beginning of each topic; certificate of successful attendance.

Conditions
Materials Science and Engineering I & II

Learning Outcomes
The students are able to describe the relationship between atomic structure, microscopical observations, and properties of solid materials.

The students are familiar with the typical property profies and applications of the most important engineering materials.

The students know about standard materials characterization methods and are able to asses materials on base of the data obtained by these methods.

Content
Performing and evaluating of two laboratory experiments in each of the following topics:

Mechanical testing of materials
Nonmetallic materials
Microstructure and properties
Cyclic loading / fatigue
Influence of manufacturing technique on materials

Literature
Laboratory script;

Shackelford, J.F.
Werkstofftechnologie für Ingenieure
Verlag Pearson Studium, 2005

Course: Fluid Technology [2114093]

Coordinators: Marcus Geimer
Part of the modules: Compulsory optional subject (BSc) (p. 45)[BSc-Modul 14, WPF]

ECTS Credits	Hours per week	Term	Instruction language
4	2/2	Winter term	de

Learning Control / Examinations
The assessment consists of an oral exam (20 min) taking place in the recess period. The exam takes place in every semester. Re-examinations are offered at every ordinary examination date.

Conditions
None.

Learning Outcomes
The students will be able to

- know and understand physical principles of fluid power systems
- know the current components and their operating mode
- know the advantages and disadvantages of different components
- dimension the components for a given purpose
- calculate simple systems

Content
In the range of hydrostatics the following topics will be introduced:

- Hydraulic fluids
- Pumps and motors
- Valves
- Accessories
- Hydraulic circuits.

In the range of pneumatics the following topics will be introduced:

- Compressors
- Motors
- Valves
- Pneumatic circuits.

Literature
Scritum for the lecture *Fluidtechnik*
Institute of Vehicle System Technology
downloadable

Course: Fundamentals of Chemistry [mach1NA1]

Coordinators: Olaf Deutschmann
Part of the modules: Principles of Natural Science (p. 30)[BSc-Modul 02, NG]

ECTS Credits	Hours per week	Term	Instruction language
3	2	Winter term	de

Learning Control / Examinations
Written examination

Conditions
None

Learning Outcomes
A basic understanding of chemical processes is to be acquired. Basic ideas concerning the structure of mater and of the proceeding of chemical reaction are to be understood. Important inorganic compounds and the metallurgy of important industrially used metals are to be known. The structure of organic compounds, the significance of important functional groups as well as the process of motoric combustion and the methods of exhaust after treatment are to be understood.

Content
Structure of matter: Definition of Chemistry, Basic terms, Element, Atom, Molecule, Ions, Avogadro-constant, Atomic mass, Coulomb's law, Mass spectrometer, Electron, Proton, Neutron, Mass number, Order number, Isotopes, Energy levels of electrons, Spectral lines, Ionization energies, Wave- particle- Dualism, Wave function/Orbital, Hydrogen atom, Quantum numbers, Energy level scheme, Electron configuration, Structure of the periodic system, Main properties of the groups, Ionic bonds, Valence electrons, Atomic unions, Atomic bond, Lewis-Formulae, Multiple bonds, Bonding enthalpies, Electronegativity, Ionic bonds, Metallic bonds, Molecule grids, Water, Dipole, van der Waals-forces, Hydrogen bridges, Ion grids, Metal grids, Phase diagrams, Eutectics, Solid state compounds, Crystals, Crystal systems, Gaseous state, Liquids, Solutions, Osmosis, Chromatography, Phase transitions.
Chemical Reactions: Stoiciometric calculations, Molar amounts, Concentrations, Solutions, State variables, Energy, Enthalpy, Entropy, Gibbs, chemical equilibrium, law of mass action, Equilibrium constant, Solubility product, Enthalpy and entropy of solutions, Reaction rate, Arrhenius- equation, Transition state, Radical reactions, Catalysis, Acids, Bases, Bronstedt, Acid/Base-couples, ph-Value, pKs, pKB, Indicators, Buffer solutions, Neutralisation, Oxidation/Reduction, Oxidation number, Electron transfer, Redox potentials, Standard potential, Nernst- equation, Galvanic cell, Batteries (Led-Accumulator, Ni/Cd, Li-Ions), Fuel cells (PEM, SOFC), Corrosion, Electrolysis.
Inorganic Chemistry: Non metals: Nobel gases, Halogens, Hydrogen, Oxygen and Ozone, Sulfur and sulfur compounds, Nitrogen and nitrogen compounds, Carbon and Silicon.
Metals: Sources, Winning, Properties, Winning and use of important industrially used metals, Metallurgy of selected metals (Iron, Aluminium), 4. Main group, Transition metals, Corrosion, Corrosion protection.
Organic Chemistry: Types of bonds, Formulae, Spectroscopy, Separation and distillation, Alkanes, Alkenes, Alkynes, Aromatic hydrocarbons, Coal, Crude oil, Composition of fuel, Motoric combustion, Gas turbines, Basics of polymers, Reactions of polymer formation (Polymerization, Poly condensation, Poly addition, cross linking), important polymers.

Course: Measurement and Control Systems [2137301]

Coordinators: Christoph Stiller
Part of the modules: Measurement and control systems (p. 41)[BSc-Modul 11, MRT]

ECTS Credits	Hours per week	Term	Instruction language
7	3	Winter term	de

Learning Control / Examinations
written exam; duration 2,5 h; paper reference materials only (no calculator)

Conditions
Fundamentals in physics and electrical engineering; ordinary linear differential equations; Laplace transform

Learning Outcomes
Measurement and control of physical entities is a vital requirement in most technical applications. Such entities may comprise e.g. pressure, temperature, flow, rotational speed, power, voltage and electrical current, etc.. From a general perspective, the objective of measurement is to obtain information about the state of a system while control aims to influence the state of a system in a desired manner. This lecture provides an introduction to this field and general systems theory. The control part of the lecture presents classical linear control theory. The measurement part discusses electrical measurement of non-electrical entities.

Content
1 Dynamic systems
2 Properties of important systems and modeling
3 Transfer characteristics and stability
4 Controller design
5 Fundamentals of measurement
6 Estimation
7 Sensors
8 Introduction to digital measurement

Literature

- Measurement and Control Systems:

R.H. Cannon: Dynamics of Physical Systems, McGraw-Hill Book Comp., New York,1967
G.F. Franklin: Feedback Control of Dynamic Systems, Addison-Wesley Publishing Company, USA, 1988
R. Dorf and R. Bishop: Modern Control Systems, Addison-Wesley
C. Phillips and R. Harbor: Feedback Control Systems, Prentice-Hall

- Regelungstechnische Bücher:

J. Lunze: Regelungstechnik 1 & 2, Springer-Verlag
R. Unbehauen: Regelungstechnik 1 & 2, Vieweg-Verlag
O. Föllinger: Regelungstechnik, Hüthig-Verlag
W. Leonhard: Einführung in die Regelungstechnik, Teubner-Verlag
Schmidt, G.: Grundlagen der Regelungstechnik, Springer-Verlag, 2. Aufl., 1989

- Messtechnische Bücher:

E. Schrüfer: Elektrische Meßtechnik, Hanser-Verlag, München, 5. Aufl., 1992
U. Kiencke, H. Kronmüller, R. Eger: Meßtechnik, Springer-Verlag, 5. Aufl., 2001
H.-R. Tränkler: Taschenbuch der Messtechnik, Verlag Oldenbourg München, 1996
W. Pfeiffer: Elektrische Messtechnik, VDE Verlag Berlin 1999
Kronmüller, H.: Prinzipien der Prozeßmeßtechnik 2, Schnäcker-Verlag, Karlsruhe, 1. Aufl., 1980

Course: Basics of Technical Logistics [2117095]

Coordinators: Martin Mittwollen, Linsel
Part of the modules: Compulsory optional subject (BSc) (p. 45)[BSc-Modul 14, WPF]

ECTS Credits	Hours per week	Term	Instruction language
6	4	Winter term	de

Learning Control / Examinations
after each lesson period; oral / written (if necessary) => (look at "Studienplan Maschinenbau", version of 7.7.2010)

Conditions
None.

Recommendations
None.

Learning Outcomes
The student:

- knows about processes and machines of technical logistics
- is able to handle fundamental structures and the impacts
- is able to refer to industrially used machines and
- practices the calculation on applying knowledge from lessons.

Content
Bases effect model of conveyor machines made for the change of position and orientation; conveyor processes; identification systems; drives; mechanical behaviour of conveyors; structure and function of conveyor machines; elements of intralogistics (belt conveyor, racks, automatic guided vehicles, fan-in, bifurcation)
sample applications and calculations in addition to the lectures inside practical lectures

Media
supplementary sheets,projector, blackboard

Literature
Recommendations during lessons

Course: Fundmentals of Combustion I [2165515]

Coordinators: Ulrich Maas
Part of the modules: Compulsory optional subject (BSc) (p. 45)[BSc-Modul 14, WPF]

ECTS Credits	Hours per week	Term	Instruction language
4	2	Winter term	de

Learning Control / Examinations
Oral
Duration: 30 min.

Conditions
None

Recommendations
None

Learning Outcomes
Based on the explanation of the fundamental concepts and observed phenomena in combustion, this lecture studies the experimental analysis and the mathematical description of laminar and turbulent flames. The lecture aims at giving insights in the fundamental physico-chemical processes during combustion, in particular with regard to technical combustion systems e.g. engines, gas turbines, furnaces.

Content
Fundamental concepts ans phenomena
Experimental analysis of flames
Conservation equations for laminar flat flames
Thermodynamics of combustion processes
Transport phenomena
Chemical reactions
Chemical kinetics mechanisms
Laminar premixed flames
Laminar diffusion flames

Media
Blackboard and Powerpoint presentation

Literature
Lecture notes,
Combustion - Physical and Chemical Fundamentals, Modeling and Simulation, Experiments, Pollutant Formation, authors: U. Maas, J. Warnatz, R.W. Dibble, Springer-Lehrbuch, Heidelberg 1996

Course: Advanced Mathematics I [1310]

Coordinators: Andreas Kirsch, Tilo Arens, Frank Hettlich
Part of the modules: Advanced Mathematics (p. 29)[BSc-Modul 01, HM]

ECTS Credits	Hours per week	Term	Instruction language
7	4	Winter term	de

Learning Control / Examinations
non graded (precondition for the admission to the examination): certificate of homeworks
graded: written examination

Conditions
none

Learning Outcomes
The students should know the basic facts and tools of one dimensional analysis

Content
Basic concepts, sequences and convergence, functions and continuity, series, differntial calculus of one variable, integral calculus

Literature
Burg, Haf, Wille: Höhere Mathematik für Ingenieure, Merziger, Wirth: Repetitorium der höheren Mathematik, Arens, Hettlich et al: Mathematik

Course: Advanced Mathematics II [1808]

Coordinators: Tilo Arens, Andreas Kirsch
Part of the modules: Advanced Mathematics (p. 29)[BSc-Modul 01, HM]

ECTS Credits	Hours per week	Term	Instruction language
7	4	Summer term	de

Learning Control / Examinations
precondition for the admission to the examination: certificate of homeworks (non graded)
written examination (graded)

Conditions
compulsary preconditions: none

Recommendations
cours of 1st semester

Learning Outcomes
The student shoud know the basics on vector spaces and multi-dimensional calculus and the basic techniques to solve differential equations

Content
vector spaces, differential equations, Laplace transform, vector-valued functions of several variables

Literature
Burg, Haf, Wille: Höhere Mathematik für Ingenieure, Merziger, Wirth: Repetitorium der höheren Mathematik, Arens, Hettlich et al: Mathematik

Course: Advanced Mathematics III [1314]

Coordinators: Andreas Kirsch
Part of the modules: Advanced Mathematics (p. 29)[BSc-Modul 01, HM]

ECTS Credits	Hours per week	Term	Instruction language
7	4	Winter term	de

Learning Control / Examinations
precondition for the admission to the examination: certificate for homeworks (non graded)
written examination (graded)

Conditions
compulsary preconditions: none

Recommendations
courses of 1st and 2nd semester

Learning Outcomes
The student shoud know techniques and applications of the multi-dimensional calculus (vector calculus) and should have basic knowledge on partial differential equations and stochastics

Content
Applications of multi-dimensional calculus, domain integral, vector analysis, partial differential equations, Fourier theory, stochastics

Literature
Burg, Haf, Wille: Höhere Mathematik für Ingenieure, Merziger, Wirth: Repetitorium der höheren Mathematik, Arens, Hettlich et al: Mathematik

Course: Advanced Methods in Strength of Materials [2161252]

Coordinators: Thomas Böhlke
Part of the modules: Compulsory optional subject (BSc) (p. 45)[BSc-Modul 14, WPF]

ECTS Credits	Hours per week	Term	Instruction language
4	2	Winter term	de

Learning Control / Examinations
depending on choice according to acutal version of study regulations
Additives as announced

Conditions
None.

Recommendations
None.

Learning Outcomes
The students can effectively apply the methods of advanced strength of materials. The students especially master the description of the strength characteristics of materials, the elastic, plastic and the hardening behaviour of metallic materials. The students can apply the failure description by deformation localization, damage or fracture. The students know the basics of bearing structures.

Content

- basics of tensor calculus
- elasticity theory
- application of elasticity: linear elastic fracture mechanics
- application of elasticity: bearing structures
- plasticity theory
- application of plasticity: stability of materials

Literature
Gummert, P.; Reckling, K.-A.: Mechanik. Vieweg 1994. Gross, D.; Seelig, T.: Bruchmechanik. Springer 2002. Hibbeler, R.C: Technische Mechanik 2 - Festigkeitslehre. Pearson Studium 2005. Parkus, H.: Mechanik der festen Körper. Springer 1988.

Course: Computer Science for Engineers [2121390]

Coordinators: Jivka Ovtcharova
Part of the modules: Computer Science (p. 39)[BSc-Modul 09, Inf]

ECTS Credits	Hours per week	Term	Instruction language
8	2	Winter term	de

Learning Control / Examinations
Written examination

Duration: 3 hours (compulsory subject)

Auxiliary means: none

Examination prerequisite: passed Lab Course [2121392]

Conditions
Examination prerequisite: passed Lab Course [2121392]

Recommendations
None.

Learning Outcomes
The students have a basic understanding of the fundamental terms of information technology, such as data, signals, information, numeral systems, propositional logic, computer architectures, data structures, algorithms, database managements systems as well as the related concepts and theories. The students master the essential methods of object-oriented programming (OOP) and OO-modeling with UML. They are acquainted with the most important dynamic data structures (graphs, trees, lists) that use the class concept. The students are capable of implementing effectively and efficiently both the theoretical and the practical concepts of information technology that are required for algorithmic thinking and the realization of algorithms as executable (JAVA) programs.

Content
Basics: Information representation- and processing, terms and definitions: alphabet, data, signals, information, numeral systems, propositional logic and Boolean algebra, computer architectures, programming paradigms.
Object Orientation: Definition and important characteristics of object orientation, Object-oriented modeling with UML.
Data Structures: Definition, properties and application of graphs, trees, linked lists, queues and stacks.
Algorithms: Characteristics of algorithms, complexity analysis, design methods, important examples.
Database management systems: Relational data model, relational algebra, declarative language SQL

Literature
Lecture notes
Robert Sedgewick: Algorithms in Java, Part 1-4, 3. Auflage, Addison Wesley, 2002, ISBN 0201361205.
Robert Sedgewick: Algorithms in Java, Part 5, 3. Auflage. Addison Wesley, 2003, ISBN 0201361213.
Gerhard Goos: Informatik 1. Eine einführende Übersicht, 4. Auflage, Springer Lehrbuch, 1992, ISBN 3540527907
Gerhard Goos: Informatik 2. Eine einführende Übersicht, 4. Auflage, Springer Lehrbuch, 1992, ISBN 3540555676
Sebastian Abeck: Kursbuch Informatik (Broschiert), Universitätsverlag Karlsruhe, 2005, ISBN-10: 3937300686
Russ Miles, Kim Hamilton: Learning UML 2.0, 1. Auflage, O'Reilly, 2006, ISBN 0596009828
Craig Larman: Applying UML and Patterns: An Introduction to Object-Oriented Analysis and Design and Iterative Development, 3. Auflage. Prentice Hall, 2004, ISBN 0131489062
Peter Drake: Data Structures and Algorithms in Java. 1. Auflage. Prentice Hall, 2005, ISBN 0131469142
Thomas Rießinger: Informatik für Ingenieure und Naturwissenschaftler: Eine anschauliche Einführung in das Programmieren mit C und Java, Springer, 2005, ISBN-10: 3540262431
Raghu Ramakrishnan, Johannes Gehrke: Database Management Systems, 3. Auflage, McGraw-Hill, 2003, ISBN 0072465638

Course: Machinery and Processes [2185000]

Coordinators: Heiko Kubach, Martin Gabi, Hans-Jörg Bauer, Ulrich Maas, Maas, Gabi, Bauer, Spicher, Kubach
Part of the modules: Machines and Processes (p. 43)[BSc-Modul 13, MuP]

ECTS Credits	Hours per week	Term	Instruction language
7	4	Winter term	de

Learning Control / Examinations
successful lab course and written exam (2 h)

Conditions
None.

Learning Outcomes
The students get to know the basic energy conversion processes and their applications in different machines.

Content
basics of thermodynamics
thermal fluid machines

- steam turbunes
- gas turbines
- combined-cycle plants
- turbines and compressors
- aircraft engines

hydraulic fluid machines

- oerating performance
- characterization
- control
- cavitation
- wind turbines, propellers

internal combustion engines

- characteristic parameters
- engine parts
- kinematics
- engine processes
- fuels
- emissions
- alternative drive trains

Media
slides and lecture notes to download

Remarks
Every student attends one lab course. Passing the lab course is required to write the exam.

Course: Machine Dynamics [2161224]

Coordinators: Carsten Proppe
Part of the modules: Compulsory optional subject (BSc) (p. 45)[BSc-Modul 14, WPF]

ECTS Credits	Hours per week	Term	Instruction language
5	3	Winter term	de

Learning Control / Examinations
Written examination (compulsory subject), auxiliary means: own manuscripts
Oral examination (optional subject) , no auxiliary means allowed

Conditions
none

Recommendations
none

Learning Outcomes
Application of engineering-oriented calculation methods in order to model and to understand dynamic effects in rotating machinery, e.g., runup, stationary operation of rigid rotors including balancing, transient and stationary behavior of flexible rotors, critical speeds, dynamics of slider-crank mechanisms, torsional oscillations.

Content
1. Introduction
2. Machine as mechatronic system
3. Rigid rotors: equations of motion, transient and stationary motion, balancing
4. Flexible rotors: Laval rotor (equations of motion, transient and stationary behavior, critical speed, secondary effects), refined models)
5. Slider-crank mechanisms: kinematics, equations of motion, mass and power balancing

Literature
Biezeno, Grammel: Technische Dynamik, 2. Edition, 1953

Holzweißig, Dresig: Lehrbuch der Maschinendynamik, 1979

Dresig, Vulfson: Dynamik der Mechanismen, 1989

Course: Mechanical Design I [2145178]

Coordinators: Albert Albers, Burkardt
Part of the modules: Mechanical Design (p. 34)[BSc-Modul 06, MKL]

ECTS Credits	Hours per week	Term	Instruction language
2	2	Winter term	de

Learning Control / Examinations
The exam in the discipline of mechanical engineering is composed of the topics from MD I to MD IV.
The complete MD-exam consists of the theoretical and constructive part.
Exam duration:
- 2 h theoretical part
- 3 h constructive part
Both parts of the exam must be passed to pass the complete MD-exam.

Conditions
Obligatory requirements: no

Recommendations
Attendance at MKL I to MKL IV lectures.

Learning Outcomes
Aims of the course

- Implementation of exemplary design process steps of product development with the help of **complex Systems,**
- Procuration of conforming to standards **interpretative rules and dimensioning rules** for part assemblies,
- Adduction to **complex** mechanical common used **machine parts** by fundamental considerations,
- Promotion of the **capacity for teamwork** as well as the **elaboration ability and assertiveness** during activity-related and supervised workshops

Content
Introduction in product development
Tools for visualization (technical drawing)
Product generation as a problem solving process
Technical systems for Product generation

- systems theory
- Elementary model C&CM

Basics of selected technical components

- springs
- bearings

Media

- Beamer
- Visualizer
- Mechanical components

Literature
Lecture notes:
The lecture notes can be downloaded via the eLearning platform Ilias.
Literature:
Konstruktionselemente des Maschinenbaus - 1 und 2
Grundlagen der Berechnung und Gestaltung von
Maschinenelementen;
Steinhilper, Sauer, Springer Verlag, ISBN 3-540-22033-X
or per full text access provided by university library
Grundlagen von Maschinenelementen für Antriebsaufgaben;
Steinhilper, Sauer, Springer Verlag, ISBN 3-540-29629-8

Remarks
Lecture notes:
The Productdevelopment knowledge base PKB will be provided in digital form for registered students. All lecture notes and additional slides will be provided in Ilias.

Course: Mechanical Design II [2146178]

Coordinators: Albert Albers, Burkardt
Part of the modules: Mechanical Design (p. 34)[BSc-Modul 06, MKL]

ECTS Credits	Hours per week	Term	Instruction language
2	2	Summer term	de

Learning Control / Examinations
The knowledge will be proofed in a complete exam after MDII (CIW/VT/Dipl-Päd/Mech) or MD IV (MACH/ID).

Conditions
Obligatory requirements: no

Recommendations
Attendance Mechanical Design I

Learning Outcomes
The lecture hat the goal

- to permute the complex steps of product engineering at the example of complex assemblies,
- to convey the normal application of depiction and drawing techniques, but also design and dimensioning instructions,
- to extend the view on machine elements, but also showing some parallels using the C&CM (Contact & Channel Model),

Content
Following contents will be teached:Grundlagen Lagerung

- Bearings
- Selaings
- Design
- Tolerances and fittings
- Shaft-hub connections

Media

- Beamer
- Visualizer
- Mechanical components

Literature
Konstruktionselemente des Maschinenbaus - 1 und 2
Grundlagen der Berechnung und Gestaltung von
Maschinenelementen;
Steinhilper, Sauer, Springer Verlag, ISBN 3-540-22033-X,
also available as electronic paper at the KIT catalogue.
Grundlagen von Maschinenelementen für Antriebsaufgaben;
Steinhilper, Sauer, Springer Verlag, ISBN 3-540-29629-8)

Remarks
Lecture notes:
The Productdevelopment knowledge base PKB will be provided in digital form for registered students. All lecture notes and additional slides will be provided in Ilias.

Course: Mechanical Design III [2145151]

Coordinators: Albert Albers, N. Burkardt
Part of the modules: Mechanical Design (p. 34)[BSc-Modul 06, MKL]

ECTS Credits	Hours per week	Term	Instruction language
2	2	Winter term	de

Learning Control / Examinations
The exam in the discipline of mechanical engineering is composed of the topics from MD I to MD IV.
The complete MD-exam consists of the theoretical and constructive part.
Exam duration:
- 2 h theoretical part
- 3 h constructive part
Both parts of the exam must be passed to pas the complete MD-exam.

Conditions
Obligatory requirements: no

Recommendations
Attendance at MKL I to MKL III lectures.

Learning Outcomes
Aims of the course

- Implementation of exemplary design process steps of product development with the help of **complex Systems,**
- Procuration of conforming to standards **interpretative rules and dimensioning rules** for part assemblies,
- Adduction to **complex** mechanical common used **machine parts** by fundamental considerations,
- Promotion of the **capacity for teamwork** as well as the **elaboration ability and assertiveness** during activity-related and supervised workshops,
- introduction into engineering **software** tools.

In the MD III lectures machine parts will be holistically examined. Several part assemblies, integrated into complete systems, will be analyzed concerning requirements and functions.
During the work on the given comprehensive development and construction task, the motivation and the social skills of the students will be developed for team work. At the same time the students will be qualified to estimate the given task concerning time period and functional circumferences and they will be qualified to portion the task in the team on one's own responsibility.

Content
These topics will be discussed:
Tolerancing
Bearings
Dimensioning
Joints

Media

- Beamer
- Visualizer
- Mechanical components

Literature
Lecture notes:
The lecture notes can be downloaded via the eLearning platform Ilias.
Literature:

Konstruktionselemente des Maschinenbaus - 1 und 2
Grundlagen der Berechnung und Gestaltung von
Maschinenelementen;
Steinhilper, Sauer, Springer Verlag, ISBN 3-540-22033-X
or per full text access provided by university library
Grundlagen von Maschinenelementen für Antriebsaufgaben;
Steinhilper, Sauer, Springer Verlag, ISBN 3-540-29629-8
CAD:
3D-Konstruktion mit Pro/Engineer - Wildfire, Paul Wyndorps, Europa Lehrmittel, ISBN: 978-3-8085-8948-9
Pro/Engineer Tipps und Techniken, Wolfgang Berg, Hanser Verlag, ISBN: 3-446-22711-3 (für Fortgeschrittene)

Remarks
Lecture notes:
The Productdevelopment knowledge base PKB will be provided in digital form for registered students. All lecture notes and additional slides will be provided in Ilias.

Course: Mechanical Design IV [2146177]

Coordinators: Albert Albers, N. Burkardt
Part of the modules: Mechanical Design (p. 34)[BSc-Modul 06, MKL]

ECTS Credits	Hours per week	Term	Instruction language
2	2	Summer term	de

Learning Control / Examinations
The exam in the discipline of mechanical engineering is composed of the topics from MD I to MD IV.
The complete MD-exam consists of the theoretical and constructive part.
Exam duration:
- 2 h theoretical part
- 3 h constructive part
Both parts of the exam must be passed to pass the complete MD-exam.

Conditions
Obligatory requirements: no

Recommendations
Attendance at MD I to MD III lectures.

Learning Outcomes
Aims of the course

- Implementation of exemplary design process steps of product development with the help of **complex systems,**
- Procuration of conforming to standards **interpretative and dimensioning rules** for part assemblies,
- Adduction to **complex**, common used **machine parts** by fundamental considerations,
- Promotion of the **capacity for teamwork** as well as the **elaboration ability and assertiveness** during activity-related and supervised workshops,
- introduction into engineering **software** tools.

In the MD IV lectures complex machine parts will be holistically examined. Several part assemblies, integrated into complete systems, will be analyzed concerning requirements and functions.
Due to the point of view on machine elements and machine systems with the help of the elementary model "working surface pairs & channel and support structure", students will be qualified to analyze and to pre-think unknown machine elements.
During the work on the given comprehensive development and construction task, the motivation and the social skills of the students will be developed for team work. At the same time the students will be qualified to estimate the given task concerning time period and functional circumferences and they will be qualified to portion the task in the team on one's own responsibility.

Content
Basic connections - part 2
Coupling fundamentals
Function and working principles
Significant characteristics and classification
Non-shiftable shaft couplings
Shiftable shaft couplings
Elastic couplings
Gear transmission fundamentals
Function and working principles
Fundamentals of gear transmissions
Significant characteristics and classification
Selection criteria
Fundamentals of further gear drives
Fundamentals of lubrication and lubricants

Tooth system fundamentals
Function and working principles
Tooth pitch characters
Cycloid as slope curve
Evolvent as slope curve
Manufacturing technologies
Transverse contact ratio
Profile offset
Application limits and technical defects
Dimensioning
Root bearing
Flank bearing
Hydraulic fundamentals
Basic functions and working principles
Significant characteristics and classification
Model types and characteristics
Selection criteria
Application
Dimensioning

Media

- Beamer
- Visualizer
- Mechanical components

Literature
Lecture notes:
The lecture notes can be downloaded via the eLearning platform Ilias.
Literature:
Konstruktionselemente des Maschinenbaus - 1 und 2
Grundlagen der Berechnung und Gestaltung von
Maschinenelementen;
Steinhilper, Sauer, Springer Verlag, ISBN 3-540-22033-X
or per full text access provided by university library
Grundlagen von Maschinenelementen für Antriebsaufgaben;
Steinhilper, Sauer, Springer Verlag, ISBN 3-540-29629-8
CAD:
3D-Konstruktion mit Pro/Engineer - Wildfire, Paul Wyndorps, Europa Lehrmittel, ISBN: 978-3-8085-8948-9
Pro/Engineer Tipps und Techniken, Wolfgang Berg, Hanser Verlag, ISBN: 3-446-22711-3 (für Fortgeschrittene)

Remarks
Lecture notes:
The product development knowledge base PKB will be provided in digital form for registered students. All lecture notes and additional slides will be provided in Ilias.

Course: Mathematical Methods in Dynamics [2161206]

Coordinators: Carsten Proppe
Part of the modules: Compulsory optional subject (BSc) (p. 45)[BSc-Modul 14, WPF]

ECTS Credits	Hours per week	Term	Instruction language
4	2	Winter term	de

Learning Control / Examinations
written examination (compulsory subject), auxiliary means: own manuscripts allowed
oral examination (optional subject) no auxiliary means allowed

Conditions
none

Recommendations
none

Learning Outcomes
The students know the mathematical methods of dynamics precisely. They are able to use the basic mathematical methods for modelling the dynamical behaviour of elastic and rigid bodies.
The students have a basic understanding of the description of kinematics and kinetics of bodies. They also master the alternative formulations based on weak formulations and variational methods and the approximate solution methods for numerical calculations of the moving behaviour of elastic bodies.

Content
Dynamics of continua:
Concept of continuum, geometry of continua, kinematics and kinetics of continua

Dynamics of rigid bodies:
Kinematics and kinetics of rigid bodies

Variational principles:
Priniciple of virtual work, variational calculations, Principle of Hamilto

Approximate solution methods:
Methods of weighted residuals, method of Ritz

Applications

Literature
Lecture notes (available online)

J.E. Marsden, T.J.R. Hughes: Mathematical foundations of elasticity, New York, Dover, 1994

P. Haupt: Continuum mechanics and theory of materials, Berlin, Heidelberg, 2000

M. Riemer: Technische Kontinuumsmechanik, Mannheim, 1993

K. Willner: Kontinuums- und Kontaktmechanik : synthetische und analytische Darstellung, Berlin, Heidelberg, 2003

J.N. Reddy: Energy Principles and Variational Methods in applied mechanics, New York, 2002

A. Boresi, K.P. Chong, S. Saigal: Approximate solution methods in engineering mechanics, New York, 2003

Course: Mathematical Methods in Strength of Materials [2161254]

Coordinators: Thomas Böhlke
Part of the modules: Compulsory optional subject (BSc) (p. 45)[BSc-Modul 14, WPF]

ECTS Credits	Hours per week	Term	Instruction language
4	2	Winter term	de

Learning Control / Examinations
depending on choice according to acutal version of study regulations
Additives as announced

Conditions
None.

Recommendations
None.

Learning Outcomes
The students can effectively and precise apply the mathematical methods of strength of materials.
They master the basic principles of tensor algebra and tensor analysis for a continuum mechanical modelling of materials. They know how to apply methods of continuum mechanics for dimensioning of work pieces.

Content
Tensor algebra

- vectors; basis transformation; dyadic product; tensors of 2nd order
- properties of 2nd order tensors: symmetry, anti-symmetry, orthogonality etc.
- eigenvalue problem, theorem of Cayley-Hamilton, invariants; tensors of higher order
- tensor algebra in curvilinear coordinate systems
- tensor analysis in curvilinear coordinate systems
- Differentiation of tensor functions

Application of tensor calculus in strength of materials

- kinematics of infinitesimal and finite deformations
- transport theorem, balance equations, stress tensor
- theory of elasticity
- thermo-elasticity
- theory of plasticity

Literature
lecture notes
Bertram, A.: Elasticity and Plasticity of Large Deformations - an Introduction. Springer 2005.
Liu, I-S.: Continuum Mechanics. Springer, 2002.
Schade, H.: Tensoranalysis.Walter de Gruyter, New York, 1997.
Wriggers, P.: Nichtlineare Finite-Element-Methoden. Springer, 2001.

Course: Mathematical methods of vibration theory [2162241]

Coordinators: Wolfgang Seemann
Part of the modules: Compulsory optional subject (BSc) (p. 45)[BSc-Modul 14, WPF]

ECTS Credits	Hours per week	Term	Instruction language
5	3	Summer term	de

Learning Control / Examinations
written (compulsory subject), oral (optional subject)

Duration: 3 hours (compulsory subject), 30 minutes (optional subject), 20 minutes (major subject)

Allowed during exam: own scripts, literature (compulsory subject), none (optional subject or major subject)

Conditions
Technische Mechanik III, IV / Engineering Mechanics III, IV

Learning Outcomes
The course presents several mathematical methods to analyze dynamical systems in the time and the frequency domain. In the first part, methods to solve ordinary single differential equations are discussed where attention is focused to non-periodic excitation. Systems of ordinary differential equations are considered next. Also partial differential equations (including the derivation of boundary value problems by Hamilton's principle) are treated. Analytical methods are emphasized but some selected approximate methods are dealt with as well. An introduction into the dynamic stability theory is also given.

Content
Linear, time-invariant, ordinary single differential equations: homogeneous solution; harmonic, periodic and non-periodic excitations; Duhamel's integral; Fourier and Laplace transform; introduction into the theory of distributions; Systems of ordinary differential equations: matrix notation, eigenvalue theory, fundamental matrix, forced vibrations via modal expansion and transition matrix; Introduction into the dynamic stability theory; Partial differential equations: solution in product form, eigenvalue theory, modal expansion using Ritz series; Variational methods, Hamilton's principle, boundary value problems representing vibrating continua; Perturbation methods

Literature
Riemer, Wedig, Wauer: Mathematische Methoden der Technischen Mechanik

Course: Mathematical Methods in Fluid Mechanics [2154432]

Coordinators: Torsten Schenkel
Part of the modules: Compulsory optional subject (BSc) (p. 45)[BSc-Modul 14, WPF]

ECTS Credits	Hours per week	Term	Instruction language
4	2	Summer term	de

Learning Control / Examinations
written

Duration: 3 hours

Aux. means: formules, pocket calculator

Conditions
None.

Learning Outcomes
The students can apply the mathematical methods of Dynamics effectively and precise.
They're able to use the basic mathematical methods for analytical and numerical modelling of the non linear behaviour moving fluids.
The students have a basic understanding of the procedures to describe, simplify and solve the Navier-Stokes equations by analytical integration, linearisation and important approximate solution methods (Finite Differences, Finite Volumes) for numerical calculations of the behaviour of flows.

In the accompanying tutorial 21433 the application of the methods can be trained.

Content
1.2 Regions of Flow

4.1.2 Linearisation
4.2.3 Finite Differences Method, Convergence, Stability
4.2.4 Finite Volume Method
5. Fluid Mechanical Applications
3.2.2 Reynolds Equations
3.2.3 Basic Turbulence Modelling

Numbering according to Lehrbuch Strömungsmechanik

Literature
Oertel, H., Böhle, M.: Strömungsmechanik, Vieweg-Verlag, 2006

Oertel, H., Dohrmann, U.Böhle, M.: Übungsbuch Strömungsmechanik, Vieweg-Verlag, 2006
Oertel,H., Laurien, E.: Numerische Strömungsmechanik, Vieweg Verlag 2003

Course: Laboratory mechatronics [2105014]

Coordinators: Albert Albers, Georg Bretthauer, Carsten Proppe, Christoph Stiller
Part of the modules: Compulsory optional subject (BSc) (p. 45)[BSc-Modul 14, WPF]

ECTS Credits	Hours per week	Term	Instruction language
4	3	Winter term	de

Learning Control / Examinations
Certification of participation or oral examination depending on the "Studienplan" resp. "Prüfungs- und Studienordnung (SPO)" / IPEK: partial exmanination with grade

Conditions
None.

Learning Outcomes
A manipulator as an examplary mechatronic system is used to practise the contents of the stage II - lectures on mechatronics. The laboratory course comprises simulation, bus communication, measurement instrumentation, control engineering and programming. Instead of separate experiments the laboratory course continuously handles with the several aspects of the manipulator system. The final aim is to integrate the different subsystems to a working compound system.

Content
Part I
Control, programming and simulation of robots
CAN-Bus communication
Image processing / machine vision
Dynamic simulation of robots in ADAMS

Part II
Solution of a complex problem in team work

Literature
Manuals for the laboratory course on Mechatronics

Course: Modelling of Microstructures [2183702]

Coordinators: Britta Nestler
Part of the modules: Compulsory optional subject (BSc) (p. 45)[BSc-Modul 14, WPF]

ECTS Credits	Hours per week	Term	Instruction language
4	2	Winter / Summer Term	de

Learning Control / Examinations
We regularly hand out exercise sheets. The individual solutions will be corrected.
Exam: oral 30 minutes or written.

Conditions
None.

Learning Outcomes
The students are introduced into the fundamentals of liquid-solid and solid-solid phase transformations. We discuss microstructures such as dendrites, eutectics and peritectics and consider the specific physics of heat and mass transport combined with the particular phase transformation. We study polycrystalline grain structures and examine the motion of interfaces and the effect of various external fields. Next, we learn the method of phase-field modelling for simulation of microstructure formation processes. As an extension of the phase-field modelling for phase transitions, we get to know the coupling with other field variables. The course will be combined with practical excercises.

Content
The course consists of a lecture and exercise classes. The aim is an introduction to the simulation of phase transformations and microstructure formation under the influence of different physical quantities. Contents are:
- fundamentals of phase transformation and microstructure evolution
- polycrystalline grain structures
- heat and mass diffusion
- phase-field modelling and simulation
- extension of phase-field modelling to include other physical fields

Media
Black board and slides.

Literature
Fundamentals of Solidification, Kurz and Fisher
Theory of Solidification, Davis.
The science of crystallization: microscopic interfacial phenomena, W. A. Tiller -> Only special reading
Transport phenomena in metallurgy, G.H. Geiger and D. R. Poirier
Transport Phenomena, R. Bird, W. Stewart, E. Lightfoot
Kinetics of Materials , W. Craig Carter
Physical Metallurgy, Porter and Easterling
Construction of binary phase diagrams, R. Haansen
Introduction to the thermodynamics of materials, David. R. Gaskell
Numerical recipes in C

Course: MD - Team Orientated Mechanical Design (3 + 4) [2145154]

Coordinators: Albert Albers, diverse
Part of the modules: Key Competences (p. 35)[BSc-Modul 07, SQL], Mechanical Design (p. 34)[BSc-Modul 06, MKL]

ECTS Credits	Hours per week	Term	Instruction language
2	2	Winter / Summer Term	de

Learning Control / Examinations
MD III and MD IV Workshops:
In every workshop session the knowledge of the students will be reviewed. The knowledge and the handling of the workshop tasks are required to pass the MD III and MD IV workshops.

Conditions
A prosperous participation at the MD III and MD IV is compulsory to attend the exam.

Recommendations
Attendance on MD I to MD IV lectures.

Learning Outcomes
Workshop MD III and MD IV:
In MD III and MD IV the student will get a technical task, which is similar to a real development project and must be solved by teamwork. There are several session during the semester. To every session the student must solve a specific task. There are different boundary conditions and design clearances, which must considered by the student. The tasks must be solved methodically, according to the lecture. Some parts must be solved in CAD software (Pro/Engineer).

Content
Interrogation of the purchased knowledge in MD by means of the workshop task.

Literature
Konstruktionselemente des Maschinenbaus - 1 und 2
Grundlagen der Berechnung und Gestaltung von
Maschinenelementen;
Steinhilper, Sauer, Springer Verlag, ISBN 3-540-22033-X
Grundlagen von Maschinenelementen für Antriebsaufgaben;
Steinhilper, Sauer, Springer Verlag, ISBN 3-540-29629-8
CAD:
3D-Konstruktion mit Pro/Engineer - Wildfire, Paul Wyndorps, Europa Lehrmittel, ISBN: 978-3-8085-8948-9
Pro/Engineer Tipps und Techniken, Wolfgang Berg, Hanser Verlag, ISBN: 3-446-22711-3 (für Fortgeschrittene)

Remarks
Bonus
In the case of an average number of three points (3,0) or above in MD II / III /IV workshop (weighting MD II : MD III : MD IV = 2 : 3 : 4) the student will achieve an extra bonus for the mechanical design exam. This bonus amounts to 0,3 exam points and it can only be achieved in case of passed MD-exam (lowest passing grade 4,0).

Course: Modelling and Simulation [2183703]

Coordinators: Britta Nestler
Part of the modules: Compulsory optional subject (BSc) (p. 45)[BSc-Modul 14, WPF]

ECTS Credits	Hours per week	Term	Instruction language
4	2	Winter / Summer Term	de

Learning Control / Examinations
We regularly hand out exercise sheets. In addition, the course will be accompanied by practical exercises at the computer.
written examination: 90 minutes

Conditions
None.

Learning Outcomes
The students learn fundamental algorithms and numerical methods of particular importance for materials simulations. The course introduces solution techniques for dynamical systems and partial differential equations. The methods are applied to describe heat and mass diffusion processes and to model microstructure formation (e.g. phase-field method). The next aim is to learn adaptive and parallel algorithms. The students will get familiar with fundamental concepts of high performance computations. Practical experience is obtained by the integrated exercises.

Content
The course gives an introduction to modelling and simulation techniques.
The following topics are included:
- splines, interpolation methods, Taylor series
- finite difference method
- dynamical systems
- numerics of partial differential equations
- mass and heat diffusion
- microstructure simulation
- parallel and adaptive algorithms
- high performance computing
- practical exercises

Media
Slides and black board. The slides will be provided as a manuscript for the course.

Literature
Scientific Computing, G. Golub and J.M. Ortega (B.G.Teubner Stuttgart 1996)

Course: Modern Physics for Engineers [2400451]

Coordinators: Bernd Pilawa
Part of the modules: Compulsory optional subject (BSc) (p. 45)[BSc-Modul 14, WPF]

ECTS Credits	Hours per week	Term	Instruction language
4	2	Summer term	de

Learning Control / Examinations

Conditions

None.

Learning Outcomes

Content

Course: [2142890]

Coordinators: Peter Gumbsch, Arndt Last, A. Nesterov-Müller
Part of the modules: Compulsory optional subject (BSc) (p. 45)[BSc-Modul 14, WPF]

ECTS Credits	Hours per week	Term	Instruction language
4	2	Summer term	de

Learning Control / Examinations

Conditions
None.

Learning Outcomes

Content

Course: Physical basics of laser technology [2181612]

Coordinators: Johannes Schneider
Part of the modules: Compulsory optional subject (BSc) (p. 45)[BSc-Modul 14, WPF]

ECTS Credits	Hours per week	Term	Instruction language
4	2	Winter term	

Learning Control / Examinations
oral examination (30 min)

no tools or reference materials

Conditions
None.

Recommendations
None.

Learning Outcomes
Based on the description of the physical basics about the formation and the properties of laser light the lecture goes through the different types of laser beam sources used in industry these days. The lecture focus on the usage of lasers especially in materials engineering. Other areas like measurement technology or medical applications are also mentioned.

An excursion to the laser laboratory of the Institute for Applied Materials (IAM-AWP) at the KIT-campus north will be offered.

Content
physical basics of laser technology

laser beam sources (solid state, diode, gas, liquid and other lasers)

beam properties, guiding and shaping

lasers in materials processing

lasers in measurement technology

lasers for medical applications

savety aspects

Literature
F. K. Kneubühl, M. W. Sigrist: Laser, 2008, Vieweg+Teubner
W. T. Silfvast: Laser Fundamentals, 2008, Cambridge University Press
H. Hügel, T. Graf: Laser in der Fertigung, 2009, Vieweg+Teubner
R. Poprawe: Lasertechnik für die Fertigung, 2005, Springer
W. M. Steen: Laser Material Processing, 2010, Springer

Course: Product Lifecycle Management [2121350]

Coordinators: Jivka Ovtcharova
Part of the modules: Compulsory optional subject (BSc) (p. 45)[BSc-Modul 14, WPF]

ECTS Credits	Hours per week	Term	Instruction language
6	4	Winter term	de

Learning Control / Examinations
written examination
Duration:
1,5 hours

Auxiliary Means: none

Conditions
None.

Recommendations
None.

Learning Outcomes
The goal of PLM lecture is to provide an overview of management and organizational approach to product lifecycle management. The students:

- know the management concept of PLM, its objectives and are able to highlight the economic benefits of the PLM concept
- know provider of PLM solutions and can represent the current market situation
- Understand the need for an integrated and cross-departmental business process - from planning, portfolio construction and return of customer information, from the use phase to maintenance and recycling of products
- know the processes and functions needed to support the entire product life cycle
- become aware of the main operating software systems (PDM, ERP, SCM, CRM) and the mainstreaming of these systems
- develop techniques to successfully introduce the concept of Management PLM.

Content
Product Lifecycle Management (PLM) is an approach to the holistic and cross-company management and control of all product-related processes and data throughout the life cycle along the extended supply chain - from design and production to sales, to the dismantling and recycling.
Product Lifecycle Management is a comprehensive approach for effective and efficient design of the product life cycle. Based on all product information, which comes up across the entire value chain and across multiple partners, processes, methods and tools are made available to provide the right information at the right time, quality and the right place.
The course covers:

- A consistent description of all business processes that occur during the product life cycle (development, production, sales, dismantling, ...)
- the presentation of methods for the performance of the PLM business processes,
- explaining the most important corporate information systems to support the life cycle (PDM, ERP, SCM, CRM systems) to sample the software manufacturer SAP

Literature
Lecture slides.

V. Arnold et al: Product Lifecycle Management beherrschen, Springer-Verlag, Heidelberg, 2005.

J. Stark: Product Lifecycle Management, 21st Century Paradigm for Product Realisation, Springer-Verlag, London, 2006.

A. W. Scheer et al: Prozessorientiertes Product Lifecycle Management, Springer-Verlag, Berlin, 2006.

J. Schöttner: Produktdatenmanagement in der Fertigungsindustrie, Hanser-Verlag, München, 1999.

M.Eigner, R. Stelzer: Produktdaten Management-Systeme, Springer-Verlag, Berlin, 2001.

G. Hartmann: Product Lifecycle Management with SAP, Galileo press, 2007.

K. Obermann: CAD/CAM/PLM-Handbuch, 2004.

Course: Lab course Engineering Mechanics I [2161266]

Coordinators: Thomas Böhlke, Tom-Alexander Langhoff
Part of the modules: Engineering Mechanics (p. 31)[BSc-Modul 03, TM]

ECTS Credits	Hours per week	Term	Instruction language
1	2	Winter term	de

Learning Control / Examinations

Conditions
None.

Recommendations
None.

Learning Outcomes
application and practice of the contents of the lecture “Engineering Mechanics I”

Content
see lecture “Engineering Mechanics I”

Literature
see lecture “Engineering Mechanics I”

Course: Lab course Engineering Mechanics II [2162252]

Coordinators: Thomas Böhlke, Tom-Alexander Langhoff
Part of the modules: Engineering Mechanics (p. 31)[BSc-Modul 03, TM]

ECTS Credits	Hours per week	Term	Instruction language
1	2	Summer term	de

Learning Control / Examinations

Conditions
None.

Recommendations
None.

Learning Outcomes
application and practice of the contents of the lecture “Engineering Mechanics II”

Content
see lecture “Engineering Mechanics II”

Literature
see lecture “Engineering Mechanics II”

Course: Simulation of production systems and processes [2149605]

Coordinators: Kai Furmans, Volker Schulze, Gert Zülch
Part of the modules: Compulsory optional subject (BSc) (p. 45)[BSc-Modul 14, WPF]

ECTS Credits	Hours per week	Term	Instruction language
5	3	Winter term	de

Learning Control / Examinations
oral examination

Conditions
none

Recommendations
none

Learning Outcomes
The student knows different possibilities of simulation technology within the production technology and is able to use those methods. They range from the modeling of production and work systems down to simulation of single manufacturing processes.

Content
The lecture is focused on the various aspects and possibilities of the usage of simulation technologies within the production technology. First the definition of the terminology and the basic knowledge is pointed out. In the chapter "Design of experiments and validation" the procedure of a simulation study with the preparation work, the selection of the simulation tools, the validation and the analysis of the simulation runs will be discussed. The chapter "Statistical basics" deals with probability distribution and random numbers as well as the use of Monte-Carlo-simulations in practical exercises. The chapter "Simulation of plant, machinery and processes" addresses the simulative analysis of single manufacturing processes via the examination of machine tools down to the modeling of a digital plant with the focus on the production facility. The chapter "Simulation of work systems" in addition consideres the personnel integrated and orientated simulation. Here the assembly systems and the enterprise orientated simulation is considered. Finally the specifications of the material flow simulation for production systems are examined.

Literature
none

Remarks
The lecture starts in winter term 2011/12

Course: Fluid Mechanics (german language) [2153412]

Coordinators: Torsten Schenkel
Part of the modules: Fluid mechanics (p. 42)[BSc-Modul 12, SL]

ECTS Credits	Hours per week	Term	Instruction language
7	4	Winter term	de

Learning Control / Examinations
written

duration: 3 hours

Aux. Means: tables and formulas, electronic calculators

Conditions
None.

Learning Outcomes
Introduction to the fundamentals of fluid mechanics for students of mechanical engineering and related fields, physics and mathematics. The lecture is accompanied by a tutorial that is given in parallel.

Content

- Introduction
- Flows in Nature and Technologie
- Flow Regimes
- Fundamentals of Fluid Mechanics
- Properties of Fluids
- Hydro- und Aerostatics
- Hydro- und Aerodynamics
- Technical Flows
- Fundamental Equation
- Continuity equation
- Navier-Stokes equation
- Energy equation

Course: Systematic Materials Selection [2174576]

Coordinators: Alexander Wanner
Part of the modules: Compulsory optional subject (BSc) (p. 45)[BSc-Modul 14, WPF]

ECTS Credits	Hours per week	Term	Instruction language
5	3	Summer term	de

Learning Control / Examinations
oral; 20 - 30 Minutes

Conditions
Basic knowledge in materials science and engineering, mechanics and mechanical design

Learning Outcomes
The students are able to select the best material for a given application. They are proficient in selecting materials on base of performance indices and materials selection charts. They can identify conflicting objectives and find sound compromises. They are aware of the potential and the limits of hybrid material concepts (composites, bimaterials, foams) and can determine whether following such a concept yields a useful benefit.

Content
Important aspects and criteria of materials selection are examined and guidelines for a systematic approach to materials selection are deeloped. The following topics are covered: the status of materials selection in mechanical design and product development; the most important classes of materials and their property profiles;

Literature
Lecture notes; Problem sheets; Textbook: M.F. Ashby, A. Wanner (Hrsg.), C. Fleck (Hrsg.);
Materials Selection in Mechanical Design: Das Original mit Übersetzungshilfen
Easy-Reading-Ausgabe, 3. Aufl., Spektrum Akademischer Verlag, 2006
ISBN: 3-8274-1762-7

Course: Integrated Information Systems for engineers [2121001]

Coordinators: Sven Rogalski, Jivka Ovtcharova
Part of the modules: Compulsory optional subject (BSc) (p. 45)[BSc-Modul 14, WPF]

ECTS Credits	Hours per week	Term	Instruction language
5	3	Winter term	de

Learning Control / Examinations
Oral examination, Duration: 25 min., Auxiliary Means: none

Conditions
None

Recommendations
None

Learning Outcomes
Students should gain deeper knowledge about structures and functions of IT-systems applied in product development (engineering and manufacturing). They achieve general knowledge about the relevance of IT-support in engineering tasks.
Students know general approaches for introducing IT systems in existing Enterprise structures and have detail knowledge about "evolutionary process models of PLM" for a successful of IT-Systems installation.

Content

- Information, information systems, information management
- CAP- and CAM-systems
- PPS- and ERP- systems
- PDM-Systems
- Virtual product configuration
- Installation of technical information systems in existing enterprise structures

Literature
Lecture slides

Course: Engineering Mechanics I [2161245]

Coordinators: Thomas Böhlke
Part of the modules: Engineering Mechanics (p. 31)[BSc-Modul 03, TM]

ECTS Credits	Hours per week	Term	Instruction language
4	3	Winter term	de

Learning Control / Examinations
written, 90 min. Additives as announced

Conditions
Homework is mandatory and a precondition to take part in the exam "Engineering Mechanics I".

Recommendations
None.

Learning Outcomes
The Studenten know the basics for computing statical mechanical systems in engineering. Based on the notion of force, the studens can analyse different equilibrium systems, e.g. plane and spatial force systems on rigid bodies. The students master the computation of internal forces and moments. in addition to the axion of equilibrium the students can effectively appls the principle of virtual displacements. In the framework of statics of straight bars the students can compute the internal forces and moments using elastic, thermo-elastic and elasto-plastic constitutive relations.

Content

- basics of vector calculus
- force systems
- statics of rigid bodies
- internal forces and moments in bars and beams
- friction
- centre of gravity, centre of mass
- work, energy, principle of virtual work
- statics of inextensible ropes
- elastostatics of tension-compression- bars

Literature
Hibbeler, R.C: Technische Mechanik 1 - Statik. Prentice Hall. Pearson Studium 2005. Gross, D. et al.: Technische Mechanik 1 - Statik. Springer 2006. Gummert, P.; Reckling, K.-A.: Mechanik. Vieweg 1994. Parkus, H.: Mechanik der festen Körper. Springer 1988.

Course: Engineering Mechanics II [2162250]

Coordinators: Thomas Böhlke
Part of the modules: Engineering Mechanics (p. 31)[BSc-Modul 03, TM]

ECTS Credits	Hours per week	Term	Instruction language
3	2	Summer term	de

Learning Control / Examinations
written, 90 min. Additives as announced

Conditions
Homework is mandatory and a precondition to take part in the exam “Engineering Mechanics 2”.

Recommendations
None.

Learning Outcomes
The students master the elementary theories of bending, shear and torsion of straight beams. They know the principles of elasticity theory in 3D, especially multi-axial stress and strain states and Hookes law. The students can effectively apply energy methods and know approximation methods of elastostatics. They master the concept of stability and know basics of an elasto-plastic theory.

Content

- bending
- shear
- torsion
- stress and strain state in 3D
- Hookes law in 3D
- elasticity theors in 3D
- energy methods in elastostatics
- approximation methods
- stability
- inelastic material behaviour

Literature
lecture notes
Hibbeler, R.C: Technische Mechanik 2 - Festigkeitslehre. Prentice Hall. Pearson Studium 2005.
Gross, D. et al.: Technische Mechanik 2 - Elastostatik. Springer 2006.
Gummert, P.; Reckling, K.-A.: Mechanik. Vieweg 1994.
Parkus, H.: Mechanik der festen Körper. Springer 1988.

Course: Engineering Mechanics III [2161203]

Coordinators: Wolfgang Seemann
Part of the modules: Engineering Mechanics (p. 31)[BSc-Modul 03, TM]

ECTS Credits	Hours per week	Term	Instruction language
3	2	Winter term	de

Learning Control / Examinations
written exam

Duration: 3h (including TM III and TM IV) for engineering mechanics and for Techno-mathematics

Resources allowed during exam: onw lecture notes and notes from tutorial, books in 'Engineering Mechanics'

Conditions
Homework is mandatory and a precondition to take part in the exam “Engineering Mechanics 3/4”.

Recommendations
None.

Learning Outcomes
Engineering mechanics III deals with kinematics and kinetics of system of particles as well as plane motion of rigid bodies under the influence of forces and moments. Equations of motion are derived using Newton's axiom and the principle of moment of momentum. As applications the equations of motion are derived for systems of particles and simple systems of rigid bodies, including impact problems. Therefore, the course aims at applying Newton-Euler's equations, Principle of moment and principle of moment of momentum as well as principle of energy conservation for simple mechanical engineering problems.

Content
Kinematics: Cartesian, cylindrical and natural coordinates. Time derivatives in moving reference frames, angular velocities of reference frames.

Kinetics of a particle:
Newton's axiom, Principle of d'Alembert, work of a force, kinetic and potential energies, principle of linear momentum, principle of moment of momentum, kinetics in moving reference systems

Systems of particles:
Principle of center of mass, Principle of moment of momentum, impacts between particles, systems with variable mass, applications.

Plain motion of rigid bodies:
Pure translation, pure rotation, general plain motion. Instantaneous center of rotation, Kinetics, moment of momentum, principle of work and principle of energy conservation for a rotation around a space-fixed axis. Mass moment of inertia, parallel-axis-theorem.Principle of linear momentum and principle of moment of momentum for arbitrary plain motion. Principle of d'Alembert for plain motion. Principles of linear and moment of momentum in integral form. Applications for impact problems.

Literature
Hibbeler: Technische Mechanik 3, Dynamik, München, 2006

Gross, Hauger, Schnell: Technische Mechanik Bd. 3, Heidelberg, 1983

Lehmann: Elemente der Mechanik III, Kinetik, Braunschweig, 1975

Göldner, Holzweissig: Leitfaden der Technischen Mechanik.

Hagedorn: Technische Mechanik III.

Course: Engineering Mechanics IV [2162231]

Coordinators: Wolfgang Seemann
Part of the modules: Engineering Mechanics (p. 31)[BSc-Modul 03, TM]

ECTS Credits	Hours per week	Term	Instruction language
3	2	Summer term	de

Learning Control / Examinations
written exam: 3h (together with TM III)

Conditions
Homework is mandatory and a precondition to take part in the exam “Engineering Mechanics 3/4”.

Learning Outcomes
The course is a continuation of Engineering Mechanics III. The goal is to understand the spatial motion of a rigid body. This includes both kinematics as well as dynamics. In a second part an introduction into analytic mechanics is given. The third part deals with vibration of simple one or two degrees of freedom systems.

Content
Spatial kinematics of a rigid body, Euler angles, angular velocity using Euler angles, Euler’s equations, inertia tensor, kinetic energy of a rigid body, free gyroscopes, forced gyroscopes, systems of rigid bodies, principle of d’Alembert, Lagrange’s equations of the first and second kind, generalized coordinates, free and forced vibration of one degree of freedom systems, frequency response, vibration of multi degree of freedom systems, vibration absorption

Literature
Hibbeler: Technische Mechanik 3, Dynamik, München, 2006
Marguerre: Technische Mechanik III, Heidelberger Taschenbücher, 1968
Magnus: Kreisel, Theorie und Anwendung, Springer-Verlag, Berlin,
1971 Klotter: Technische Schwingungslehre, 1. Bd. Teil A, Heidelberg

Course: Vibration Theory [2161212]

Coordinators: Wolfgang Seemann
Part of the modules: Compulsory optional subject (BSc) (p. 45)[BSc-Modul 14, WPF]

ECTS Credits	Hours per week	Term	Instruction language
5	3	Winter term	de

Learning Control / Examinations
Written exam
If course is chosen as optional subject or part of major subject:
Oral exam, 30 minutes (optional subject), 20 minutes (major subject), no means

Conditions
EM III, EM IV

Learning Outcomes
The course gives an introduction into the vibration theory of linear systems. First, general vibration in form of harmonic signals is considered. One degree of freedom systems are treated in detail for free and forced vibration, especially for harmonic, periodic and arbitrary excitation. This is the foundation for systems with many degrees of freedom as these may be transformed with the help of modal coordinates. For multiple dof systems the eigenvalue problem is solved. Then forced vibration is treated. Finally, wave propagation problems and eigenvalue problems for systems with distributed parameters are discussed. As an application an introduction into rotor dynamics is given.

Goal of the course is to see the similarities for systems with one dof and with multiple dof. Besides typical phenomena like resonance a systematic mathematical approach to vibration problems and an interpretation of the mathematical results should be obtained.

Content
Concept of vibration, superposition of vibration with equal and with different frequencies, complex frequency response.

Vibration of systems with one dof: Free undamped and damped vibration, forced vibration for harmonic, periodic and arbitrary excitation. Excitation of undamped vibration in resonance.

Systems with many degrees of freedom: Eigenvalue problem for undamped vibration, orthogonality of eigenvectors, modal decoupling, approximation methods, eigenvalue problem for damped vibration. Forced vibration for harmonic excitation, modal decomposition for arbitrary forced vibration, vibration absorber.

Vibration of systems with distributed parameters: Partial differential equations as equations of motion, wave propagation, d'Alembert's solution, Ansatz for separation of time and space, eigenvalue problem, infinite number of eigenvalues and eigenfunctions.

Introduction to rotor dynamics: Laval rotor in rigid and elastic bearings, inner damping, Laval rotor in anisotropic bearings, synchronous and asynchronous whirl, rotors with asymmetric shaft.

Literature
Klotter: Technische Schwingungslehre, Bd. 1 Teil A, Heidelberg, 1978

Hagedorn, Otterbein: Technische Schwingungslehre, Bd 1 and Bd 2, Berlin, 1987

Wittenburg: Schwingungslehre, Springer-Verlag, Berlin, 1995

Course: Engineering Thermodynamics and Heat Transfer I [2165526]

Coordinators: Ulrich Maas
Part of the modules: Engineering Thermodynamics (p. 33)[BSc-Modul 05, TTD]

ECTS Credits	Hours per week	Term	Instruction language
6,5	3	Winter term	de

Learning Control / Examinations
Written
Duration: 2 hours

Conditions
None

Recommendations
None

Learning Outcomes
Thermodynamics is a theoretical discipline of mechanical engineering. One of the aims of the lecture is to introduce the correlations between the properties of pure substances and mixtures (temperature, pressure, volume, energy content etc.) and to develop the structure of these correlations. Furthermore, the lecture deals with the transformation of energy and the direction and the velocity of processes. The lecture is completed by exercises, where the subjects of the lecture are deepened by their application to selected examples.

Content
System, properties of state
Absolute temperature, model systems
1st law of thermodynamics for resting and moved systems
Entropy and 2nd law of thermodynamics
Behavior of real substances described by tables, diagrams and equations of state
Machine processes

Media
Blackboard and Powerpoint presentation

Literature
Course note packet
Elsner, N.; Dittmann, A.: Energielehre und Stoffverhalten (Grundlagen der technischen Thermodynamik Bd. 1 und 2), 8. Aufl., Akademie-Verlag, 680 S. 1993.
Baehr, H.D.: Thermodynamik: eine Einführung in die Grundlagen und ihre technischen Anwendungen, 9. Aufl., Springer-Verlag, 460 S., 1996.

Course: Technical Thermodynamics and Heat Transfer II [2166526]

Coordinators: Ulrich Maas
Part of the modules: Engineering Thermodynamics (p. 33)[BSc-Modul 05, TTD]

ECTS Credits	Hours per week	Term	Instruction language
6,5	3	Summer term	de

Learning Control / Examinations
Written
Duration: 2 hours

Conditions
None

Recommendations
None

Learning Outcomes
Extended knowledge of thermodynamic processes and heat transfer.

Content
Repetition of the topics of “Thermodynamics and Heat Transfer I”
Mixtures of ideal gases
Moist air
Behaviour of real substances described by equations of state
Applications of the laws of thermodynamics to chemical reactions

Media
Blackboard and Powerpoint presentation

Literature
Course notes
Elsner, N.; Dittmann, A.: Energielehre und Stoffverhalten (Grundlagen der technischen Thermodynamik Bd. 1 und 2), 8. Aufl., Akademie-Verlag, 680 S. 1993.
Baehr, H.D.: Thermodynamik: eine Einführung in die Grundlagen und ihre technischen Anwendungen, 9. Aufl., Springer-Verlag, 460 S., 1996.

Course: Exercises Computer Science for Engineers [2121391]

Coordinators: Jivka Ovtcharova
Part of the modules: Computer Science (p. 39)[BSc-Modul 09, Inf]

ECTS Credits	Hours per week	Term	Instruction language
0	2	Winter term	de

Learning Control / Examinations
None

Conditions
None

Recommendations
None

Learning Outcomes
The tutorial provides insight into object-oriented programming with Java. An object-oriented way of thinking is practically communicated, based on the basic language elements that are also dealt with. Programming is taught from scratch, in order to communicate the essential skills for successfully participating in the computer science workshop.

After successfully completing the tutorial, students should be able to develop simple object-oriented programs in Java. They should know enough of the basics, in order to be capable of familiarizing themselves with further object-oriented languages within a limited period of time.

Besides programming, which is the main focus of the tutorial, subjects from the lecture will be implemented in programs.

Content
Basics and language elements of Java
Classes, attributes, methods
Constructors and objects
Loops and conditions
Inheritance, polymorphism
Interfaces, abstract classes
Collections, exceptions
Parallelism, threads

Literature
See lecture

Course: Tutorials Mechanical Design I [2145185]

Coordinators: Albert Albers
Part of the modules: Mechanical Design (p. 34)[BSc-Modul 06, MKL]

ECTS Credits	Hours per week	Term	Instruction language
2	1	Winter term	de

Learning Control / Examinations
Workshop:
In every workshop session - integrated in the tutorials - the knowledge of the students will be reviewed. The knowledge and the handling of the workshop tasks are required to pass the MD I workshops.
The knowledge of the lecture will be proofed in a complete exam after MD IV.

Conditions
A prosperous participation is compulsory to attend the exam.

Learning Outcomes
Tutorial MD I:
In the exercises of MKL II the machine elements and their design guidelines, which were teached in the lecture, will be practiced with examples. The student will learn to calculate specific machine elements and to implement them into the construction.
Workshop MD I:
The students of the first semester have the chance to get in contact with real machine elements in three Workshops. That means, they can keep an eye on elements in interaction in a machine system.
The Workshop should convey additionally to the professional competence also those important Softskills. That is why the exercises are consequently made in one Group. So the students have to interchange their experience. For the appraisal is not only the personal achievement important, also the achievement of the whole group is important.

Content
The tutorials in MD I are composed as follows:
Exercise:
The contet of the tutorials is based on the content of the lectures. Additionally tutorials for technical drawing will be provided.
Workshop MD I in groups of 5 students

Media

- Beamer
- Visualizer
- Gear box (Workshop)

Literature
Konstruktionselemente des Maschinenbaus - 1 und 2
Grundlagen der Berechnung und Gestaltung von
Maschinenelementen;
Steinhilper, Sauer, Springer Verlag, ISBN 3-540-22033-X
Grundlagen von Maschinenelementen für Antriebsaufgaben;
Steinhilper, Sauer, Springer Verlag, ISBN 3-540-29629-8
CAD:
3D-Konstruktion mit Pro/Engineer - Wildfire, Paul Wyndorps, Europa Lehrmittel, ISBN: 978-3-8085-8948-9
Pro/Engineer Tipps und Techniken, Wolfgang Berg, Hanser Verlag, ISBN: 3-446-22711-3 (für Fortgeschrittene)

Course: Tutorials Mechanical Design II [2146185]

Coordinators: Albert Albers, Divers tutors
Part of the modules: Mechanical Design (p. 34)[BSc-Modul 06, MKL]

ECTS Credits	Hours per week	Term	Instruction language
2	1	Summer term	de

Learning Control / Examinations
The succes control will be done by test, which will take place during the lecture time.

Conditions
keine

Recommendations
Attendance Tutorial Mechanical Design I

Learning Outcomes
Tutorial MKL II
In the exercises of MKL II the machine elements and their design guidelines, which were teached in the lecture, will be practiced with examples. The student will learn to calculate specific machine elements and to implement them into the construction.

Content
The tutorials are composed as follows:
Exercise:
The covered machine elements are bearings, design, tolerances and fittings. Additionally the student will be introduced into basic CAD techniques (Pro/Engineer).

Media

- Beamer
- Visualizer
- model box (Workshop)

Literature
Konstruktionselemente des Maschinenbaus - 1 und 2
Grundlagen der Berechnung und Gestaltung von
Maschinenelementen;
Steinhilper, Sauer, Springer Verlag, ISBN 3-540-22033-X
Grundlagen von Maschinenelementen für Antriebsaufgaben;
Steinhilper, Sauer, Springer Verlag, ISBN 3-540-29629-8
CAD:
3D-Konstruktion mit Pro/Engineer - Wildfire, Paul Wyndorps, Europa Lehrmittel, ISBN: 978-3-8085-8948-9
Pro/Engineer Tipps und Techniken, Wolfgang Berg, Hanser Verlag, ISBN: 3-446-22711-3 (für Fortgeschrittene)

Course: Tutorials Mechanical Design III [2145153]

Coordinators: Albert Albers, diverse
Part of the modules: Mechanical Design (p. 34)[BSc-Modul 06, MKL]

ECTS Credits	Hours per week	Term	Instruction language
2	1	Winter term	de

Learning Control / Examinations
integrated in workshops (2145154):
In every workshop session the knowledge of the students will be reviewed. The knowledge and the handling of the workshop tasks are required to pass the MKL III workshops.

Conditions
A prosperous participation is compulsory to attend the exam.

Recommendations
Attendance on MD I to MD III lectures.

Learning Outcomes
Tutorial MKL III:
In the exercises of MKL III the machine elements and their design guidelines, which were teached in the lecture, will be practiced with examples. The student will learn to calculate specific machine elements and to implement them into the construction.
Workshop MD III:
In the Workshop the student will get a technical task, which is similar to a real development project and must be solved by teamwork. There are several session during the semester. To every session the student must solve a specific task. There are different boundary conditions and design clearances, which must considered by the student. The tasks must be solved methodically, according to the lecture. Some parts must be solved in CAD software (Pro/Engineer).

Content
The tutorials are composed as follows:
Exercise:
The contet of the tutorials is based on the content of the lectures. Additionally CAD tutorials will be provided in Pro/Engineer.
Workshop MD III:
An exam sheet will be solved in group work.

Media

- Beamer
- Visualizer
- model box (Workshop)

Literature
Konstruktionselemente des Maschinenbaus - 1 und 2
Grundlagen der Berechnung und Gestaltung von
Maschinenelementen;
Steinhilper, Sauer, Springer Verlag, ISBN 3-540-22033-X
Grundlagen von Maschinenelementen für Antriebsaufgaben;
Steinhilper, Sauer, Springer Verlag, ISBN 3-540-29629-8
CAD:
3D-Konstruktion mit Pro/Engineer - Wildfire, Paul Wyndorps, Europa Lehrmittel, ISBN: 978-3-8085-8948-9
Pro/Engineer Tipps und Techniken, Wolfgang Berg, Hanser Verlag, ISBN: 3-446-22711-3 (für Fortgeschrittene)

Remarks
In the case of an average number of three points (3,0) or above in MD II / III /IV workshop (weighting MD II : MD III : MD IV = 2 : 3 : 4) the student will achieve an extra bonus for the mechanical design exam. This bonus amounts to 0,3 exam points and it can only be achieved in case of passed MD-exam (lowest passing grade 4,0).

Course: Tutorials Mechanical Design IV [2146184]

Coordinators: Albert Albers, diverse
Part of the modules: Mechanical Design (p. 34)[BSc-Modul 06, MKL]

ECTS Credits	Hours per week	Term	Instruction language
2	1	Summer term	de

Learning Control / Examinations
Workshop:
In every workshop session the knowledge of the students will be reviewed. The knowledge and the handling of the workshop tasks are required to pass the MKL IV workshops.

Conditions
A prosperous participation is compulsory to attend the exam.

Recommendations
Attendance on MD I to MD IV lectures.

Learning Outcomes
Tutorial MKL IV
In the exercises of MKL IV the machine elements and their design guidelines which were teached in the lectures will be practiced with examples. The student will learn to calculate specific machine elements and to implement them into the construction.
Workshop MD IV:
In the Workshop the student will get a technical task which is similar to a real development project and must be solved by teamwork. There are several sessions during the semester. To every session the student must solve a specific task. There are different boundary conditions and design clearances which must considered by the student. The tasks must be solved methodically, according to the lectures. Some parts must be solved in CAD software (Pro/Engineer).

Content
The tutorials are composed as follows:
Exercise:
The covered machine elements are basic connections, gear transmissions and tooth systems, couplings and hydraulic systems. Additionally CAD tutorials will be provided in Pro/Engineer.
Workshop MD IV:
Groups of up to 5 students

Media

- Beamer
- Visualizer
- Model box (Workshop)

Literature
Konstruktionselemente des Maschinenbaus - 1 und 2
Grundlagen der Berechnung und Gestaltung von
Maschinenelementen;
Steinhilper, Sauer, Springer Verlag, ISBN 3-540-22033-X
Grundlagen von Maschinenelementen für Antriebsaufgaben;
Steinhilper, Sauer, Springer Verlag, ISBN 3-540-29629-8
CAD:
3D-Konstruktion mit Pro/Engineer - Wildfire, Paul Wyndorps, Europa Lehrmittel, ISBN: 978-3-8085-8948-9
Pro/Engineer Tipps und Techniken, Wolfgang Berg, Hanser Verlag, ISBN: 3-446-22711-3 (für Fortgeschrittene)

Remarks
In the case of an average number of three points (3,0) or above in MD II / III /IV workshop (weighting MD II : MD III : MD IV = 2 : 3 : 4) the student will achieve an extra bonus for the mechanical design exam. This bonus amounts to 0,3 exam points and it can only be achieved in case of an passed MD-exam (lowest passing grade 4,0).

Course: Tutorial Engineering Mechanics I [2161246]

Coordinators: Thomas Böhlke, Mitarbeiter
Part of the modules: Engineering Mechanics (p. 31)[BSc-Modul 03, TM]

ECTS Credits	Hours per week	Term	Instruction language
1	2	Winter term	de

Learning Control / Examinations
Homework is mandatory and a precondition to take part in the exam “Engineering Mechanics I”.

Conditions
None.

Recommendations
None.

Learning Outcomes
Application and practice of the course “Engineering Mechanics I”

Content
see lecture Engineering Mechanics I

Literature
see lecture Engineering Mechanics I

Course: Tutorial Engineering Mechanics II [2162251]

Coordinators: Thomas Böhlke, Mitarbeiter
Part of the modules: Engineering Mechanics (p. 31)[BSc-Modul 03, TM]

ECTS Credits	Hours per week	Term	Instruction language
1	2	Summer term	de

Learning Control / Examinations
Homework is mandatory and a precondition to take part in the exam “Engineering Mechanics II”

Conditions
None.

Recommendations
None.

Learning Outcomes
Application and practice of the course “Engineering Mechanics II”

Content
see lecture Engineering Mechanics II

Literature
see lecture Engineering Mechanics II

Course: Engineering Mechanics III (Tutorial) [2161204]

Coordinators: Wolfgang Seemann, Assistenten
Part of the modules: Engineering Mechanics (p. 31)[BSc-Modul 03, TM]

ECTS Credits	Hours per week	Term	Instruction language
2	2	Winter term	de

Learning Control / Examinations
Homework is mandatory and a precondition to take part in the exam TM III.

Conditions
None.

Recommendations
None.

Learning Outcomes
Application and practice of the course TM III

Content
In the Tutorial excercises for the corresponding subjects of the lecture are presented. During the tutorial part of the tutorial excercises are presented and instructions for those excercises are given which have to be done as homework.

The homework is mandatory and is corrected by the tutors. A successful elaboration of the homework is necessary to take part in the final exam.

Literature
Hibbeler: Technische Mechanik 3, Dynamik, München, 2006

Gross, Hauger, Schnell: Technische Mechanik Bd. 3, Heidelberg, 1983

Lehmann: Elemente der Mechanik III, Kinetik, Braunschweig, 1975

Göldner, Holzweissig: Leitfaden der Technischen Mechanik.

Hagedorn: Technische Mechanik III.

Course: Engineering Mechanics IV (Tutorial) [2162232]

Coordinators: Wolfgang Seemann
Part of the modules: Engineering Mechanics (p. 31)[BSc-Modul 03, TM]

ECTS Credits	Hours per week	Term	Instruction language
2	2	Summer term	de

Learning Control / Examinations
Homework is mandatory and a precondition to take part in the exam.

Conditions
None.

Learning Outcomes
Application and practice of the course TM IV

Content
In the Tutorial excercises for the corresponding subjects of the lecture are presented. During the tutorial part of the excercises are presented and instructions are given for those excercises which have to be done as homework.

The homework is mandatory and is corrected by the tutors. A successful elaboration of the homework is necessary to take part in the final exam.

Literature
Hibbeler: Technische Mechanik 3, Dynamik, München, 2006
Marguerre: Technische Mechanik III, Heidelberger Taschenbücher, 1968
Magnus: Kreisel, Theorie und Anwendung, Springer-Verlag, Berlin,
1971 Klotter: Technische Schwingungslehre, 1. Bd. Teil A, Heidelberg

Course: Tutorial: Engineering Thermodynamics I [2165527]

Coordinators: Ulrich Maas, Assisitenten
Part of the modules: Engineering Thermodynamics (p. 33)[BSc-Modul 05, TTD]

ECTS Credits	Hours per week	Term	Instruction language
0	2	Winter term	de

Learning Control / Examinations
Written
Duration: 4 x 30 min hours

Conditions
None

Recommendations
Attendance of the lecture

Learning Outcomes
Application and consolidating of the lecture matter

Content
Calculation of thermodynamical problems

Literature
Course notes;
Elsner, N.; Dittmann, A.: Energielehre und Stoffverhalten (Grundlagen der technischen Thermodynamik Bd. 1 und 2), 8. Aufl., Akademie-Verlag, 680 S. 1993.
Baehr, H.D.: Thermodynamik: eine Einführung in die Grundlagen und ihre technischen Anwendungen, 9. Aufl., Springer-Verlag, 460 S., 1996.

Course: Excercises in Technical Thermodynamics and Heat Transfer II [2166527]

Coordinators: Ulrich Maas
Part of the modules: Engineering Thermodynamics (p. 33)[BSc-Modul 05, TTD]

ECTS Credits	Hours per week	Term	Instruction language
0	2	Summer term	de

Learning Control / Examinations
Written
Duration: 4 x 30 min hours

Conditions
None

Recommendations
Attendance of the lecture

Learning Outcomes
Application and consolidating of the lecture matter

Content
Calculation of thermodynamical problems

Literature
Course notes
Elsner, N.; Dittmann, A.: Energielehre und Stoffverhalten (Grundlagen der technischen Thermodynamik Bd. 1 und 2), 8. Aufl., Akademie-Verlag, 680 S. 1993.
Baehr, H.D.: Thermodynamik: eine Einführung in die Grundlagen und ihre technischen Anwendungen, 9. Aufl., Springer-Verlag, 460 S., 1996.

Course: Tutorial: Engineering Thermodynamics II - Repetition [2165501]

Coordinators: UlrichMaas, Halmer
Part of the modules: Engineering Thermodynamics (p. 33)[BSc-Modul 05, TTD]

ECTS Credits	Hours per week	Term	Instruction language
0	2	Winter term	de

Learning Control / Examinations
written;
Duration: 4 x 30 min hours

Conditions
Failed performance test in Engineering Thermodynamics II

Learning Outcomes
Application and consolidating of the lecture matter

Content
Calculation of thermodynamical problems

Literature
Course note packet
Elsner, N.; Dittmann, A.: Energielehre und Stoffverhalten (Grundlagen der technischen Thermodynamik Bd. 1 und 2), 8. Aufl., Akademie-Verlag, 680 S. 1993.
Baehr, H.D.: Thermodynamik: eine Einführung in die Grundlagen und ihre technischen Anwendungen, 9. Aufl., Springer-Verlag, 460 S., 1996.

Course: Exercises in Material Science I for mach, mage, phys [2173552]

Coordinators: Kay Weidenmann, Gruber
Part of the modules: Materials Science and Engineering (p. 32)[BSc-Modul 04, WK]

ECTS Credits	Hours per week	Term	Instruction language
0	1	Winter term	de

Learning Control / Examinations
none

Conditions
Lecture Materials Science and Engineering I

Learning Outcomes
Deepening of the lecture by examplary calculations

Content
Examplary calculations

Literature
Institute of Materials Science and Engineering I: Lecture Notes

Course: Exercises in Material Science II for mach, mage, phys [2174563]

Coordinators: Alexander Wanner, Gruber
Part of the modules: Materials Science and Engineering (p. 32)[BSc-Modul 04, WK]

ECTS Credits	Hours per week	Term	Instruction language
0	1	Summer term	de

Learning Control / Examinations
none

Conditions
Lecture Materials Science and Engineering II

Learning Outcomes
Deepening of the lecture by examplary calculations

Content
Examplary calculations

Literature
Institute of Materials Science and Engineering I: Lecture Notes

Course: Virtual Engineering (Specific Topics) [3122031]

Coordinators: Jivka Ovtcharova
Part of the modules: Compulsory optional subject (BSc) (p. 45)[BSc-Modul 14, WPF]

ECTS Credits	Hours per week	Term	Instruction language
	2	Summer term	en

Learning Control / Examinations
Oral examination
Duration: 20 min

Auxiliary Means: none

Conditions
None

Recommendations
None

Learning Outcomes
The students will acquire an introduction in Product Lifecycle Management (PLM) and understand the application of PLM in Virtual Engineering.
Furthermore, they will have an extensive knowledge of the data models, the specific modules and functions of CAD systems. They will have an awareness of the IT background of CAx systems, as well as the integration problems and possible approaches.
Students will receive an overview of various CAE analysis methods along with the application possibilities, basic conditions and limitations. They will know the different function of preprocessor, solver and postprocessor of CAE systems.
The students will get to know the definition of virtual reality how the stereoscopic effect occurs and which technologies can be used to simulate this effect.
Moreover, they will know which validation tests can be carried through in the product development process with the aid of a virtual mock-up (VMU) and what's the difference between a VMU, a physical mock-up (PMU) and a virtual prototype (VP).

Content
The lecture presents the informational interrelationship required for understanding the virtual product development process. For this purpose, an emphasis and focus will be placed on IT-systems used in the industrial sector as support for the process chain of virtual engineering:

- Product Lifecycle Management refers to the entire lifecycle of the product, beginning with the concept phase up through disassembling and recycling.
- CAx-systems for the virtual product development allow the modeling of a digital product in regards to design, construction, manufacturing and maintenance.
- Validation Systems allow the checking of the product in regard to static, dynamics, safety and build ability.
- The corresponding models can be visualized in Virtual Reality Systems, from single parts up through a complete assembly.
- Virtual Prototypes combine CAD-data as well as information about the remaining characteristics of the components and assembly groups for immersive visualisation, functionality tests and functional validations in the VR/AR/MR environment.
- Integrated Virtual Product Development explains exemplified the product development process from the point of view of Virtual Engineering.

The goal of the lecture is to clarify the relationship between construction and validation operations through the usage of virtual prototypes and VR/AR/MR visualisation techniques in connection with PDM/PLM-systems.

Literature
Lecture slides

Course: Heat and mass transfer [22512]

Coordinators: Henning Bockhorn
Part of the modules: Compulsory optional subject (BSc) (p. 45)[BSc-Modul 14, WPF]

ECTS Credits	Hours per week	Term	Instruction language
4	2	Winter term	de

Learning Control / Examinations

Conditions

None.

Learning Outcomes

Content

Course: [mach1NA2]

Coordinators: Bernd Pilawa
Part of the modules: Principles of Natural Science (p. 30)[BSc-Modul 02, NG]

ECTS Credits	Hours per week	Term	Instruction language
4	2	Summer term	de

Learning Control / Examinations
written examination

Conditions
None

Learning Outcomes

Content

Course: Material Sciencel for mach, mage, phys; Part 2 of class: Letters L-Z [2173551]

Coordinators: Alexander Wanner, Hans Jürgen Seifert, Kay Weidenmann
Part of the modules: Materials Science and Engineering (p. 32)[BSc-Modul 04, WK]

ECTS Credits	Hours per week	Term	Instruction language
7	5	Winter term	de

Learning Control / Examinations
Combined with “Materials Science and Engineering II”; oral; about 30 minutes

Conditions
none

Learning Outcomes
The students are able to describe the relationship between atomic structure, microscopical observations, and properties of solid materials.

The students are familiar with the typical property profies and applications of the most important engineering materials.

The students know about standard materials characterization methods and are able to asses materials on base of the data obtained by these methods.

Content
Atomic structure and atomic bonds

Structures of crystalline solids

Defects in crystalline solids

Structure of amorphous and semi-crystalline solids

Alloys

Transport and transformation phenomena in the solid state

Microscopy methods

Characterization by means of X-rays, Neutrons and Electrons

Nondestructive testing of materials

Mechanical testing of materials

Literature
Lecture Notes; Problem Sheets;

Shackelford, J.F.
Werkstofftechnologie für Ingenieure
Verlag Pearson Studium, 2005

Course: Material Science I for mach, mage, phys; Part 1 of class: Letters A-K [2173550]

Coordinators: Alexander Wanner, Hans Jürgen Seifert, Kay Weidenmann
Part of the modules: Materials Science and Engineering (p. 32)[BSc-Modul 04, WK]

ECTS Credits	Hours per week	Term	Instruction language
7	5	Winter term	de

Learning Control / Examinations
Combined with 'Materials Science and Engineering II'; oral; about 30 minutes

Conditions
None.

Recommendations
None.

Learning Outcomes
The students are able to describe the relationship between atomic structure, microscopical observations, and properties of solid materials.

The students are familiar with the typical property profies and applications of the most important engineering materials.

The students know about standard materials characterization methods and are able to asses materials on base of the data obtained by these methods.

Content
Atomic structure and atomic bonds

Structures of crystalline solids

Defects in crystalline solids

Structure of amorphous and semi-crystalline solids

Alloys

Transport and transformation phenomena in the solid state

Microscopy methods

Characterization by means of X-rays, Neutrons and Electrons

Nondestructive testing of materials

Mechanical testing of materials

Literature
Lecture Notes; Problem Sheets;

Shackelford, J.F.
Werkstofftechnologie für Ingenieure
Verlag Pearson Studium, 2005

Course: Material Science II for mach, mage, phys; Part 1 of class: Letters A-K [2174560]

Coordinators: Alexander Wanner, Hans Jürgen Seifert, Kay Weidenmann
Part of the modules: Materials Science and Engineering (p. 32)[BSc-Modul 04, WK]

ECTS Credits	Hours per week	Term	Instruction language
5	4	Summer term	de

Learning Control / Examinations
Combined with 'Materials Science and Engineering I'; oral; about 30 minutes

Conditions
Materials Science and Engineering I

Learning Outcomes
The students are able to describe the relationship between atomic structure, microscopical observations, and properties of solid materials.

The students are familiar with the typical property profies and applications of the most important engineering materials.

The students know about standard materials characterization methods and are able to asses materials on base of the data obtained by these methods.

Content
Ferrous materials

Non-ferrous metals and alloys

Engineering ceramics

Glasses

Polymers

Composites

Literature
Lecture Notes; Problem Sheets;

Shackelford, J.F.
Werkstofftechnologie für Ingenieure
Verlag Pearson Studium, 2005

Course: Material Science II for mach, mage, phys; Part 2 of class: Letters L-Z [2174561]

Coordinators: Alexander Wanner, Hans Jürgen Seifert, Kay Weidenmann
Part of the modules: Materials Science and Engineering (p. 32)[BSc-Modul 04, WK]

ECTS Credits	Hours per week	Term	Instruction language
5	4	Summer term	de

Learning Control / Examinations
Combined with “Materials Science and Engineering I”; oral; about 30 minutes

Conditions
Materials Science and Engineering I

Learning Outcomes
The students are able to describe the relationship between atomic structure, microscopical observations, and properties of solid materials.

The students are familiar with the typical property profies and applications of the most important engineering materials.

The students know about standard materials characterization methods and are able to asses materials on base of the data obtained by these methods.

Content
Ferrous materials

Non-ferrous metals and alloys

Engineering ceramics

Glasses

Polymers

Composites

Literature
Lecture Notes; Problem Sheets;

Shackelford, J.F.
Werkstofftechnologie für Ingenieure
Verlag Pearson Studium, 2005

Course: Scientific computing for Engineers [2181738]

Coordinators: Daniel Weygand, Peter Gumbsch
Part of the modules: Compulsory optional subject (BSc) (p. 45)[BSc-Modul 14, WPF]

ECTS Credits	Hours per week	Term	Instruction language
4	2	Winter term	de

Learning Control / Examinations
oral exam 30 minutes

Conditions
compulsory preconditions: none

Learning Outcomes
The student learns the programming language C++ used for computational material science on parallel platforms. Numerical methods for the solution of differential equations are learned and used.

Content
1. Introduction: why scientific computing
2. computer architectures
3. Introduction to Unix/Linux
4. Foundations of C++
* progamm organization
* data types, operator, control structures
* dynamic memory allocation
* functions
* class
* OpenMP parallelization
5. numeric /algorithms
* finite differences
* MD simulations: 2nd order differential equations
* algorithms for particle simulations
* solver for linear systems of eqns.

Literature
[1] C++: Einführung und professionelle Programmierung; U. Breymann, Hanser Verlag München
[2] C++ and object-oriented numeric computing for Scientists and Engineers, Daoqui Yang, Springer Verlag.
[3] The C++ Programming Language, Bjarne Stroustrup, Addison-Wesley
[4] Die C++ Standardbibliothek, S. Kuhlins und M. Schader, Springer Verlag

Numerik:

[1] Numerical recipes in C++ / C / Fortran (90), Cambridge University Press
[2] Numerische Mathematik, H.R. Schwarz, Teubner Stuttgart
[3] Numerische Simulation in der Moleküldynamik, Griebel, Knapek, Zumbusch, Caglar, Springer Verlag

Course: Workshop 'Working Methods in Mechanical Engineering' (AIA) [2106984]

Coordinators: Georg Bretthauer
Part of the modules: Key Competences (p. 35)[BSc-Modul 07, SQL]

ECTS Credits	Hours per week	Term	Instruction language
2	1	Summer term	de

Learning Control / Examinations

Conditions

None.

Learning Outcomes

Content

Course: Workshop 'Working Methods in Mechanical Engineering' (FAST - Bahnsystemtechnik) [2114990]

Coordinators: Peter Gratzfeld
Part of the modules: Key Competences (p. 35)[BSc-Modul 07, SQL]

ECTS Credits	Hours per week	Term	Instruction language
2	1	Summer term	de

Learning Control / Examinations

Conditions
None.

Learning Outcomes

Content

Course: Workshop 'Working Methods in Mechanical Engineering' (FAST - Fahrzeugtechnik) [2114989]

Coordinators: Frank Gauterin, El-Haji, Unrau
Part of the modules: Key Competences (p. 35)[BSc-Modul 07, SQL]

ECTS Credits	Hours per week	Term	Instruction language
2	1	Summer term	de

Learning Control / Examinations

Conditions
None.

Learning Outcomes

Content

Course: Workshop 'Working Methods in Mechanical Engineering' (FAST-Leichtbautechnologie) [2114450]

Coordinators: Frank Henning
Part of the modules: Key Competences (p. 35)[BSc-Modul 07, SQL]

ECTS Credits	Hours per week	Term	Instruction language
2	1	Summer term	de

Learning Control / Examinations

Conditions

None.

Learning Outcomes

Content

Course: Workshop 'Working Methods in Mechanical Engineering' (FAST-MOBIMA) [2114979]

Coordinators: Marcus Geimer
Part of the modules: Key Competences (p. 35)[BSc-Modul 07, SQL]

ECTS Credits	Hours per week	Term	Instruction language
2	1	Summer term	de

Learning Control / Examinations

Conditions
None.

Learning Outcomes

Content

Course: Workshop 'Working Methods in Mechanical Engineering' (FSM) [2158978]

Coordinators: Martin Gabi
Part of the modules: Key Competences (p. 35)[BSc-Modul 07, SQL]

ECTS Credits	Hours per week	Term	Instruction language
2	1	Summer term	de

Learning Control / Examinations

Conditions
None.

Learning Outcomes

Content

Course: Workshop ’Working Methods in Mechanical Engineering’ (IAM-AWP) [2174987]

Coordinators: Hans Jürgen Seifert
Part of the modules: Key Competences (p. 35)[BSc-Modul 07, SQL]

ECTS Credits	Hours per week	Term	Instruction language
2	1	Summer term	de

Learning Control / Examinations

Conditions
None.

Learning Outcomes

Content

Course: Workshop 'Working Methods in Mechanical Engineering' (IAM-ZBS, Nestler) [2182982]

Coordinators: Britta Nestler
Part of the modules: Key Competences (p. 35)[BSc-Modul 07, SQL]

ECTS Credits	Hours per week	Term	Instruction language
2	1	Summer term	de

Learning Control / Examinations
depending on the topic either by presentation or documentation

Conditions
required: lecture 2174970

Learning Outcomes
Study of a given topic by literature search and by research articles, preparation of appropriate contents, selection of material for presentation and documentation

Content
application of the lecture:
* project work in groups
* study of a particular given topic
* selection of material for presentation
* preparation of a presentation by poster or talk
* depending on the topic: Composition of a documentation

Media
books, research articles, web

Literature
Lecture notes, books, articles

Course: Workshop 'Working Methods in Mechanical Engineering' (IFAB) [2110968]

Coordinators: Gert Zülch, Patricia Stock
Part of the modules: Key Competences (p. 35)[BSc-Modul 07, SQL]

ECTS Credits	Hours per week	Term	Instruction language
2	1	Summer term	de

Learning Control / Examinations
The attendance and active collaboration is required for all workshops.
There will be no exam.

Conditions

- Attendance at the lecture "Arbeitstechniken für den Maschinenbau (2110969)" mandatory
- Limited number of participants
- Registration via internet on http://www.mach.kit.edu
- Mandatory attendance in all workshops

Learning Outcomes
The student should be able

- To plan a concrete task under the considertion of specific regulations in a goal- and resource-oriented way.
- To find and chose scientific information according to pre-defined quality criteria.
- To write a precise and conclusive scientific abstract and to evaluate scientific papers.
- To present scientific information.
- To work in a team in a motivating and team-oriented way.

Content
Workshop 1: Self management, Problem solving, Work organisation

Workshop 2: Structuring of problems, Scientific research

Workshop 3: Scientific use of information

Workshop 4: Scientific presentations

Literature
Learning material:
Handout online on: https://ilias.rz.uni-karlsruhe.de/goto_rz-uka_cat_7815.html

Literature:

- SEIWERT, Lothar J.: Mehr Zeit für das Wesentliche: besseres Zeitmanagement mit der Seiwert-Methode konsequente Zeitplanung und effektive Arbeitsmethodik. Landsberg, Lech: Verlag Moderne Industrie, 12. Auflage, 1991.
- BECHER, Stephan: Schnell und erfolgreich studieren: Organisation – Zeitmanagement – Arbeitstechniken. Würzburg: Lexika Verlag / Krick Fachmedien GmbH + Co, 1998.
- KOEDER, Kurt W.: Studienmethodik: Selbstmanagement für Studienanfänger. München: Vahlen, 3. Auflage, 1998.
- FRANCK, Norbert; STARY, Joachim: Die Technik wissenschaftlichen Arbeitens. Paderborn u.a.:Verlag Ferdinand Schöningh, 15. Auflage, 2009.

- KARMASIN, Matthias; RIBING, Rainer: Die Gestaltung wissenschaftlicher Arbeiten. Wien: Facultas Verlags- und Buchhandels AG, 4. Auflage, 2009.
- KARMASIN, Matthias; RIBING, Rainer: Die Gestaltung wissenschaftlicher Arbeiten. Wien: Facultas Verlags- und Buchhandels AG, 4. Auflage, 2009.
- KRUSE, Otto: Keine Angst vor dem leeren Blatt. Frankfurt a.M.; New York: Campus Verlag, 12. Auflage, 2007.
- ROSSIG, Wolfram; PRÄTSCH, Joachim: Wissenschaftliche Arbeiten. Leitfaden für Haus- und Seminararbeiten, Bachelor- und Masterthesis, Diplom- und Magisterarbeiten, Dissertationen. Achim: BerlinDruck, 7. Auflage, 2008.

Please refer to the latest edition.

Course: Workshop 'Working Methods in Mechanical Engineering' (IFKM) [2134996]

Coordinators: Ulrich Spicher
Part of the modules: Key Competences (p. 35)[BSc-Modul 07, SQL]

ECTS Credits	Hours per week	Term	Instruction language
2	1	Summer term	de

Learning Control / Examinations

Conditions
None.

Learning Outcomes

Content

Course: Workshop 'Working Methods in Mechanical Engineering' (IFL) [2118973]

Coordinators: Baur
Part of the modules: Key Competences (p. 35)[BSc-Modul 07, SQL]

ECTS Credits	Hours per week	Term	Instruction language
2	1	Summer term	de

Learning Control / Examinations
The successful participation is certified after active participation in all four Workshops and in the conclusion meeting .

Conditions
None.

Recommendations
None.

Learning Outcomes
The control of different work technics belongs to the key qualifications of a prospective mechanical engineer and the vocational practice. In the lecture some particular important aspects are treated: Scientific-technologic writing, investigating and quoting, time management, teamwork as well as presentation and communication technics . In four Workshops for this on the basis by setting of tasks from different areas of mechanical engineering practical experiences are gained.

Content
In four Workshops working technologies like scientific-technical writing, investigating and quoting, time management, teamwork as well as presentation and communication technologies are practiced and deepened.

Literature
None.

Course: Workshop ’Working Methods in Mechanical Engineering’ (IKM) [2126980]

Coordinators: Michael Hoffmann
Part of the modules: Key Competences (p. 35)[BSc-Modul 07, SQL]

ECTS Credits	Hours per week	Term	Instruction language
2	1	Summer term	de

Learning Control / Examinations

Conditions

None.

Learning Outcomes

Content

Course: Workshop 'Working Methods in Mechanical Engineering' (IKR) [2130985]

Coordinators: DanGabriel Cacuci, Erkan Arslan
Part of the modules: Key Competences (p. 35)[BSc-Modul 07, SQL]

ECTS Credits	Hours per week	Term	Instruction language
2	1	Summer term	de

Learning Control / Examinations

Conditions
None.

Learning Outcomes

Content

Course: Workshop 'Working Methods in Mechanical Engineering' (IMI) [2128998]

Coordinators: Jivka Ovtcharova, Mitarbeiter
Part of the modules: Key Competences (p. 35)[BSc-Modul 07, SQL]

ECTS Credits	Hours per week	Term	Instruction language
2	1	Summer term	de

Learning Control / Examinations
Team reports of the work packages and final team presentation will be estimated

Conditions
None.

Recommendations
None.

Learning Outcomes
Students become acquainted with working in a team and as well as gain experience in scientific research. They are able to analyze, to evaluate and to structure new information, as well as to abstract it within scientific reporting. Students develop independent concepts and case-based solutions and are able to present professionally the results, which have been worked out in the team. The students get a first insight into the approaches and ways of Product Lifecycle Management (PLM).

Content
Creativity techniques, presentation skills, communication techniques

Remarks
None.

Course: Workshop 'Working Methods in Mechanical Engineering' (IMT) [2142975]

Coordinators: Matthias Worgull
Part of the modules: Key Competences (p. 35)[BSc-Modul 07, SQL]

ECTS Credits	Hours per week	Term	Instruction language
2	1	Summer term	de

Learning Control / Examinations

- Participation in all workshops
- Deliverables
- Active Cooperation

Conditions
Participation of Lesson "Arbeitstechniken im Maschinenbau"

Learning Outcomes
Competences in

- Teamwork
- Working with limitation of time
- Scientific investigation
- Scientific citation
- Scientific writing
- Presentation

Content
Within the frame of a scientific conference the contents from the corresponding lesson will be implemented in a practical way.
The students have to organise a scientific conference by themself. The contributions have to prepared by the students and will be presented within the frame of abstracts, conference articles, posters, and presentations.
1. part of the workshop - Organisation of a conference

- Structure of a conference
- Generation of workgroups - Committees
- Exchange of Informations between workgroups
- Decision-making based on the information available
- Decision-making based under limitation of time
- Gerartion of technical progam, budget, flyer etc. of the conference
- Definition of critera for abstracts - communication of criteria

2. partl of the workshop - Investigation and writing of abstracts

- Investigation in Literatur / Patent Database
- Citation of scientific literature
- Writing of abstracts
- Evaluation of abstracts

3. part of the workshop - Writing of scientific conference contributions

- Structure of a scientific article
- Rules for scientific writing - style
- Citation - Sources and their citation
- Design of scientifi posters
- Design of a scientific presentation

4. part of the workshop - Moderation and presentation

- Presentation of the results of the workshop - oral presentations
- Presentation of posters
- Moderation of the confernce

Media
Computer with internet access

Literature
Script for the Workshop - Fundamentals of scientific writing, poster design, moderation and presentation were summerized in a kind of workshop guide.

Course: Workshop 'Working Methods in Mechanical Engineering' (ITS) [2170972]

Coordinators: Hans-Jörg Bauer
Part of the modules: Key Competences (p. 35)[BSc-Modul 07, SQL]

ECTS Credits	Hours per week	Term	Instruction language
2	1	Summer term	de

Learning Control / Examinations

Conditions
None.

Learning Outcomes

Content

Course: Workshop 'Working Methods in Mechanical Engineering' (ITT) [2166991]

Coordinators: Ulrich Maas
Part of the modules: Key Competences (p. 35)[BSc-Modul 07, SQL]

ECTS Credits	Hours per week	Term	Instruction language
2	1	Summer term	de

Learning Control / Examinations

Conditions

None.

Learning Outcomes

Content

Course: Workshop 'Working Methods in Mechanical Engineering' (MRT) [2138997]

Coordinators: Christoph Stiller
Part of the modules: Key Competences (p. 35)[BSc-Modul 07, SQL]

ECTS Credits	Hours per week	Term	Instruction language
2	1	Summer term	de

Learning Control / Examinations

Conditions
None.

Learning Outcomes

Content

Course: Workshop I 'Working Methods in Mechanical Engineering' (IAM-ZBS, Gumbsch) [2182974]

Coordinators: Peter Gumbsch, Matthias Weber, Anja Haug
Part of the modules: Key Competences (p. 35)[BSc-Modul 07, SQL]

ECTS Credits	Hours per week	Term	Instruction language
2	1	Summer term	de

Learning Control / Examinations
see lecture description

Conditions
required: lecture 2174970

Learning Outcomes
application of the lecture.

Content
application of the lecture:
* project work
* presentations, poster

Literature
Lecture notes

Course: Workshop I 'Working Methods in Mechanical Engineering' (IFRT) [2190497]

Coordinators: Robert Stieglitz
Part of the modules: Key Competences (p. 35)[BSc-Modul 07, SQL]

ECTS Credits	Hours per week	Term	Instruction language
2	1	Summer term	de

Learning Control / Examinations

Conditions
None.

Learning Outcomes

Content

Course: Workshop I ’Working Methods in Mechanical Engineering’ (IPEK) [2146971]

Coordinators: Albert Albers
Part of the modules: Key Competences (p. 35)[BSc-Modul 07, SQL]

ECTS Credits	Hours per week	Term	Instruction language
2	1	Summer term	de

Learning Control / Examinations

Conditions
None.

Learning Outcomes

Content

Course: Workshop I 'Working Methods in Mechanical Engineering' (ITM) [2162983]

Coordinators: Thomas Böhlke, Mitarbeiter
Part of the modules: Key Competences (p. 35)[BSc-Modul 07, SQL]

ECTS Credits	Hours per week	Term	Instruction language
2	1	Summer term	de

Learning Control / Examinations

Conditions
None.

Recommendations
None.

Learning Outcomes

Content

Course: Workshop I ’Working Methods in Mechanical Engineering’ (IWK I) [2174976]

Coordinators: Katja Poser
Part of the modules: Key Competences (p. 35)[BSc-Modul 07, SQL]

ECTS Credits	Hours per week	Term	Instruction language
2	1	Summer term	de

Learning Control / Examinations
certificate after active participation in all four workshops

Conditions
none

Learning Outcomes
strengthening of students’ skills and abilities in
- scientific writing
- literature research and citation techniques
- time management
- teamwork
- presentation and communication skills

Content
On four afternoons at intervals of 2 weeks the students have to work on a project task in teams of 4. In the last workshop the teams have to present their results orally (presentation) and written (abstract, poster) and get feedback from the teching staff and the students from the other teams.

Course: Workshop I ’Working Methods in Mechanical Engineering’ (WBK) [2150987]

Coordinators: Volker Schulze
Part of the modules: Key Competences (p. 35)[BSc-Modul 07, SQL]

ECTS Credits	Hours per week	Term	Instruction language
2	1	Summer term	de

Learning Control / Examinations
see lecture description

Conditions
required: lecture 2174970

Learning Outcomes
application of the lecture.

Content
application of the lecture:
* project work
* presentations, poster

Literature
Lecture notes

Course: Workshop II 'Working Methods in Mechanical Engineering' (IFRT) [2190498]

Coordinators: Kostadin Ivanov
Part of the modules: Key Competences (p. 35)[BSc-Modul 07, SQL]

ECTS Credits	Hours per week	Term	Instruction language
2	1	Summer term	de

Learning Control / Examinations

Conditions

None.

Learning Outcomes

Content

Course: Workshop II 'Working Methods in Mechanical Engineering' (IPEK) [2146972]

Coordinators: Sven Matthiesen, Wissenschaftlicher Mitarbeiter des IPEK
Part of the modules: Key Competences (p. 35)[BSc-Modul 07, SQL]

ECTS Credits	Hours per week	Term	Instruction language
2	1	Summer term	de

Learning Control / Examinations
The attendance and active collaboration is required for all workshops.
There will be no exam.

Conditions

- Attendance at the lecture "Arbeitstechniken für den Maschinenbau (2110969)" is required
- Limited number of participants
- Registration via internet on http://www.mach.kit.edu
- Mandatory attendance in all workshops

Learning Outcomes
Empowering students in the following areas:

- Find scientific sources and document the results wiith the program Zotero (Freeware)
- Quote to DIN 1505
- Scientific and technical writing, by submitting a summary of research results
- Teamwork, by working in a highly networked group, which has an team expert in it.
- Creativity techniques, by using the 635 method and the Gallery Method
- Decision-making in the team, by applying the weighted scoring method and the PMI (Plus / Minus / Interesting)
- presentation and communication techniques

Content
Task:

Development of alternative concepts of separation processes in handheld devices. These concepts are elaborated in the following workshops.

1st Workshop:
Introduction to Zotero software, Self- Organisation of the research task, division of labor within the team

2nd Workshop:
Introduction to creativity and application of these techniques in the team, hosted by appropriate experts.

3rd Workshop:
Introduction to methods for making and applying this as a team, hosted by appropriate experts.

4th Workshop:
Present scientific information and develop a presentation of the concept of alternative separation method in a hand-held device.

Media
Computer, Beamer, Flipchart

Course: Workshop II ’Working Methods for Mechanical Engineering’ (ITM) [2162994]

Coordinators: Carsten Proppe
Part of the modules: Key Competences (p. 35)[BSc-Modul 07, SQL]

ECTS Credits	Hours per week	Term	Instruction language
2	1	Summer term	de

Learning Control / Examinations

Conditions
None.

Learning Outcomes

Content

Course: Workshop II 'Working Methods in Mechanical Engineering' (IWK I) [2174986]

Coordinators: Alexander Wanner
Part of the modules: Key Competences (p. 35)[BSc-Modul 07, SQL]

ECTS Credits	Hours per week	Term	Instruction language
2	1	Summer term	de

Learning Control / Examinations
certificate after active participation in all four workshops

Conditions
none

Learning Outcomes
strengthening of students' skills and abilities in
- scientific writing
- literature research and citation techniques
- time management
- teamwork
- presentation and communication skills

Content
On four afternoons at intervals of 2 weeks the students have to work on a project task in teams of 4. In the last workshop the teams have to present their results orally (presentation) and written (abstract, poster) and get feedback from the teching staff and the students from the other teams.

Course: Workshop II 'Working Methods in Mechanical Engineering' (IZBS) [2182981]

Coordinators: Oliver Kraft, Patric Gruber, Courty
Part of the modules: Key Competences (p. 35)[BSc-Modul 07, SQL]

ECTS Credits	Hours per week	Term	Instruction language
2	1	Summer term	de

Learning Control / Examinations
see lecture notes

Conditions
required: lecture 2174970

Learning Outcomes
application of the lecture.

Content
application of the lecture:
* project work
* presentations, poster

Literature
Lecture notes

Course: Workshop II 'Working Methods in Mechanical Engineering' (WBK) [2150988]

Coordinators: Gisela Lanza
Part of the modules: Key Competences (p. 35)[BSc-Modul 07, SQL]

ECTS Credits	Hours per week	Term	Instruction language
2	1	Summer term	de

Learning Control / Examinations
see lecture description

Conditions
required: lecture 2174970

Learning Outcomes
application of the lecture.

Content
application of the lecture:
* project work
* presentations, poster

Literature
Lecture notes

Course: Workshop III 'Working Methods in Mechanical Engineering' (IFRT) [2190975]

Coordinators: Xu Cheng
Part of the modules: Key Competences (p. 35)[BSc-Modul 07, SQL]

ECTS Credits	Hours per week	Term	Instruction language
2	1	Summer term	de

Learning Control / Examinations
The successful participation is certified after active participation in all four Workshops.

Conditions
None.

Learning Outcomes

Content

Course: Workshop III ’Working Methods in Mechanical Engineering’ (ITM) [2162995]

Coordinators: Wolfgang Seemann
Part of the modules: Key Competences (p. 35)[BSc-Modul 07, SQL]

ECTS Credits	Hours per week	Term	Instruction language
2	1	Summer term	de

Learning Control / Examinations

Conditions
None.

Learning Outcomes

Content

Course: Workshop III 'Working Methods in Mechanical Engineering' (WBK) [2150989]

Coordinators: Jürgen Fleischer
Part of the modules: Key Competences (p. 35)[BSc-Modul 07, SQL]

ECTS Credits	Hours per week	Term	Instruction language
2	1	Summer term	de

Learning Control / Examinations
see lecture description

Conditions
required: lecture 2174970

Learning Outcomes
application of the lecture.

Content
application of the lecture:
* project work
* presentations, poster

Literature
Lecture notes

5 Major Fields

SP 02: Powertrain Systems

ID	Cat	Course	Lecturer	h	CP	Term
2113077	K	Drive Train of Mobile Machines (p. 190)	M. Geimer	2/1	4	W
2146180	K	Powertrain Systems Technology A: Automotive Systems (p. 191)	A. Albers, S. Ott	2	4	S
2145150	K	Powertrain Systems Technology B: Stationary Machinery (p. 192)	A. Albers, S. Ott	2	4	W
2163111	K	(p. 227)	A. Fidlin	4	8	W
2105012	E	Adaptive Control Systems (p. 185)	G. Bretthauer	2	3	W
2145181	E	Applied Tribology in Industrial Product Development (p. 189)	A. Albers, W. Burger	2	4	W
2162235	E	Introduction into the multi-body dynamics (p. 236)	W. Seemann	3	5	S
2117500	E	Energy efficient intralogistic systems (p. 242)	F. Schönung	2	4	W
2118083	E	IT for facility logistics (p. 295)	F. Thomas	4	6	S
2145184	E	Leadership and Product Development (p. 309)	A. Ploch	2	4	W
2161224	E	Machine Dynamics (p. 316)	C. Proppe	3	5	W
2162220	E	Machine Dynamics II (p. 317)	C. Proppe	2	4	S
2145180	E	Methodic Development of Mechatronic systems (p. 331)	A. Albers, W. Burger	2	4	W
2141865	E	Novel actuators and sensors (p. 340)	M. Kohl, M. Sommer	2	4	W
2147160	E	Patents and Patent Strategies (p. 346)	R. Einsele	2	4	W/S
2146194	E (P)	Mobile Robot Systems Lab (p. 354)	A. Albers, M. Frietsch	3	3	S
23311	E	Electrical Powertrains in Practice (p. 357)	M. Braun, Braun	2	3	S
2145182	E	Project management in Global Product Engineering Structures (p. 370)	P. Gutzmer	2	4	W
2173562	E	Failure Analysis (p. 381)	K. Poser	2	4	W
2150683	E	Control engineering (p. 397)	C. Gönnheimer	2	4	S
2146193	E	Strategic Product Planing (p. 398)	A. Siebe	2	4	S
2146192	E	Sustainable Product Engineering (p. 401)	K. Ziegahn	2	4	S
2181711	E	Failure of structural materials: deformation and fracture (p. 429)	P. Gumbsch, O. Kraft, D. Weygand	2	4	W
2173570	E	Materials and mechanical loads in the power train: engines, gearboxes and drive sections (p. 434)	J. Hoffmeister	2	4	W
23321	E	(p. 284)	M. Doppelbauer	2+1	4	W
2133101	E	Combustion Engines A with tutorial (p. 425)	U. Spicher	6	8	W
2134135	E	Combustion Engines B with Tutorial (p. 426)	U. Spicher	3	4	S
2186126	E	Automobile and Environment (p. 208)	H. Kubach, U. Spicher, U. Maas, H. Wirbser	2	4	S

Conditions: none
Recommendations: Recommended Courses:

- 2147175 CAE-Workshop

Remarks:

SP 05: Calculation Methods in Mechanical Engineering

ID	Cat	Course	Lecturer	h	CP	Term
2154434	K	Applied Fluid Mechanics (p. 187)	T. Schenkel	2	4	S
2162235	K	Introduction into the multi-body dynamics (p. 236)	W. Seemann	3	5	S
2161252	K	Advanced Methods in Strength of Materials (p. 283)	T. Böhlke	2	4	W
2181740	E	Atomistic simulations and molecular dynamics (p. 197)	P. Gumbsch	2	4	W
2147175	E (P)	CAE-Workshop (p. 217)	A. Albers, Assistenten	3	3	W/S
2106004	E	Computational Intelligence I (p. 220)	G. Bretthauer, R. Mikut	2	3	S
2105015	E	Computational Intelligence II (p. 221)	G. Bretthauer, MIkut	2	3	W
2106020	E	Computational Intelligence III (p. 222)	R. Mikut	2	3	S
2162282	E	Introduction to the Finite Element Method (p. 231)	T. Böhlke	2	4	S
2154401	E	Fluid-Structure-Interaction (p. 259)	T. Schenkel	2	4	S
2146190	E	Lightweight Engineering Design (p. 301)	A. Albers, N. Burkardt	2	4	S
2161214	E	Vibration of continuous systems (p. 302)	H. Hetzler	2	4	W
2161224	E	Machine Dynamics (p. 316)	C. Proppe	3	5	W
2162220	E	Machine Dynamics II (p. 317)	C. Proppe	2	4	S
2161206	E	Mathematical Methods in Dynamics (p. 320)	C. Proppe	2	4	W
2161254	E	Mathematical Methods in Strength of Materials (p. 321)	T. Böhlke	2	4	W
2162241	E	Mathematical methods of vibration theory (p. 322)	W. Seemann	3	5	S
2162242	E	Mathematical methods of vibration theory (Tutorial) (p. 420)	W. Seemann, N.N.	1	1	S
2162280	E	Mathematical Methods in Structural Mechanics (p. 323)	T. Böhlke	2	4	S
2134134	E	Analysis tools for combustion diagnostics (p. 330)	U. Wagner	2	4	S
2183702	E	Modelling of Microstructures (p. 332)	B. Nestler	2	4	W/S
2183703	E	Modelling and Simulation (p. 336)	B. Nestler	2	4	W/S
2153408	E	Numerical Fluid Mechanics (p. 345)	T. Schenkel	2	4	W
2162244	E	Plasticity Theory (p. 348)	T. Böhlke	2	4	S
2161250	E	Computational Mechanics I (p. 378)	T. Böhlke, T. Langhoff	2	5	W
2162296	E	Computational Mechanics II (p. 379)	T. Böhlke, T. Langhoff	2	5	S
2114095	E	Simulation of Coupled Systems (p. 391)	M. Geimer	2/2	4	S
2185264	E	Simulation in product development process (p. 392)	A. Albers, T. Böhlke, J. Ovtcharova	2	4	W
2161217	E (P)	Mechatronic Softwaretools (p. 395)	C. Proppe	2	4	W
2117095	E	Basics of Technical Logistics (p. 272)	M. Mittwollen, Linsel	4	6	W
2161212	E	Vibration Theory (p. 405)	W. Seemann	3	5	W
2117060	E/P	Analytical methods in material flow methodology (mach and wiwi) (p. 186)	K. Furmans	4	6	W
2133114	E	Simulation of spray and mixture formation processes in combustion engines (p. 394)	C. Baumgarten	2	4	W
2163111	E	(p. 227)	A. Fidlin	4	8	W
2163113	E	(p. 396)	A. Fidlin	4	8	W
2162247	E	Nonlinear vibrations (p. 341)	A. Fidlin	4	8	S
2161241	E (P)	Schwingungstechnisches Praktikum (p. 386)	H. Hetzler, A. Fidlin	3	3	S

ID	Cat	Course	Lecturer	h	CP	Term
2162248	E	Introduction into the nonlinear vibrations (Tutorial) (p. 421)	A. Fidlin, N.N.	1	1	S
2117096	E	Elements of Technical Logistics (p. 241)	M. Mittwollen	4	6	W
2162207	E	Dynamics of mechanical Systems with tribological Contacts (p. 226)	H. Hetzler	2	4	S

Conditions:
Recommendations:
Remarks:

SP 07: Dimensioning and Validation of Mechanical Constructions

ID	Cat	Course	Lecturer	h	CP	Term
2161252	KP	Advanced Methods in Strength of Materials (p. 283)	T. Böhlke	2	4	W
2181745	K	Design of highly stresses components (p. 204)	J. Aktaa	2	4	W
2162282	K	Introduction to the Finite Element Method (p. 231)	T. Böhlke	2	4	S
2173585	K	Fatigue of Metallic Materials (p. 385)	K. Lang	2	4	W
2174574	K	Materials for Lightweight Construction (p. 435)	K. Weidenmann	2	4	S
2123356	E (P)	CATIA V5 CAD training course (p. 215)	J. Ovtcharova, M. Hajdukovic	3	2	W/S
2123355	E (P)	CAD-NX5 training course (p. 216)	J. Ovtcharova, M. Hajdukovic	3	2	W/S
2147175	E (P)	CAE-Workshop (p. 217)	A. Albers, Assistenten	3	3	W/S
2161229	E	Designing with numerical methods in product development (p. 224)	E. Schnack	2	4	W
2125755	E	Introduction to Ceramics (p. 232)	M. Hoffmann	2	4	W
2175588	E (P)	Metallographic Lab Class, Metallographic Lab Class, Ferrous Materials (p. 245)	K. Poser, A. Wanner	3	4	W/S
2175589	E (P)	Metallographic Lab Class, Non-Ferrous Materials (p. 246)	K. Poser, A. Wanner	3	4	W/S
2173560	E (P)	Welding Lab Course, in groupes (p. 247)	V. Schulze	3	4	W
2146190	E	Lightweight Engineering Design (p. 301)	A. Albers, N. Burkardt	2	4	S
2161224	E	Machine Dynamics (p. 316)	C. Proppe	3	5	W
2162220	E	Machine Dynamics II (p. 317)	C. Proppe	2	4	S
2161206	E	Mathematical Methods in Dynamics (p. 320)	C. Proppe	2	4	W
2161254	E	Mathematical Methods in Strength of Materials (p. 321)	T. Böhlke	2	4	W
2162280	E	Mathematical Methods in Structural Mechanics (p. 323)	T. Böhlke	2	4	S
2162244	E	Plasticity Theory (p. 348)	T. Böhlke	2	4	S
2173590	E	Polymer Engineering I (p. 351)	P. Elsner	2	4	W
2162275	E (P)	Lab course experimental solid mechanics (p. 355)	T. Böhlke, Mitarbeiter	2	2	S
2161250	E	Computational Mechanics I (p. 378)	T. Böhlke, T. Langhoff	2	5	W
2162296	E	Computational Mechanics II (p. 379)	T. Böhlke, T. Langhoff	2	5	S
2173562	E	Failure Analysis (p. 381)	K. Poser	2	4	W
2185264	E	Simulation in product development process (p. 392)	A. Albers, T. Böhlke, J. Ovtcharova	2	4	W
2174579	E	Technology of steel components (p. 407)	V. Schulze	2	4	S

Conditions:
Recommendations:
Remarks:

SP 09: Dynamic Machine Models

ID	Cat	Course	Lecturer	h	CP	Term
2162235	K	Introduction into the multi-body dynamics (p. 236)	W. Seemann	3	5	S
2118078	K	Logistics - organisation, design and control of logistic systems (p. 311)	K. Furmans	4	6	S
2105012	E	Adaptive Control Systems (p. 185)	G. Bretthauer	2	3	W
2146180	E	Powertrain Systems Technology A: Automotive Systems (p. 191)	A. Albers, S. Ott	2	4	S
2147175	E (P)	CAE-Workshop (p. 217)	A. Albers, Assistenten	3	3	W/S
2117500	E	Energy efficient intralogistic systems (p. 242)	F. Schönung	2	4	W
2113807	E	Handling Characteristics of Motor Vehicles I (p. 249)	H. Unrau	2	4	W
2114838	E	Handling Characteristics of Motor Vehicles II (p. 250)	H. Unrau	2	4	S
2113806	E	Vehicle Comfort and Acoustics I (p. 251)	F. Gauterin	2	4	W
2114825	E	Vehicle Comfort and Acoustics II (p. 252)	F. Gauterin	2	4	S
2146190	E	Lightweight Engineering Design (p. 301)	A. Albers, N. Burkardt	2	4	S
2161206	E	Mathematical Methods in Dynamics (p. 320)	C. Proppe	2	4	W
24152	E	Robotic I (p. 380)	R. Dillmann, K. Welke, Dillmann, Welker, Do	2	3	W
2114095	E	Simulation of Coupled Systems (p. 391)	M. Geimer	2/2	4	S
2185264	E	Simulation in product development process (p. 392)	A. Albers, T. Böhlke, J. Ovtcharova	2	4	W
2138336	E	Behaviour Generation for Vehicles (p. 427)	C. Stiller, T. Dang	2	4	S
2122378	E	Virtual Engineering II (p. 431)	J. Ovtcharova	3	4	S
2118087	E/P	Selected Applications of Technical Logistics (p. 201)	M. Mittwollen, Linsel	3	4	S
2118088	E/P	Selected Applications of Technical Logistics and Project (p. 202)	M. Mittwollen, Linsel	4	6	S
2122379	E	Exercises Virtual Engineering II (p. 423)	J. Ovtcharova	1	0	S
2163111	E	(p. 227)	A. Fidlin	4	8	W
2163113	E	(p. 396)	A. Fidlin	4	8	W
2162247	E	Nonlinear vibrations (p. 341)	A. Fidlin	4	8	S
2161241	E (P)	Schwingungstechnisches Praktikum (p. 386)	H. Hetzler, A. Fidlin	3	3	S
2162248	E	Introduction into the nonlinear vibrations (Tutorial) (p. 421)	A. Fidlin, N.N.	1	1	S
2161212	E	Vibration Theory (p. 405)	W. Seemann	3	5	W
2162241	E	Mathematical methods of vibration theory (p. 322)	W. Seemann	3	5	S
2161214	E	Vibration of continuous systems (p. 302)	H. Hetzler	2	4	W
2162207	E	Dynamics of mechanical Systems with tribological Contacts (p. 226)	H. Hetzler	2	4	S

Conditions:
Recommendations:
Remarks:

SP 10: Engineering Design

ID	Cat	Course	Lecturer	h	CP	Term
2146180	K	Powertrain Systems Technology A: Automotive Systems (p. 191)	A. Albers, S. Ott	2	4	S
2145150	K	Powertrain Systems Technology B: Stationary Machinery (p. 192)	A. Albers, S. Ott	2	4	W
2146190	K	Lightweight Engineering Design (p. 301)	A. Albers, N. Burkardt	2	4	S
2113073	K	Mobile Machines (p. 333)	M. Geimer	4	8	S
2145181	E	Applied Tribology in Industrial Product Development (p. 189)	A. Albers, W. Burger	2	4	W
2117064	E	Application of technical logistics in modern crane systems (p. 193)	M. Golder	2	4	W
2113079	E	Design and Development of Mobile Machines (p. 205)	M. Geimer	2	4	W
2147175	E (P)	CAE-Workshop (p. 217)	A. Albers, Assistenten	3	3	W/S
2149657	E	manufacturing technology (p. 256)	V. Schulze	4	8	W
2113805	E	Automotive Engineering I (p. 267)	F. Gauterin, H. Unrau	4	8	W
2113814	E	Fundamentals for Design of Motor-Vehicles Bodies I (p. 277)	H. Bardehle	1	2	W
2114840	E	Fundamentals for Design of Motor-Vehicles Bodies II (p. 278)	H. Bardehle	1	2	S
2113812	E	Fundamentals in the Development of Commercial Vehicles I (p. 279)	J. Zürn	1	2	W
2114844	E	Fundamentals in the Development of Commercial Vehicles II (p. 280)	J. Zürn	1	2	S
2113810	E	Fundamentals of Automobile Development I (p. 281)	R. Frech	1	2	W
2114842	E	Fundamentals of Automobile Development II (p. 282)	R. Frech	1	2	S
2174571	E	Design with Plastics (p. 299)	C. Bonten	2	4	S
2145184	E	Leadership and Product Development (p. 309)	A. Ploch	2	4	W
2110017	E	Leadership and Conflict Management (in German) (p. 314)	H. Hatzl	2	4	S
2105014	E (P)	Laboratory mechatronics (p. 327)	A. Albers, G. Bretthauer, C. Proppe, C. Stiller	3	4	W
2145180	E	Methodic Development of Mechatronic systems (p. 331)	A. Albers, W. Burger	2	4	W
2146194	E (P)	Mobile Robot Systems Lab (p. 354)	A. Albers, M. Frietsch	3	3	S
2109025	E	Product Ergonomics (in German) (p. 362)	G. Zülch	2	4	W
2109028	E	Industrial Engineering I (in German) (p. 364)	G. Zülch	2	4	W
2145182	E	Project management in Global Product Engineering Structures (p. 370)	P. Gutzmer	2	4	W
2149667	E	Quality Management (p. 375)	G. Lanza	2	4	W
2117061	E	Safety engineering (p. 389)	H. Kany	2	4	W
2185264	E	Simulation in product development process (p. 392)	A. Albers, T. Böhlke, J. Ovtcharova	2	4	W
2146193	E	Strategic Product Planing (p. 398)	A. Siebe	2	4	S
2146192	E	Sustainable Product Engineering (p. 401)	K. Ziegahn	2	4	S
2158107	E	Technical Acoustics (p. 402)	M. Gabi	2	4	S
2146179	E	Technical Design in Product Development (p. 406)	M. Schmid, Dr. -Ing. Markus Schmid	2	4	S
2174574	E	Materials for Lightweight Construction (p. 435)	K. Weidenmann	2	4	S

ID	Cat	Course	Lecturer	h	CP	Term
2185578	E/P	Design Principles and Materials for High-Temperature Components (p. 300)	Wanner et al.	4	4	W
2149658	E	manufacturing technology exercises (p. 418)	V. Schulze	1	1	W
2149902	E	Machine Tools and Industrial Handling (p. 438)	J. Fleischer	4	8	W

Conditions: SP 10 as bachechelor module selectable
SP10 as master module selection depends on individual specialisation of the master course
Recommendations: Recommended Courses:

- 2147175 CAE-Workshop
- 2105014 Mechatronik - Workshop

Remarks:

SP 12: Automotive Technology

ID	Cat	Course	Lecturer	h	CP	Term
2113805	KP	Automotive Engineering I (p. 267)	F. Gauterin, H. Unrau	4	8	W
2146180	E	Powertrain Systems Technology A: Automotive Systems (p. 191)	A. Albers, S. Ott	2	4	S
2186126	E	Automobile and Environment (p. 208)	H. Kubach, U. Spicher, U. Maas, H. Wirbser	2	4	S
2114850	E	Driving Dynamics Evaluation within the Global Vehicle Simulation (p. 248)	B. Schick	2	4	S
2113807	E	Handling Characteristics of Motor Vehicles I (p. 249)	H. Unrau	2	4	W
2114838	E	Handling Characteristics of Motor Vehicles II (p. 250)	H. Unrau	2	4	S
2113806	E	Vehicle Comfort and Acoustics I (p. 251)	F. Gauterin	2	4	W
2114825	E	Vehicle Comfort and Acoustics II (p. 252)	F. Gauterin	2	4	S
2113816	E	Vehicle Mechatronics I (p. 253)	D. Ammon	2	4	W
2138340	E	Automotive Vision (p. 254)	C. Stiller, M. Lauer	2	4	S
2114835	E	Automotive Engineering II (p. 268)	F. Gauterin, H. Unrau	2	4	S
2134138	E	Fundamentals of catalytic exhaust gas aftertreatment (p. 270)	E. Lox	2	4	S
2114843	E	Basics and Methods for Integration of Tires and Vehicles (p. 276)	G. Leister	2	4	S
2113814	E	Fundamentals for Design of Motor-Vehicles Bodies I (p. 277)	H. Bardehle	1	2	W
2114840	E	Fundamentals for Design of Motor-Vehicles Bodies II (p. 278)	H. Bardehle	1	2	S
2113812	E	Fundamentals in the Development of Commercial Vehicles I (p. 279)	J. Zürn	1	2	W
2114844	E	Fundamentals in the Development of Commercial Vehicles II (p. 280)	J. Zürn	1	2	S
2113810	E	Fundamentals of Automobile Development I (p. 281)	R. Frech	1	2	W
2114842	E	Fundamentals of Automobile Development II (p. 282)	R. Frech	1	2	S
2146190	E	Lightweight Engineering Design (p. 301)	A. Albers, N. Burkardt	2	4	S
2115808	E (P)	Motor Vehicle Laboratory (p. 304)	M. Frey, M. El-Haji	2	4	W/S
2182642	E	Laser in automotive engineering (p. 308)	J. Schneider	2	4	S
2149669	E	Materials and processes for the lightweight production of car bodies (p. 319)	H. Haepp	2	4	W
2147160	E	Patents and Patent Strategies (p. 346)	R. Einsele	2	4	W/S
2123364	E	Product, Process and Resource Integration in the Automotive Industry (p. 361)	S. Mbang	3	4	S
2150690	E	Production Systems and Production Technology in Major Assembly Production (p. 365)	V. Stauch	2	4	W
2115817	E	Project Workshop: Automotive Engineering (p. 367)	F. Gauterin	3	6	W/S
2113071	E	Development of Mobile Hydraulic Systems (p. 368)	G. Geerling	2	4	W
2145182	E	Project management in Global Product Engineering Structures (p. 370)	P. Gutzmer	2	4	W

ID	Cat	Course	Lecturer	h	CP	Term
2162256	E	Computational Vehicle Dynamics (p. 377)	C. Proppe	2	4	S
2185264	E	Simulation in product development process (p. 392)	A. Albers, T. Böhlke, J. Ovtcharova	2	4	W
2146193	E	Strategic Product Planing (p. 398)	A. Siebe	2	4	S
2146192	E	Sustainable Product Engineering (p. 401)	K. Ziegahn	2	4	S
2138336	E	Behaviour Generation for Vehicles (p. 427)	C. Stiller, T. Dang	2	4	S
2149655	E	Gear Cutting Technology (p. 430)	K. Felten	2	4	W
2173570	E	Materials and mechanical loads in the power train: engines, gearboxes and drive sections (p. 434)	J. Hoffmeister	2	4	W
2174574	E	Materials for Lightweight Construction (p. 435)	K. Weidenmann	2	4	S
2153425	E	Industrial aerodynamics (p. 287)	T. Breitling	2	4	W
2133101	E	Combustion Engines A with tutorial (p. 425)	U. Spicher	6	8	W
2134135	E	Combustion Engines B with Tutorial (p. 426)	U. Spicher	3	4	S
2134112	E	Supercharging of Combustion Engines (p. 200)	R. Golloch	2	4	S
23321	E	(p. 284)	M. Doppelbauer	2+1	4	W

Conditions:
Recommendations:
Remarks:

SP 13: Strength of Materials/ Continuum Mechanics

ID	Cat	Course	Lecturer	h	CP	Term
2161252	KP	Advanced Methods in Strength of Materials (p. 283)	T. Böhlke	2	4	W
2162282	K	Introduction to the Finite Element Method (p. 231)	T. Böhlke	2	4	S
2161254	K	Mathematical Methods in Strength of Materials (p. 321)	T. Böhlke	2	4	W
2162280	K	Mathematical Methods in Structural Mechanics (p. 323)	T. Böhlke	2	4	S
2181711	K	Failure of structural materials: deformation and fracture (p. 429)	P. Gumbsch, O. Kraft, D. Weygand	2	4	W
1606	E	Adaptive Finite Element Methods (p. 184)	Dörfler	2	3	S
2181740	E	Atomistic simulations and molecular dynamics (p. 197)	P. Gumbsch	2	4	W
1246	E	Boundary and Eigenvalue Problems (p. 213)	M. Plum, W. Reichel, Plum, Reichel	6	6	S
2147175	E (P)	CAE-Workshop (p. 217)	A. Albers, Assistenten	3	3	W/S
2162255	E	Designing with composites (p. 225)	E. Schnack	2	4	S
2182732	E	Introduction to Theory of Materials (p. 233)	M. Kamlah	2	4	S
19110	E	Finite Elements for Field- and Time Dependent Problems (p. 258)	K. Schweizerhof, Schweizerhof	2	3	S
2181720	E	Foundations of nonlinear continuum mechanics (p. 271)	M. Kamlah	2	4	W
2161206	E	Mathematical Methods in Dynamics (p. 320)	C. Proppe	2	4	W
2183702	E	Modelling of Microstructures (p. 332)	B. Nestler	2	4	W/S
2183703	E	Modelling and Simulation (p. 336)	B. Nestler	2	4	W/S
2162244	E	Plasticity Theory (p. 348)	T. Böhlke	2	4	S
2162275	E (P)	Lab course experimental solid mechanics (p. 355)	T. Böhlke, Mitarbeiter	2	2	S
2161501	E	process simulation in forming operations (p. 373)	D. Helm	2	4	W
2162246	E	Computational Dynamics (p. 376)	C. Proppe	2	4	S
2161250	E	Computational Mechanics I (p. 378)	T. Böhlke, T. Langhoff	2	5	W
2162296	E	Computational Mechanics II (p. 379)	T. Böhlke, T. Langhoff	2	5	S
2185264	E	Simulation in product development process (p. 392)	A. Albers, T. Böhlke, J. Ovtcharova	2	4	W
2182740	E	Materials modelling: dislocation based plasticy (p. 437)	D. Weygand	2	4	S

Conditions:
Recommendations:
Remarks:

SP 15: Fundamentals of Energy Technology

ID	Cat	Course	Lecturer	h	CP	Term
2130927	KP	Fundamentals of Energy Technology (p. 266)	D. Cacuci, F. Badea	4	8	S
2166538	K	Fundamentals of combustion II (p. 274)	U. Maas	2	4	S
2157432	K	Hydraulic Fluid Machinery I (Basics) (p. 285)	M. Gabi	4	8	W
2130921	K	Nuclear Energy (p. 297)	D. Cacuci, F. Badea	2	4	S
2169453	K	Thermal Turbomachines I (p. 411)	H. Bauer	3	6	W
2117500	E	Energy efficient intralogistic systems (p. 242)	F. Schönung	2	4	W
2171486	E (P)	Integrated measurement systems for fluid mechanics applications (p. 293)	K. Dullenkopf, Mitarbeiter	5	4	W/S
2171487	E (P)	Laboratory Exercise in Energy Technology (p. 310)	H. Bauer, U. Maas, K. Dullenkopf, H. Wirbser	4	4	W/S
2130935	E	Photovoltaics (p. 347)	M. Powalla	3	6	S
2169472	E	Thermal Solar Energy (p. 410)	R. Stieglitz	2	4	W
23381	E	Environmentally compatible energy generation / wind turbines (p. 424)	N. Lewald, Lewald	2	4	W
2133109	E/P	Fuels and Lubricants for Combustion Engines and their Testing (p. 212)	J. Volz	2	4	W
2169459	E/P (P)	CFD-Lab using Open Foam (p. 219)	R. Koch	3	4	W
2158105	E/P	Hydraulic Fluid Machinery II (p. 286)	S. Caglar, M. Gabi	2	4	S
2134134	E/P	Analysis tools for combustion diagnostics (p. 330)	U. Wagner	2	4	S
2157441	E/P	Computational Methods in Fluid Mechanics (p. 343)	F. Magagnato	2	4	W
2169458	E/P	Numerical simulation of reacting two phase flows (p. 344)	R. Koch	2	4	W
2157442	E/P (P)	Computational Methods in Fluid Mechanics (Exercise) (p. 356)	B. Pritz	2	4	W
2146192	E/P	Sustainable Product Engineering (p. 401)	K. Ziegahn	2	4	S
2158107	E/P	Technical Acoustics (p. 402)	M. Gabi	2	4	S
2158106	E/P	Technologies for energy efficient buildings (p. 408)	F. Schmidt	2	4	S
2133101	E/P	Combustion Engines A with tutorial (p. 425)	U. Spicher	6	8	W

Conditions:
Recommendations:
Remarks:

SP 17: Information Management

ID	Cat	Course	Lecturer	h	CP	Term
2121001	KP	Integrated Information Systems for engineers (p. 404)	S. Rogalski, J. Ovtcharova	3	5	W
2123356	K (P)	CATIA V5 CAD training course (p. 215)	J. Ovtcharova, M. Hajdukovic	3	2	W/S
2123355	K (P)	CAD-NX5 training course (p. 216)	J. Ovtcharova, M. Hajdukovic	3	2	W/S
2123380	K	CATIA advanced (p. 218)	J. Ovtcharova, M. Mrkonjic	2	2	S
2123357	K (P)	PLM-CAD workshop (p. 350)	J. Ovtcharova	4	4	W
2123370	K	Pro/ENGINEER advanced (p. 358)	J. Ovtcharova, M. Mrkonjic	2	2	W
2121350	K	Product Lifecycle Management (p. 359)	J. Ovtcharova	4	6	W
2118089	E	Application of technical logistics in sorting- and distribution technology (p. 194)	J. Föller	2	4	S
2147175	E (P)	CAE-Workshop (p. 217)	A. Albers, Assistenten	3	3	W/S
2149650	E	Electronic Business for industrial Companies (p. 239)	A. Weisbecker	2	4	W
2118094	E	Information Systems in Logistics and Supply Chain Management (p. 289)	C. Kilger	2	4	S
2118083	E	IT for facility logistics (p. 295)	F. Thomas	4	6	S
2147160	E	Patents and Patent Strategies (p. 346)	R. Einsele	2	4	W/S
2121366	K	PLM in the Manufacturing Industry (p. 349)	G. Meier	2	4	W
2123364	K	Product, Process and Resource Integration in the Automotive Industry (p. 361)	S. Mbang	3	4	S
2110678	E (P)	Production Techniques Laboratory (p. 366)	K. Furmans, J. Ovtcharova, V. Schulze, G. Zülch, Research assitants of wbk, ifab und IFL	3	4	S
2145182	E	Project management in Global Product Engineering Structures (p. 370)	P. Gutzmer	2	4	W
2110036	E	Process Design and Industrial Engineering (p. 371)	S. Stowasser	2	4	S
2117062	E	Supply chain management (p. 400)	K. Alicke	4	6	W
2146192	E	Sustainable Product Engineering (p. 401)	K. Ziegahn	2	4	S
2123375	E (P)	Virtual Reality Laboratory (p. 432)	J. Ovtcharova, Jurica Katicic	3	3	W/S

Conditions: The course *Technische Informationssyteme* [2121001] is compulsory module and must be examined.
Recommendations: Attendance of the course Product Lifecycle Management [2121350] as elective module is recommended.
Remarks:

SP 18: Information Technology

ID	Cat	Course	Lecturer	h	CP	Term
2106004	K	Computational Intelligence I (p. 220)	G. Bretthauer, R. Mikut	2	3	S
2105015	K	Computational Intelligence II (p. 221)	G. Bretthauer, MIkut	2	3	W
2137309	K	Digital Control (p. 223)	M. Knoop	2	4	W
2137308	K	Machine Vision (p. 313)	C. Stiller, M. Lauer	4	8	W
2138326	K	Measurement II (p. 329)	C. Stiller	2	4	S
2106002	K	Computer Engineering (p. 403)	G. Bretthauer	3	4	S
2105012	E	Adaptive Control Systems (p. 185)	G. Bretthauer	2	3	W
2118089	E	Application of technical logistics in sorting- and distribution technology (p. 194)	J. Föller	2	4	S
2114092	E	BUS-Controls (p. 214)	M. Geimer	2	4	S
2106020	E	Computational Intelligence III (p. 222)	R. Mikut	2	3	S
2138340	E	Automotive Vision (p. 254)	C. Stiller, M. Lauer	2	4	S
2118094	E	Information Systems in Logistics and Supply Chain Management (p. 289)	C. Kilger	2	4	S
2105022	E	Informationsverarbeitung in mechatronischen Systemen (p. 291)	M. Kaufmann	2	3	W
24102	E	Information Processing in Sensor Networks (p. 292)	U. Hanebeck, Hanebeck	3	4	W
2118083	E	IT for facility logistics (p. 295)	F. Thomas	4	6	S
2137304	E	Correlation Methods in Measurement and Control (p. 303)	F. Mesch	2	4	W
2105014	E (P)	Laboratory mechatronics (p. 327)	A. Albers, G. Bretthauer, C. Proppe, C. Stiller	3	4	W
2134137	E	Engine measurement techniques (p. 339)	S. Bernhardt	2	4	S
2137306	E (P)	Lab Computer-aided methods for measurement and control (p. 353)	C. Stiller, P. Lenz	3	4	W
2150683	E	Control engineering (p. 397)	C. Gönnheimer	2	4	S
2138336	E	Behaviour Generation for Vehicles (p. 427)	C. Stiller, T. Dang	2	4	S

Conditions:
Recommendations:
Remarks:

SP 24: Energy Converting Engines

ID	Cat	Course	Lecturer	h	CP	Term
2157432	K	Hydraulic Fluid Machinery I (Basics) (p. 285)	M. Gabi	4	8	W
2169453	K	Thermal Turbomachines I (p. 411)	H. Bauer	3	6	W
2133101	K	Combustion Engines A with tutorial (p. 425)	U. Spicher	6	8	W
2158112	E	Low Temperature Technology (p. 188)	F. Haug	2	4	S
2134112	E	Supercharging of Combustion Engines (p. 200)	R. Golloch	2	4	S
22509	E	Design of combustion chamber in gas turbines (Project) (p. 203)	N. Zarzalis	2	4	S
2133109	E	Fuels and Lubricants for Combustion Engines and their Testing (p. 212)	J. Volz	2	4	W
2114093	E	Fluid Technology (p. 260)	M. Geimer	2/2	4	W
2134138	E	Fundamentals of catalytic exhaust gas aftertreatment (p. 270)	E. Lox	2	4	S
2165515	E	Fundmentals of Combustion I (p. 273)	U. Maas	2	4	W
2166538	E	Fundamentals of combustion II (p. 274)	U. Maas	2	4	S
2158105	E	Hydraulic Fluid Machinery II (p. 286)	S. Caglar, M. Gabi	2	4	S
2157441	E	Computational Methods in Fluid Mechanics (p. 343)	F. Magagnato	2	4	W
2157442	E (P)	Computational Methods in Fluid Mechanics (Exercise) (p. 356)	B. Pritz	2	4	W
2158107	E	Technical Acoustics (p. 402)	M. Gabi	2	4	S
2170476	E	Thermal Turbomachines II (p. 412)	H. Bauer	3	6	S
2169462	E	Turbine and compressor Design (p. 416)	H. Bauer, A. Schulz	2	4	W
2170478	E	Turbo Jet Engines (p. 417)	H. Bauer, A. Schulz	2	4	S
2134135	E	Combustion Engines B with Tutorial (p. 426)	U. Spicher	3	4	S
2186126	E	Automobile and Environment (p. 208)	H. Kubach, U. Spicher, U. Maas, H. Wirbser	2	4	S

Conditions:
Recommendations:
Remarks:

SP 26: Materials Science and Engineering

ID	Cat	Course	Lecturer	h	CP	Term
2173553	K	Material Science III (p. 436)	A. Wanner	5	8	W
2193002	K	(p. 413)	H. Seifert	3	4	W
2193003	K	(p. 257)	D. Cupid, P. Franke	3	4	W
2181740	E	Atomistic simulations and molecular dynamics (p. 197)	P. Gumbsch	2	4	W
2178643	E	Constitution and Properties of Wear resistant materials (p. 198)	S. Ulrich	2	4	S
2162255	E	Designing with composites (p. 225)	E. Schnack	2	4	S
2125755	E	Introduction to Ceramics (p. 232)	M. Hoffmann	2	4	W
2182734	E	Introduction to the Mechanics of Composite Materials (p. 234)	Y. Yang	2	4	S
2175588	E (P)	Metallographic Lab Class, Metallographic Lab Class, Ferrous Materials (p. 245)	K. Poser, A. Wanner	3	4	W/S
2175589	E (P)	Metallographic Lab Class, Non-Ferrous Materials (p. 246)	K. Poser, A. Wanner	3	4	W/S
2174575	E	Foundry Technology (p. 261)	C. Wilhelm	2	4	S
2193010	E	Grundlagen der Herstellungsverfahren der Keramik und Pulvermetallurgie (p. 269)	R. Oberacker	2	4	W
2174571	E	Design with Plastics (p. 299)	C. Bonten	2	4	S
2182642	E	Laser in automotive engineering (p. 308)	J. Schneider	2	4	S
2161983	E	Mechanics of laminated composites (p. 324)	E. Schnack	2	4	W
2173580	E	Mechanics and Strengths of Polymers (p. 325)	B. von Bernstorff (Graf), von Bernstorff	2	4	W
2183702	E	Modelling of Microstructures (p. 332)	B. Nestler	2	4	W/S
2183703	E	Modelling and Simulation (p. 336)	B. Nestler	2	4	W/S
2173590	E	Polymer Engineering I (p. 351)	P. Elsner	2	4	W
2183640	E (P)	Laboratory "Laser Materials Processing" (p. 352)	J. Schneider, W. Pfleging	3	4	W/S
2173562	E	Failure Analysis (p. 381)	K. Poser	2	4	W
2173565	E	Welding Technology I (p. 383)	B. Spies	1	2	W
2174570	E	Welding Technology II (p. 384)	B. Spies	1	2	S
2173585	E	Fatigue of Metallic Materials (p. 385)	K. Lang	2	4	W
2173577	E	Failure Analysis Seminar (p. 388)	K. Poser	2	2	W
2174579	E	Technology of steel components (p. 407)	V. Schulze	2	4	S
2181715	E	Failure of Structural Materials: Fatigue and Creep (p. 428)	O. Kraft, P. Gumbsch, P. Gruber	2	4	W
2181711	E	Failure of structural materials: deformation and fracture (p. 429)	P. Gumbsch, O. Kraft, D. Weygand	2	4	W
2174586	E	Material Analysis (p. 433)	J. Gibmeier	2	4	S
2173570	E	Materials and mechanical loads in the power train: engines, gearboxes and drive sections (p. 434)	J. Hoffmeister	2	4	W
2174574	E	Materials for Lightweight Construction (p. 435)	K. Weidenmann	2	4	S
2177601	E/P	Constitution and Properties of Protective Coatings (p. 199)	S. Ulrich	2	4	W
2181744	E/P	Size effects in micro and nanostructures materials (p. 265)	P. Gumbsch, D. Weygand, C. Eberl, P. Gruber, M. Dienwiebel	2	4	W
2185578	E/P	Design Principles and Materials for High-Temperature Components (p. 300)	Wanner et al.	4	4	W

ID	Cat	Course	Lecturer	h	CP	Term
2162280	E/P	Mathematical Methods in Structural Mechanics (p. 323)	T. Böhlke	2	4	S
2162244	E/P	Plasticity Theory (p. 348)	T. Böhlke	2	4	S
2126749	E/P	Advanced powder metals (p. 374)	R. Oberacker	2	4	S
2126775	E/P	Structural and Functional Ceramics (p. 399)	M. Hoffmann	2	4	S
2182740	E/P	Materials modelling: dislocation based plasticy (p. 437)	D. Weygand	2	4	S

Conditions: Basic knowledge in materials science and engineering (Werkstoffkunde I/II)
Recommendations: suggested optional compulsory subject:

- 2174576 Systematic Materials Selection

Remarks:

SP 31: Mechatronics

ID	Cat	Course	Lecturer	h	CP	Term
2105012	K	Adaptive Control Systems (p. 185)	G. Bretthauer	2	3	W
2106004	K	Computational Intelligence I (p. 220)	G. Bretthauer, R. Mikut	2	3	S
2162235	K	Introduction into the multi-body dynamics (p. 236)	W. Seemann	3	5	S
2138340	K	Automotive Vision (p. 254)	C. Stiller, M. Lauer	2	4	S
2105024	K	Modern Concepts of Control (p. 337)	L. Gröll, Groell	2	3	W
2161217	K (P)	Mechatronic Softwaretools (p. 395)	C. Proppe	2	4	W
2138336	K	Behaviour Generation for Vehicles (p. 427)	C. Stiller, T. Dang	2	4	S
2106005	E	Automation Systems (p. 207)	M. Kaufmann	2	3	S
2114092	E	BUS-Controls (p. 214)	M. Geimer	2	4	S
2147175	E (P)	CAE-Workshop (p. 217)	A. Albers, Assistenten	3	3	W/S
2105015	E	Computational Intelligence II (p. 221)	G. Bretthauer, MIkut	2	3	W
2106020	E	Computational Intelligence III (p. 222)	R. Mikut	2	3	S
2137309	E	Digital Control (p. 223)	M. Knoop	2	4	W
2106031	E	Experimental Modelling (p. 244)	L. Gröll	2	3	S
23144	E	Informationstechnik in der industriellen Automation (p. 290)	P. Bort, Bort	2	3	S
2118083	E	IT for facility logistics (p. 295)	F. Thomas	4	6	S
2149670	E (P)	Micro manufacturing laboratory (p. 305)	V. Schulze, C. Ruhs	5	4	W
2161224	E	Machine Dynamics (p. 316)	C. Proppe	3	5	W
2162220	E	Machine Dynamics II (p. 317)	C. Proppe	2	4	S
2181710	E	Mechanics in Microtechnology (p. 326)	C. Eberl, P. Gruber	2	4	W
2105014	E (P)	Laboratory mechatronics (p. 327)	A. Albers, G. Bretthauer, C. Proppe, C. Stiller	3	4	W
24154	E	Human Robot Cooperation (p. 328)	Burghart	2	3	W
2138326	E	Measurement II (p. 329)	C. Stiller	2	4	S
2145180	E	Methodic Development of Mechatronic systems (p. 331)	A. Albers, W. Burger	2	4	W
2141865	E	Novel actuators and sensors (p. 340)	M. Kohl, M. Sommer	2	4	W
2147160	E	Patents and Patent Strategies (p. 346)	R. Einsele	2	4	W/S
2145182	E	Project management in Global Product Engineering Structures (p. 370)	P. Gutzmer	2	4	W
24152	E	Robotic I (p. 380)	R. Dillmann, K. Welke, Dillmann, Welker, Do	2	3	W
23109	E	Signals and Systems (p. 390)	F. Puente	2	3	W
2185264	E	Simulation in product development process (p. 392)	A. Albers, T. Böhlke, J. Ovtcharova	2	4	W
2146192	E	Sustainable Product Engineering (p. 401)	K. Ziegahn	2	4	S
2123375	E (P)	Virtual Reality Laboratory (p. 432)	J. Ovtcharova, Jurica Katicic	3	3	W/S
23321	E	(p. 284)	M. Doppelbauer	2+1	4	W

Conditions:
Recommendations:
Remarks:

SP 38: Production Systems

ID	Cat	Course	Lecturer	h	CP	Term
2149657	K	manufacturing technology (p. 256)	V. Schulze	4	8	W
2149902	K	Machine Tools and Industrial Handling (p. 438)	J. Fleischer	4	8	W
2150660	K	Integrated production planning (p. 294)	G. Lanza	4	8	S
2109026	K	Work Science (Lecture and Excercises; in German) (p. 195)	G. Zülch	4	6	W
2149610	K	Global Production and Logistics - Part 1: Global Production (p. 262)	G. Lanza	2	4	W
2149600	K	Global Production and Logistics - Part 2: Global Logistics (p. 263)	K. Furmans	2	4	W
2117051	K	Material flow in logistic systems (p. 318)	K. Furmans	3	6	W
2149605	K	Simulation of production systems and processes (p. 393)	K. Furmans, V. Schulze, G. Zülch	3	5	W
2149650	E	Electronic Business for industrial Companies (p. 239)	A. Weisbecker	2	4	W
2118085	E	Automotive Logistics (p. 312)	K. Furmans	2	4	S
2121350	E	Product Lifecycle Management (p. 359)	J. Ovtcharova	4	6	W
2149667	E	Quality Management (p. 375)	G. Lanza	2	4	W
2150683	E	Control engineering (p. 397)	C. Gönnheimer	2	4	S
2121001	E	Integrated Information Systems for engineers (p. 404)	S. Rogalski, J. Ovtcharova	3	5	W
2121351	E	Exercises Product Lifecycle Management (p. 422)	J. Ovtcharova, Mitarbeiter	1	0	W
2150661	E	Übungen zu Integrierte Produktionsplanung (p. 419)	G. Lanza	2	2	S
2149658	E	manufacturing technology exercises (p. 418)	V. Schulze	1	1	W
2149904	E	Automated Production Line (p. 206)	J. Fleischer	2	4	S
2149903	E	Development Project for Machine Tools and Industrial Handling (p. 243)	J. Fleischer	2	4	W

Conditions:
Recommendations:
Remarks:

SP 44: Technical Logistics

ID	Cat	Course	Lecturer	h	CP	Term
2117095	KP	Basics of Technical Logistics (p. 272)	M. Mittwollen, Linsel	4	6	W
2117096	K	Elements of Technical Logistics (p. 241)	M. Mittwollen	4	6	W
2118087	K	Selected Applications of Technical Logistics (p. 201)	M. Mittwollen, Linsel	3	4	S
2118088	K	Selected Applications of Technical Logistics and Project (p. 202)	M. Mittwollen, Linsel	4	6	S
2117064	E	Application of technical logistics in modern crane systems (p. 193)	M. Golder	2	4	W
2118089	E	Application of technical logistics in sorting- and distribution technology (p. 194)	J. Föller	2	4	S
2117500	E	Energy efficient intralogistic systems (p. 242)	F. Schönung	2	4	W
2138341	E	Cogitive Automobiles - Laboratory (p. 298)	C. Stiller, M. Lauer, B. Kitt	2	3	S
2118097	E	Warehousing and distribution systems (p. 306)	K. Furmans, C. Huber	2	4	S
2117051	E	Material flow in logistic systems (p. 318)	K. Furmans	3	6	W
2149667	E	Quality Management (p. 375)	G. Lanza	2	4	W
2117061	E	Safety engineering (p. 389)	H. Kany	2	4	W
2138336	E	Behaviour Generation for Vehicles (p. 427)	C. Stiller, T. Dang	2	4	S
2118083	E/P	IT for facility logistics (p. 295)	F. Thomas	4	6	S

Conditions: none
Recommendations: Recommended compulsory optional subjects:

- Mathematical Methods in Dynamics
- Simulation of production systems and processes
- Stochastics in Mecanical Engineering
- Modelling and Simulation
- Technical Logistics I

Remarks:

SP 48: Internal Combustion Engines

ID	Cat	Course	Lecturer	h	CP	Term
2133101	KP	Combustion Engines A with tutorial (p. 425)	U. Spicher	6	8	W
2134135	K	Combustion Engines B with Tutorial (p. 426)	U. Spicher	3	4	S
2134112	K	Supercharging of Combustion Engines (p. 200)	R. Golloch	2	4	S
2134138	K	Fundamentals of catalytic exhaust gas aftertreatment (p. 270)	E. Lox	2	4	S
2134134	K	Analysis tools for combustion diagnostics (p. 330)	U. Wagner	2	4	S
2134137	K	Engine measurement techniques (p. 339)	S. Bernhardt	2	4	S
2133109	E	Fuels and Lubricants for Combustion Engines and their Testing (p. 212)	J. Volz	2	4	W
2133114	E	Simulation of spray and mixture formation processes in combustion engines (p. 394)	C. Baumgarten	2	4	W
2186126	E	Automobile and Environment (p. 208)	H. Kubach, U. Spicher, U. Maas, H. Wirbser	2	4	S
2134001	E	Engine laboratory (block course) (p. 338)	U. Spicher	2	4	S
2181745	E	Design of highly stresses components (p. 204)	J. Aktaa	2	4	W
2113806	E	Vehicle Comfort and Acoustics I (p. 251)	F. Gauterin	2	4	W
2114825	E	Vehicle Comfort and Acoustics II (p. 252)	F. Gauterin	2	4	S
2166538	E	Fundamentals of combustion II (p. 274)	U. Maas	2	4	S
2161224	E	Machine Dynamics (p. 316)	C. Proppe	3	5	W
2162220	E	Machine Dynamics II (p. 317)	C. Proppe	2	4	S
2147160	E	Patents and Patent Strategies (p. 346)	R. Einsele	2	4	W/S
2145182	E	Project management in Global Product Engineering Structures (p. 370)	P. Gutzmer	2	4	W
2146192	E	Sustainable Product Engineering (p. 401)	K. Ziegahn	2	4	S
2158107	E	Technical Acoustics (p. 402)	M. Gabi	2	4	S
2181113	E	Tribology A (p. 414)	M. Scherge, M. Dienwiebel	2	4	W
2182139	E	Tribology B (p. 415)	M. Scherge, M. Dienwiebel	2	4	S
2185578	E/P	Design Principles and Materials for High-Temperature Components (p. 300)	Wanner et al.	4	4	W
2134139	E	(p. 335)	F. Kirschbaum			S
2134150	E	(p. 183)	M. Gohl			S
2113805	E	Automotive Engineering I (p. 267)	F. Gauterin, H. Unrau	4	8	W
2114835	E	Automotive Engineering II (p. 268)	F. Gauterin, H. Unrau	2	4	S

Conditions:
Recommendations:
Remarks:

SP 50: Rail System Technology

ID	Cat	Course	Lecturer	h	CP	Term
2115919	KP	Rail System Technology (p. 209)	P. Gratzfeld	2	4	W/S
2115996	KP	Rail Vehicle Technology (p. 382)	P. Gratzfeld	2	4	W/S
2113101	E	Introduction to Automotive Lightweight Technology (p. 230)	F. Henning	2	4	W
2105011	E	Introduction into Mechatronics (p. 235)	G. Bretthauer, A. Albers	3	6	W
19306	E	Basics Operation Systems of Ground Born Guided Systems (p. 237)	E. Hohnecker, P. Gratzfeld, Hohnecker	2	4	W
19321	E	Operation Systems of Ground Born Guided Systems (p. 238)	E. Hohnecker, P. Gratzfeld, Hohnecker	2	4	S
2114346	E	Electric Rail Vehicles (p. 240)	P. Gratzfeld	2	4	S
2138340	E	Automotive Vision (p. 254)	C. Stiller, M. Lauer	2	4	S
2114052	E	Composites for Lightweight Design (p. 255)	F. Henning	2	4	S
19066	E	Basics of Ground Born Guided Systems (p. 275)	E. Hohnecker, P. Gratzfeld, Hohnecker	3	4	S
2115915	E	Mobility Concepts of Rail Transportation in 2030 (p. 334)	P. Gratzfeld	2	4	W
2115995	E	Project Management in Rail Industry (p. 369)	P. Gratzfeld	2	4	W
2162256	E	Computational Vehicle Dynamics (p. 377)	C. Proppe	2	4	S
2161217	E (P)	Mechatronic Softwaretools (p. 395)	C. Proppe	2	4	W

Conditions: The lectures “Rail System Technology” and “Rail Vehicle Technology” are mandatory. They can be attended in the same term.
Recommendations: none
Remarks:

SP 52: Production Management

ID	Cat	Course	Lecturer	h	CP	Term
2109041	KP	Introduction to Industrial Engineering (p. 228)	G. Zülch	2	4	S
2118092	KP	Selected Topics in Manufacturing Technologies (p. 387)	V. Schulze	2	4	S
2150653	E	Basics in Material Handling and Logistics Systems (p. 210)	K. Furmans	2	4	S

Conditions:
Recommendations:
Remarks:

6 Courses of the Major Fields

6.1 All Courses

Course: [2134150]

Coordinators: Marcus Gohl
Part of the modules: SP 48: Internal Combustion Engines (p. 180)[SP_48_mach]

ECTS Credits	Hours per week	Term	Instruction language
		Summer term	de

Learning Control / Examinations

Conditions
None.

Learning Outcomes

Content

Course: Adaptive Finite Element Methods [1606]

Coordinators: Dörfler
Part of the modules: SP 13: Strength of Materials/ Continuum Mechanics (p. 170)[SP_13_mach]

ECTS Credits	Hours per week	Term	Instruction language
3	2	Summer term	

Learning Control / Examinations

Conditions

None.

Learning Outcomes

Content

Course: Adaptive Control Systems [2105012]

Coordinators: Georg Bretthauer
Part of the modules: SP 02: Powertrain Systems (p. 161)[SP_02_mach], SP 31: Mechatronics (p. 177)[SP_31_mach], SP 09: Dynamic Machine Models (p. 165)[SP_09_mach], SP 18: Information Technology (p. 173)[SP_18_mach]

ECTS Credits	Hours per week	Term	Instruction language
3	2	Winter term	de

Learning Control / Examinations
Oral examination (1 hour)

Duration: 1 hours, also possible as an optional or part of a major subject

Auxilary means: none

Conditions
Measuring and Automatic Control

Learning Outcomes
The students know different types, structures and operation of adaptive control systems. They are capable of setting up system equations theoretically and experimentally. By experimenting with examples students are prepared to apply adaptive control systems in practice.

Content
Introduction: definitions, classification of adaptive control systems, objectives

Structures of adaptive control systems: overview, parameter-, structure- and signal-adaptive control systems, open-loop and closed loop ARS, ARS with reference/identification model, application

Modeling: methods, experimental conditions, experimental modeling, identifcation methods for single input single output systems and multi input multi output systems

Parameter adaptive control systems: definitions, design methods

Literature
W. Weber. Adaptive Regelungssysteme, volume I, II. R. Oldenbourg, München, 1971.

Course: Analytical methods in material flow methodology (mach and wiwi) [2117060]

Coordinators: Kai Furmans
Part of the modules: SP 05: Calculation Methods in Mechanical Engineering (p. 162)[SP_05_mach]

ECTS Credits	Hours per week	Term	Instruction language
6	4	Winter term	de

Learning Control / Examinations
oral

30min (electives), 60min (main subject)

examination aids: none

Conditions
none

Recommendations
Basic knowledge of statistic
recommended compusory optional subject:

- Stochastics in Mecanical Engineering

recommended lecture:

- Material flow in logistic systems (also parallel)

Learning Outcomes
The student:

- has basis knowledge necessary to understand analytical solvable stochastic models of material flow systems,
- Based on easy models of queueing theory the student is able to model material flow networks and knows how control methods like Kanban can be implemented,
- executes practical computer experiments and
- uses simulation and exakt methods.

Content

- single server systems: M/M/1, M/G/1: priority rules, model of failures
- networks: open and closed approximations, exact solutions and approximations
- application to flexible manufacturing systems, AGV (automated guided vehicles) - systems
- modeling of control approaches like constant work in process (ConWIP) or kanban
- discrete-time modeling of queuing systems

Media
black board, lecture notes, presentations

Literature
Wolff: Stochastic Modeling and the Theory of Queues, Prentice Hall, 1989

Shanthikumar, Buzacott: Stochastic Models of Manufacturing Systems

Remarks
none

Course: Applied Fluid Mechanics [2154434]

Coordinators: Torsten Schenkel
Part of the modules: SP 05: Calculation Methods in Mechanical Engineering (p. 162)[SP_05_mach]

ECTS Credits	Hours per week	Term	Instruction language
4	2	Summer term	de

Learning Control / Examinations
oral

Duration: 30 minutes

no auxiliary means

Conditions
None.

Learning Outcomes
The lecture supplements the fundamentals of fluid mechanics as taught in the fundamental lecture 'Fluid Mechanics'. The student enhances his understanding of fluid mechanical phenomena. The lecture is therfore the basis for a focus on fluid mechanics.

Content

- Introduction
- Aerodynamics
- Fundamentals of Aerodynamics
- Prandtl's Theory of Airfoils
- Boundary Layers
- Transsonic Airfoils
- Flows with Heat Transfer
- Fundamentals of Heat Transfer
- Konvection on a heated plate
- Rayleigh Benard Konvection
- Pipe Flow

Content will vary.
Not all content will be taught in every semester!

Literature
Oertel, H., Böhle, M.: Strömungsmechanik, Vieweg-Verlag, 2006

Schlichting, H., Gersten, K.: Grenzschichttheorie, Springer-Verlag, 2006

Oertel,H. (Hrsg.): Prandtl-Führer durch die Strömungslehre, Vieweg-Verlag 2002

Oertel, H. (Hrsg.): Prandtls' Essentials for Fluid Mechanics, Springer-Verlag 2004

Course: Low Temperature Technology [2158112]

Coordinators: Friedrich Haug
Part of the modules: SP 24: Energy Converting Engines (p. 174)[SP_24_mach]

ECTS Credits	Hours per week	Term	Instruction language
4	2	Summer term	de

Learning Control / Examinations
oral examination
duration: 30 minutes
no tools or reference materials may be used during the exam

Conditions
none

Recommendations
Knowledge in Thermodynamics I is of advantage (however, no prerequisite)

Learning Outcomes
The lecture gives an introduction to the interdisciplinary field of low temperature technology (cryogenics) with emphasis on thermodynamics and process engineering. Fundamentals are explained followed by exercises and practical examples comprising industrial cryoplants. Where useful reference is made to cryogenic systems at CERN, the European Organization for high energy physics. Low temperature technology is a comparatively young engineering branch with future potential and is indispensible for basic research, space technology, some medical technologies, industry, superconductivity, research centres.

Content

1. Introduction to low temperature technology
2. The research centre CERN
3. Fundamentals (thermo-physical)
4. Low temperature properties of materials
5. Cryogens
6. Thermal insulation, storage, transfer of cryogenic fluids
7. Fundamentals (laws of thermodynamics)
8. Cycles and processes
9. Refrigerators and components
10. Instrumentation, automation
11. Examples of cryoplants (among others at CERN)
12. Cryocoolers
13. Production of extremely low temperatures

Literature

1. Technische Thermodynamik, beliebig
2. Tieftemperaturtechnologie, H. Frey und R. Haefer, VDI-Verlag, 1981
3. Handbook of Cryogenic Engineering, J. Weisend II, Verlag Taylor&Francis, 1998

Course: Applied Tribology in Industrial Product Development [2145181]

Coordinators: Albert Albers, Wolfgang Burger
Part of the modules: SP 10: Engineering Design (p. 166)[SP_10_mach], SP 02: Powertrain Systems (p. 161)[SP_02_mach]

ECTS Credits	Hours per week	Term	Instruction language
4	2	Winter term	

Learning Control / Examinations

Conditions
None.

Learning Outcomes

Content

Course: Drive Train of Mobile Machines [2113077]

Coordinators: Marcus Geimer
Part of the modules: SP 02: Powertrain Systems (p. 161)[SP_02_mach]

ECTS Credits	Hours per week	Term	Instruction language
4	2/1	Winter term	de

Learning Control / Examinations
oral examination

Conditions
None.

Recommendations

- general basics of mechanical engineering
- basic knowledge in hydraulics
- interest in mobile machines

Learning Outcomes
Get to know all relevant aspects and components of a drive train of a mobile machine and also the construction of various drive trains.

Content
In this course will be discussed the different drive train of mobile machinerys. The fokus of this course is:
- improve the fundamentals
- mechanical gears
- torque converter
- hydrostatic drives
- continuous variable transmission
- eletrical drives
- axial
- terra mechanic

Media
presentation

Literature
scritum for the lecture downloadable

Course: Powertrain Systems Technology A: Automotive Systems [2146180]

Coordinators: Albert Albers, Sascha Ott
Part of the modules: SP 12: Automotive Technology (p. 168)[SP_12_mach], SP 02: Powertrain Systems (p. 161)[SP_02_mach], SP 09: Dynamic Machine Models (p. 165)[SP_09_mach], SP 10: Engineering Design (p. 166)[SP_10_mach]

ECTS Credits	Hours per week	Term	Instruction language
4	2	Summer term	de

Learning Control / Examinations
oral examination

Conditions
None

Recommendations
Power Train Systems Technology B: Stationary Machinery

Learning Outcomes
The student should know the basic skills which are necessary to design energy-efficient and comfortable automotive powertrain solutions.

Content
Powertrain System, Driver System, Environment System, System Components, Development Process

Literature

1. Kirchner, E.; "Leistungsübertragung in Fahrzeuggetrieben: Grundlagen der Auslegung, Entwicklung und Validierung von Fahrzeuggetrieben und deren Komponenten", Springer Verlag Berlin Heidelberg 2007
2. Naunheimer, H.; "Fahrzeuggetriebe: Grundlagen, Auswahl, Auslegung und Konstruktion", Springer Verlag Berlin Heidelberg 2007

Course: Powertrain Systems Technology B: Stationary Machinery [2145150]

Coordinators: Albert Albers, Sascha Ott
Part of the modules: SP 10: Engineering Design (p. 166)[SP_10_mach], SP 02: Powertrain Systems (p. 161)[SP_02_mach]

ECTS Credits	Hours per week	Term	Instruction language
4	2	Winter term	de

Learning Control / Examinations
oral examination

Conditions
None

Recommendations
Powertrain Systems Technology A: Automotive Systems

Learning Outcomes
The student should know the basic skills which are necessary to design energy-efficient and secure solutions for the design of stationary powertrain applications.

Content
Powertrain System, Operator System, Environment System, System Components, Development Process

Literature

1. VDI-2241: “Schaltare fremdbetätigte Reibkupplungen und -bremsen”, VDI Verlag GmbH, Düsseldorf
2. Geilker, U.: “Industriekupplungen - Funktion, Auslegung, Anwendung”, Die Bibliothek der Technik, Band 178, verlag moderne industrie, 1999

Course: Application of technical logistics in modern crane systems [2117064]

Coordinators: Markus Golder
Part of the modules: SP 10: Engineering Design (p. 166)[SP_10_mach], SP 44: Technical Logistics (p. 179)[SP_44_mach]

ECTS Credits	Hours per week	Term	Instruction language
4	2	Winter term	de

Learning Control / Examinations
oral, approx. 20min, appointment after acknowledgement

Conditions
none

Recommendations
technical interest; Beneficial: Knowledge of the lecture 'Technical logistics I, basics'

Learning Outcomes
The student:

- knows the proceeding during the dimensioning of a modern crane installation,
- is able to transfer the approche for the dimensioning of other material handling systems.

Content

- Basics of modern crane construction
- Characteristics of application, classification
- Configuration, dimensioning, consideration of costs
- Relevant rules and standards
- Modern concepts of crane control and drives

Media
presentations, black board

Literature
None.

Remarks
none

Course: Application of technical logistics in sorting- and distribution technology [2118089]

Coordinators: Jörg Föller
Part of the modules: SP 18: Information Technology (p. 173)[SP_18_mach], SP 17: Information Management (p. 172)[SP_17_mach], SP 44: Technical Logistics (p. 179)[SP_44_mach]

ECTS Credits	Hours per week	Term	Instruction language
4	2	Summer term	de

Learning Control / Examinations
oral 30 min

Conditions
None.

Recommendations
None.

Learning Outcomes
The course provides basics of sorting techniques.

Content
Basics of goods sorting and distribution technology, employment characteristics, classification, interpretation, dimensioning, costs considerations. Relevant control, modern sets of rules and propulsion principles

Media
presentations, black board

Literature
None.

Remarks
none

Course: Work Science (Lecture and Excercises; in German) [2109026]

Coordinators: Gert Zülch
Part of the modules: SP 38: Production Systems (p. 178)[SP_38_mach]

ECTS Credits	Hours per week	Term	Instruction language
6	4	Winter term	de

Learning Control / Examinations
Specialisation “Produktionstechnik”:
Written exam, length: 90 minutes
(only in German)
Allowed resource materials: non-programmable calculator

Other specialisations:
Oral exam, length: 30 minutes
(only in German)
Allowed resource materials: none

Conditions

- **The exams “Arbeitswissenschaft (2109026)” and “Ergonomie und Arbeitswirtschaft (2109029)” are mutually exclusive.**
- **The exams “Arbeitswissenschaft (2109026)” and “Arbeitsschutz und Arbeitsrecht (2109024)” are mutually exclusive.**

Recommendations

- Willingness to learn interdisciplinarily (Product design, Legal regulations Work physiology, Work psychology . . .)
- Basic knowledge of Production Management is usefull

Learning Outcomes

- Become proficient within the general terms of ergonomics, methods study and personnel planning
- Know elementary methods and procedures of applied work science
- Know relevant labour law and regulations
- Become proficient in applying ergonomic evaluation and judgement

Content

1. Introduction
2. Basics of human performance
3. Design of workplaces
4. Time study
5. Evaluation of workplaces and determination of wages
6. Work structuring
7. Personnel planning
8. Leadership

9. Labour legislation
10. Representation of interest groups

Literature
Learning material:
Handout online on: https://ilias.rz.uni-karlsruhe.de/goto_rz-uka_cat_29099.html

Literature:

- BULLINGER, Hans-Jörg: Ergonomie. Stuttgart: B. G. Teubner 1994.
- REFA - Verband für Arbeitsstudien, Betriebsorganisation und Unternehmensentwicklung (Hrsg.): Datenermittlung. München: Carl Hanser Verlag, 1997. (Methodenlehre der Betriebsorganisation)
- REFA - Verband für Arbeitsstudien und Betriebsorganisation (Hrsg.): Anforderungsermittlung (Arbeitsbewertung). München: Carl Hanser Verlag, 2. Auflage 1991. (Methodenlehre der Betriebsorganisation)
- REFA - Verband für Arbeitsstudien und Betriebsorganisation (Hrsg.): Grundlagen der Arbeitsgestaltung. München: Carl Hanser Verlag, 1991. (Methodenlehre der Betriebsorganisation)
- REFA - Verband für Arbeitsstudien und Betriebsorganisation (Hrsg.): Entgeltdifferenzierung. München: Carl Hanser Verlag, 1991. (Methodenlehre der Betriebsorganisation)
- SCHLICK, Christopher; BRUDER, Ralph; LUCZAK, Holger: Arbeitswissenschaft. Heidelberg u.a.: Springer, 3rd edition 2010.
- SCHMIDTKE, Heinz (Hrsg.): Ergonomie. München, Wien: Carl Hanser Verlag, 3. Auflage 1998.

Please refer to the latest edition.

Course: Atomistic simulations and molecular dynamics [2181740]

Coordinators: Peter Gumbsch
Part of the modules: SP 05: Calculation Methods in Mechanical Engineering (p. 162)[SP_05_mach], SP 13: Strength of Materials/ Continuum Mechanics (p. 170)[SP_13_mach], SP 26: Materials Science and Engineering (p. 175)[SP_26_mach]

ECTS Credits	Hours per week	Term	Instruction language
4	2	Winter term	de

Learning Control / Examinations
oral exam 30 minutes

Conditions
compulsory preconditions: none

Learning Outcomes
The student learns the physical foundation of particle base simulation methods (e.g. molecular dynamics) and its application to problems in material science.

Content
The lecture introduces the foundation of particle based simulation methods focussing on molecular dynamics:

1. Introduction
2. Physics of Materials
3. MD Basics, Atom-Billard
* particle, position, energy, forces, pair potentials
* initial and boundary conditions
* time integration
4. algorithms
5. static, dynamic, thermodynamic
6. MD output
7. interaction between particles
* pair potential – many body potentials
* principles of quantum mechanics
* tight binding methods
* dissipative particle dynamics
8. application of particle based methods

Literature
[1] Understanding Molecular Simulation: From Algorithms to Applications, Daan Frenkel and Berend Smit (Academic Press, 2001) wie alle guten MD Bücher stark aus dem Bereich der physikalischen Chemie motiviert und auch aus diesem Bereich mit Anwendungsbeispielen gefüllt, trotzdem für mich das beste Buch zum Thema!

[2] Computer simulation of liquids, M. P. Allen and Dominic J. Tildesley (Clarendon Press, Oxford, 1996) Immer noch der Klassiker zu klassischen MD Anwendungen. Weniger stark im Bereich der Nichtgleichgewichts-MD.

Course: Constitution and Properties of Wear resistant materials [2178643]

Coordinators: Sven Ulrich
Part of the modules: SP 26: Materials Science and Engineering (p. 175)[SP_26_mach]

ECTS Credits	Hours per week	Term	Instruction language
4	2	Summer term	de

Learning Control / Examinations
oral examination (30 min)

no tools or reference materials

Conditions
None.

Recommendations
None.

Learning Outcomes
Basic understanding of constitution of wear-resistant materials, of the relations between constitution, properties and performance, of principles of increasing of hardness and toughness of materials as well as of the characteristics of the various groups of wear-resistant materials.

Content
introduction

materials and wear

unalloyed and alloyed tool steels

high speed steels

stellites and hard alloys

hard materials

hard metals

ceramic tool materials

superhard materials

new developments

Literature
Laska, R. Felsch, C.: Werkstoffkunde für Ingenieure, Vieweg Verlag, Braunschweig, 1981

Schedler, W.: Hartmetall für den Praktiker, VDI-Verlage, Düsseldorf, 1988

Schneider, J.: Schneidkeramik, Verlag moderne Industrie, Landsberg am Lech, 1995

Copies with figures and tables will be distributed

Course: Constitution and Properties of Protective Coatings [2177601]

Coordinators: Sven Ulrich
Part of the modules: SP 26: Materials Science and Engineering (p. 175)[SP_26_mach]

ECTS Credits	Hours per week	Term	Instruction language
4	2	Winter term	de

Learning Control / Examinations
oral examination (30 min)

no tools or reference materials

Conditions
None.

Recommendations
None.

Learning Outcomes
Transfer of the basic knowledge of surface engineering, of the relations between constitution, properties and performance, of the manifold methods of modification, coating and characterization of surfaces.

Content
introduction and overview

concepts of surface modification

coating concepts

coating materials

methods of surface modification

coating methods

characterization methods

state of the art of industrial coating of tools and components

new developments of coating technology

Literature
Bach, F.-W.: Modern Surface Technology, Wiley-VCH, Weinheim, 2006

Copies with figures and tables will be distributed

Course: Supercharging of Combustion Engines [2134112]

Coordinators: Rainer Golloch
Part of the modules: SP 48: Internal Combustion Engines (p. 180)[SP_48_mach], SP 24: Energy Converting Engines (p. 174)[SP_24_mach], SP 12: Automotive Technology (p. 168)[SP_12_mach]

ECTS Credits	Hours per week	Term	Instruction language
4	2	Summer term	de

Learning Control / Examinations
1. part: written, ca. 45 min.

2. part: oral group examination, ca. 45 min.

Conditions
none

Recommendations
Combustion Engines A helpful

Learning Outcomes
The students get to know the increasing field of supercharging fourstroke gasoline, Diesel and gas engines as a measure to increase power and decrease emissions and fuel consumption. After describing the fundamentals of supercharging including intercooling the most common superchargers and their field of application is shown. Another focus are different supercharging methods wehreas new and complex methods such as controlled two-stage supercharging are covered. Furthermore the difference in the combustion process of naturally aspirated and supercharged engines is described.

Content
Fundamentals of supercharging

Supercharger

Combination of engine and supercharger

Mechanical supercharging

Turbocharger

Complexe supercharging methods

Special fields of supercharged engines

Literature
Lecture notes available in the lectures

Course: Selected Applications of Technical Logistics [2118087]

Coordinators: Martin Mittwollen, Linsel
Part of the modules: SP 09: Dynamic Machine Models (p. 165)[SP_09_mach], SP 44: Technical Logistics (p. 179)[SP_44_mach]

ECTS Credits	Hours per week	Term	Instruction language
4	3	Summer term	de

Learning Control / Examinations
after each lesson period; oral / written (if necessary) => (look at "Studienplan Maschinenbau", version of 7.7.2010)

Conditions
look at Empfehlungen (en)

Recommendations
TL-I should be visited in advance, knowledge out of TL-I preconditioned

Learning Outcomes
Based on the knowledge from TL-I to be able to work on specific taks of conveyor machines (e.g. crane, s/r machines, fork lifts, elevators).
practice calculation on applying knowledge from lessons
Guest lectures give an idea of industrial solutions.

Content
design and dimension of machines from intralogistics // static and dynamic behaviour // operation properties and specifics // visit of real intralogistic system
Inside practical lectures: sample applications and calculations in addition to the lectures

Media
supplementary sheets,projector, blackboard

Literature
Recommendations during lessons

Remarks
-

Course: Selected Applications of Technical Logistics and Project [2118088]

Coordinators: Martin Mittwollen, Linsel
Part of the modules: SP 09: Dynamic Machine Models (p. 165)[SP_09_mach], SP 44: Technical Logistics (p. 179)[SP_44_mach]

ECTS Credits	Hours per week	Term	Instruction language
6	4	Summer term	de

Learning Control / Examinations
after each lesson period; oral / written (if necessary) => (look at “Studienplan Maschinenbau”); (counts two-thirds); project report, marked (counts one third)

Conditions
none

Recommendations
TL-I should be visited in advance, knowledge out of TL-I preconditioned

Learning Outcomes
The student

- is able to work on specific taks of conveyor machines, based on the knowledge from TL-I (e.g. crane, s/r machines, fork lifts, elevators),
- practices calculation on applying knowledge from lessons
- reports on a project topic

Content
design and dimension of machines from intralogistics // static and dynamic behaviour // operation properties and specifics // visit of real intralogistic system // self manufactured project report
Inside practical lectures: sample applications and calculations in addition to the lectures
Self manufacturing of a project report to recesses the topic.

Media
supplementary sheets,projector, blackboard

Literature
Recommendations during lessons

Course: Design of combustion chamber in gas turbines (Project) [22509]

Coordinators: Nikolaos Zarzalis
Part of the modules: SP 24: Energy Converting Engines (p. 174)[SP_24_mach]

ECTS Credits	Hours per week	Term	Instruction language
4	2	Summer term	

Learning Control / Examinations

Conditions
Engineering Thermodynamics, Fluid Mechanics, Heat and Mass Transfer, Construction

Recommendations
None.

Learning Outcomes

Content

Remarks
None.

Course: Design of highly stresses components [2181745]

Coordinators: Jarir Aktaa
Part of the modules: SP 48: Internal Combustion Engines (p. 180)[SP_48_mach], SP 07: Dimensioning and Validation of Mechanical Constructions (p. 164)[SP_07_mach]

ECTS Credits	Hours per week	Term	Instruction language
4	2	Winter term	de

Learning Control / Examinations
oral exam: 30 minutes

Conditions
material science
solid mechanics II

Learning Outcomes
The students know the rules of established design codes for the assessment of components which under operation are subjected to high thermo-mechanical and/or irradiation loadings. They know which constitutive equations are used according to state-of-the-art of technology and research to estimate deformation and damage appearing under these loadings and to predict expected lifetime. They gained insight into the application of these generally non-linear constitutive equations in finite element codes and know the major issues which shall be thereby taken into account.

Content
Contents of the lecture:

- rules of common design codes
- classical models for elasto-plasticity and creep
- lifetime rules for creep, fatigue and creep-fatigue interaction
- unified constitutive models for thermo-elasto-viscoplasticity
- continuum mechanical models for damage at high temperatures
- application of advanced material models in FE-codes

Literature

- R. Viswanathan, Damage Mechanisms and Life Assessment of High-Temperature Components, ASM International, 1989.
- Lemaitre, J.; Chaboche J.L.: Mechanics of Solid Materials, Cambridge University Press, Cambridge, 1990.

Course: Design and Development of Mobile Machines [2113079]

Coordinators: Marcus Geimer
Part of the modules: SP 10: Engineering Design (p. 166)[SP_10_mach]

ECTS Credits	Hours per week	Term	Instruction language
4	2	Winter term	de

Learning Control / Examinations
homework in small groups during the semester + oral examination

Conditions
None.

Recommendations
Knowledge in Fluid Technology (SoSe, LV 21093)

Learning Outcomes
Students will learn:
1. How to develop a mobile working machine
2. How to apply existing knowledge on a specific problem
3. How to break down and structure a complex task
4. How knowledge of different courses can be brought together

Content
Wheel loaders and excavators are highly specialized mobile machines. Their function is to detach, pick up and deposit materials near by. Significant size for dimensioning of the machines is the content of their standard shovel. In this lecture the main steps in dimensioning a wheel loader or excavator are beeing thought. This includes among others:

- Defining the size and dimensions,
- the dimensioning of the drive train,
- Determining the kinematics of the equipment,
- the dimension of the working hydraulics and
- Calculations of strength

The entire design process of these machines is strongly influenced by the use of standards and guidelines (ISO/DIN-EN). Even this aspect is dealt with.

The lecture is based on the knowledge from the fields of mechanics, strength of materials, machine elements, propulsion and fluid technique. The lecture requires active participation and continued collaboration.

Literature
None.

Course: Automated Production Line [2149904]

Coordinators: Jürgen Fleischer
Part of the modules: SP 38: Production Systems (p. 178)[SP_38_mach]

ECTS Credits	Hours per week	Term	Instruction language
4	2	Summer term	de

Learning Control / Examinations

Conditions

None.

Learning Outcomes

Content

Course: Automation Systems [2106005]

Coordinators: Michael Kaufmann
Part of the modules: SP 31: Mechatronics (p. 177)[SP_31_mach]

ECTS Credits	Hours per week	Term	Instruction language
3	2	Summer term	

Learning Control / Examinations

Conditions

None.

Learning Outcomes

Content

Course: Automobile and Environment [2186126]

Coordinators: Heiko Kubach, Ulrich Spicher, Ulrich Maas, Heiner Wirbser
Part of the modules: SP 12: Automotive Technology (p. 168)[SP_12_mach], SP 48: Internal Combustion Engines (p. 180)[SP_48_mach], SP 24: Energy Converting Engines (p. 174)[SP_24_mach], SP 02: Powertrain Systems (p. 161)[SP_02_mach]

ECTS Credits	Hours per week	Term	Instruction language
4	2	Summer term	de

Learning Control / Examinations
Presentation with written documentation

Conditions
None.

Recommendations
None.

Learning Outcomes
Thermodynamics:
The student shall understand the fundamental principles of combustion processes in engines including pollutant formation

Combustion Engines:
The student shall understand the fundamental principle modes of operation of combustion engines. Especially emission formation, fuel consumption and impact on the environment are discussed.

Content
Principles of combustion processes, chemical reaction, reaction mechanisms, NO-formation, NO-reduction, soot formation, unburnt hydrocarbons, flame extinction, combustion in Otto-engines (ignition, flame propagation, engine knock), combustion in Diesel engines (spray formation, spray combustion)

Literature
J. Warnatz, U. Maas, R. W. Dibble: Combustion, Springer

Course: Rail System Technology [2115919]

Coordinators: Peter Gratzfeld
Part of the modules: SP 50: Rail System Technology (p. 181)[SP_50_mach]

ECTS Credits	Hours per week	Term	Instruction language
4	2	Winter / Summer Term	de

Learning Control / Examinations

- Oral examination
- Duration: 20 minutes
- No tools or reference materials may be used during the exam.

Conditions
none

Recommendations
none

Learning Outcomes

- The students understand relations and interdependencies between rail vehicles, infrastructure and operation in a rail system.
- They can assess the suitability of existing elements in the overall system.
- They deduct the fundamental requirements for rail vehicles out of it.

Content

- Overview about fundamental components of a modern rail system (vehicles, infrastructure, operation)
- History and economic impact of rail systems
- Vehicle dynamics
- Wheel-rail-contact
- Train protection
- Traction power supply
- Vehicles

Media
All slides are available for download (Ilias-platform).

Literature
A bibliography is available for download (Ilias-platform).

Remarks
none

Course: Basics in Material Handling and Logistics Systems [2150653]

Coordinators: Kai Furmans
Part of the modules: SP 52: Production Management (p. 182)[SP_52_mach]

ECTS Credits	Hours per week	Term	Instruction language
4	2	Summer term	en

Learning Control / Examinations
oral examination, 20 minutes, 1 x year (after lecture period)

Conditions
none

Recommendations
none

Learning Outcomes
The student:

- understands basic material flow processes,
- is able to model material flow systems in simple models,
- knows how to determine essential performance indicators like throughput, utilization, etc.
- has the basis knowledge necessary to understand logistic systems,
- knows algorithms and is able to apply them to basic logistic problems.

Content
Conveyor Systems

- Basic elements of conveyor systems
- Key figures
- Branching elements
  - continuous/partially-continuous
  - deterministic/stochastic switch
- Integration elements
  - continuous/partially-continuous
  - dispatching rules

Queueing Theory and Production Logistics

- Basic queueing systems
- Distributions
- M|M|1 and M|G|1 model
- Application on production logistics

Distribution Centers and Order Picking

- The location problem
- Distribution centers
- Inventory management

- Order picking

Vehicle Routing

- Types of vehicle routing problems
- Linear programming model and graph theoretic model
- Heuristics
- Supporting technologies

Optimization of Logistical Networks

- Objectives
- Cooperative strategies
- Supply chain management
- Implementation

Media
presentations, blackboard, book

Literature
Literature: Arnold, Dieter; Furmans, Kai : Materialfluss in Logistiksystemen; Springer-Verlag Berlin Heidelberg, 2009

Remarks
none

Course: Fuels and Lubricants for Combustion Engines and their Testing [2133109]

Coordinators: Jürgen Volz
Part of the modules: SP 48: Internal Combustion Engines (p. 180)[SP_48_mach], SP 15: Fundamentals of Energy Technology (p. 171)[SP_15_mach], SP 24: Energy Converting Engines (p. 174)[SP_24_mach]

ECTS Credits	Hours per week	Term	Instruction language
4	2	Winter term	de

Learning Control / Examinations
oral examination, Duration: ca. 30 min., no auxiliary means

Conditions
None.

Recommendations
None.

Learning Outcomes
The students get basic knowledgement about composition and meaning of fuels, lubricants and coolants as important components in the system of todays Otto and Diesel engines. Content of this lecture are definition and chemical composition of fuels and lubricants, the meanig of crude oil as basic primary product, production processes, major properties, standards and specifications, testing methods. Furthermore future worldwide trenfd in the field of conventional and alternative fuels are discussed regarding emission standards and energy conservation.

Content
Introduction and basics

Fuels for Gasoline and Diesel engines

Hydrogen

Lubricants for Gasoline and Diesel engines

Coolants for combustion engines

Literature
Lecturer notes

Course: Boundary and Eigenvalue Problems [1246]

Coordinators: Michael Plum, Wolfgang Reichel, Plum, Reichel
Part of the modules: SP 13: Strength of Materials/ Continuum Mechanics (p. 170)[SP_13_mach]

ECTS Credits	Hours per week	Term	Instruction language
6	6	Summer term	

Learning Control / Examinations

Conditions
None.

Learning Outcomes

Content

Course: BUS-Controls [2114092]

Coordinators: Marcus Geimer
Part of the modules: SP 18: Information Technology (p. 173)[SP_18_mach], SP 31: Mechatronics (p. 177)[SP_31_mach]

ECTS Credits	Hours per week	Term	Instruction language
4	2	Summer term	de

Learning Control / Examinations
The assessment consists of an oral exam (20 min) taking place in the recess period. The exam takes place in every semester. Re-examinations are offered at every ordinary examination date.

Conditions
Basic knowledge of electrical engineering is recommended. Programming skills are also helpful.

Learning Outcomes
The students will get an overview of the theoretic and practical functioning of different bus systems.

After the practical oriented lessons the students will be able to visualize the communication structure of different applications, design basic systems and evaluate the complexity of programming of the complete system.

Content

- Knowledge of the basics of data communication in networks
- Overview of the operating mode of current field buses
- Explicit observation of the operating mode and application areas of CAN buses
- Practical programming of an example application (hardware is provided)

Literature
Elective literature:

- Etschberger, K.: Controller Area Network, Grundlagen, Protokolle, Bausteine, Anwendungen; München, Wien: Carl Hanser Verlag, 2002.
- Engels, H.: CAN-Bus - CAN-Bus-Technik einfach, anschaulich und praxisnah dargestellt; Poing: Franzis Verlag, 2002.

Remarks
The course will be replenished by interesting lectures of professionals.

Course: CATIA V5 CAD training course [2123356]

Coordinators: Jivka Ovtcharova, Mrkonjic Hajdukovic
Part of the modules: SP 07: Dimensioning and Validation of Mechanical Constructions (p. 164)[SP_07_mach], SP 17: Information Management (p. 172)[SP_17_mach]

ECTS Credits	Hours per week	Term	Instruction language
2	3	Winter / Summer Term	de

Learning Control / Examinations
Practical examination, duration: 60 min., auxiliary means: script

Conditions
None

Recommendations
Dealing with technical drawings is required.

Learning Outcomes
Students are able to create their own 3D geometric models in the CAD system, to generate drawings due to the created geometry and then carry out FE-studies and kinematic simulations using the integrated CAE tools. With advanced, knowledge-based functionalities of CATIA the participants will learn to automate the creation of geometry and thus to ensure the reusability of the models.

Content
The participant will learn the following knowledge:

- Basics of CATIA V5 such as user interface, handling etc.
- Production and processing of different model types
- Production of basic geometries and parts
- Generation of detailed drawings
- Integration of partial solutions in modules
- Working with constrains
- Strength analysis with FEM
- Kinematic simulation with DMU
- Dealing with CATIA Knowledgeware

Literature
practical course skript

Remarks
For the practical course attendance is compulsory.

Course: CAD-NX5 training course [2123355]

Coordinators: Jivka Ovtcharova, Mrkonjic Hajdukovic
Part of the modules: SP 07: Dimensioning and Validation of Mechanical Constructions (p. 164)[SP_07_mach], SP 17: Information Management (p. 172)[SP_17_mach]

ECTS Credits	Hours per week	Term	Instruction language
2	3	Winter / Summer Term	de

Learning Control / Examinations
Practical examination, duration: 60 min., auxiliary means: script

Conditions
None

Recommendations
Dealing with technical drawings is required.

Learning Outcomes
Students are able to create their own 3D geometric models in the CAD system, to generate drawings due to the created geometry and then carry out FE-studies and kinematic simulations using the integrated CAE tools. With advanced, knowledge-based functionalities of NX5 the participants will learn to automate the creation of geometry and thus to ensure the reusability of the models.

Content
The participant will learn the following knowledge:

- Overview of the functional range
- Introduction to the work environment of UG NX5
- Basics of 3D-CAD modelling
- Feature-based modelling
- Freeform modelling
- Generation of technical drawings
- Assembly modelling
- Finite element method (FEM) and multi-body simulation (MBS) with UG NX5

Literature
Practical course skript

Remarks
For the practical course compulsory attendance exists.

Course: CAE-Workshop [2147175]

Coordinators: Albert Albers, Assistenten

Part of the modules: SP 31: Mechatronics (p. 177)[SP_31_mach], SP 17: Information Management (p. 172)[SP_17_mach], SP 07: Dimensioning and Validation of Mechanical Constructions (p. 164)[SP_07_mach], SP 09: Dynamic Machine Models (p. 165)[SP_09_mach], SP 10: Engineering Design (p. 166)[SP_10_mach], SP 13: Strength of Materials/ Continuum Mechanics (p. 170)[SP_13_mach], SP 05: Calculation Methods in Mechanical Engineering (p. 162)[SP_05_mach]

ECTS Credits	Hours per week	Term	Instruction language
3	3	Winter / Summer Term	de

Learning Control / Examinations
Depending on the manner in which the CAE-Workshop will be credited.

Conditions
compulsory attendance

Recommendations
We suggest this Workshop after 2 years of classes.

Learning Outcomes
In the CAE - Workshops computer-aided tools used in the industrial product development process will be presented and trained. The complete process chain is shown using concrete examples of typical mechanical components. The possibilities and limits of virtual product development will be shown during this course. Here, the students get practical insight into the world of multi-body systems, the finite element method and optimization research questions.

The students receive the theoretical basics and are trained on modern hardware in the use of commercial software. In order to support the students to discuss the calculation and optimization results, the participants of the workshop must discuss their results in small groups and finally present it to all students.

Content
Content in the summer semester:

- introduction to the finite element analysis (FEA)
- stess and modal analysis of finite element models using Abaqus/CAE as a preprocessor and Abaqus solver
- introduction to topology and shape optimization
- creation and calculation of various optimization models with the optimization package TOSCA and the Abaqus solver

Content in the winter semester:

- introduction to the finite element analysis (FEA)
- stress and modal analysis of finite element models using Abaqus/CAE as a preprocessor and Abaqus solver
- introduction to multi-body simulation (MBS)
- preparation and running of multi-body simulation models. Coupling of the MBS and FEA to calculate hyprid multi-body simulation problems.

Literature
The workshop script will be allocated at Ilias.

Course: CATIA advanced [2123380]

Coordinators: Jivka Ovtcharova, Marina Mrkonjic
Part of the modules: SP 17: Information Management (p. 172)[SP_17_mach]

ECTS Credits	Hours per week	Term	Instruction language
2	2	Summer term	de

Learning Control / Examinations
Presentation of the results at the end of semester
and oral examination, duration: 10 min.

Conditions
None

Recommendations
Very good knowledge of Machine Design and an excellently passed CAD practical course CATIA at the IMI are required.

Learning Outcomes
At the workshop, a complete CAD model of a transmission is developed.
The design problem is worked out in small groups. Using a basic sketch the participants have to design partial solutions independently, test and then integrate them into the overall solution. The advanced capabilities of CATIA V5 are dealt with. The design process should be simulated from idea to finished model.
The focus is on independent solution finding, teamwork, functional performance, production and design.

Content

- Use of advanced CAD techniques and CATIA functionalities
- Management of data using the PLM system SmarTeam
- Design engineering with CAD
- Integration of partial solutions into the overall solution
- Ensuring the reusability of CAD models through parameterization and cataloging
- Validation, strength tests (FEM analysis)
- Kinematic simulation with the digital mockup (DMU Kinematics)
- Production with integrated CAM tool
- Animations
- Presentation of results at the end of the semester

Remarks
For the workshop compulsory attendance exists.

Course: CFD-Lab using Open Foam [2169459]

Coordinators: Rainer Koch
Part of the modules: SP 15: Fundamentals of Energy Technology (p. 171)[SP_15_mach]

ECTS Credits	Hours per week	Term	Instruction language
4	3	Winter term	de

Learning Control / Examinations

- Successful solution of problems

Conditions

- Fluid Dynamics
- Course on numerical fluid mechanics

Recommendations

- Basic knowledge in LINUX

Learning Outcomes

- Application of Open Foam modules
- Grid generation
- Proper definition of boundary conditions
- Numerical errors

Content

- Introduction to using Open Foam
- Grid generation
- Discretization schemes
- Turbulence models
- Two phase flow - spray
- Two Phase flow - Volume of Fluid method

Media

- A CD containing the course material will be handed out to the students

Literature

- Documentation of Open Foam
- www.open foam.com/docs

Remarks

- Number of participants is limited
- Priority for students of the lecture “Numerische Simulation reagierender Zweiphasenströmungen” (Vorl.-Nr. 2169458)

Course: Computational Intelligence I [2106004]

Coordinators: Georg Bretthauer, Ralf Mikut
Part of the modules: SP 31: Mechatronics (p. 177)[SP_31_mach], SP 05: Calculation Methods in Mechanical Engineering (p. 162)[SP_05_mach], SP 18: Information Technology (p. 173)[SP_18_mach]

ECTS Credits	Hours per week	Term	Instruction language
3	2	Summer term	de

Learning Control / Examinations
Oral examination (1 hour)

Duration: 1 hours, also possible as an optional or part of a major subject

Auxilary means: none

Conditions
None.

Recommendations
None.

Learning Outcomes
The students are able to apply the methods of fuzzy logic and fuzzy control efficiently. They know the basic mathematical foundations for the model design using fuzzy logic (membership functions, inference methods, defuzzification). In addition, they are able to design fuzzy controllers (Mamdani controllers and hybrid controllers with fuzzy-adaptive components) for practical applications.

Content
Terms and definitions Computational Intelligence, application fields and examples

Fuzzy logic and fuzzy sets

Fuzzification and membership functions

Inference: T-norms and -conorms, operators, aggregation, activation, accumulation

Defuzzification methods

Structures for fuzzy control

Software practice (fuzzyTECH) and applications (crane control)

Literature
Kiendl, H.: Fuzzy Control. Methodenorientiert. Oldenbourg-Verlag, München, 1997

Bandemer, H.; Gottwald, S.: Einführung in Fuzzy Methoden. Akademie-Verlag, Berlin, 1993

Zadeh, L.A.: Fuzzy Sets. Information and Control, 8, 338-353, 1965

Mikut, R.: Data Mining in der Medizin und Medizintechnik. Universitätsverlag Karlsruhe, Kapitel 5.5; 2008 (Internet)

Software: FuzzyTech (für die Übung)

Course: Computational Intelligence II [2105015]

Coordinators: Georg Bretthauer, MIkut
Part of the modules: SP 31: Mechatronics (p. 177)[SP_31_mach], SP 05: Calculation Methods in Mechanical Engineering (p. 162)[SP_05_mach], SP 18: Information Technology (p. 173)[SP_18_mach]

ECTS Credits	Hours per week	Term	Instruction language
3	2	Winter term	de

Learning Control / Examinations
Oral examination (1 hour)

Duration: 1 hours, also possible as an optional or part of a major subject

Auxilary means: none

Conditions
None.

Recommendations
None.

Learning Outcomes
The students are able to apply the methods of Artificial Neural Networks and Evolutionary Algorithms efficiently. They know the basic mathematical foundations and the goal-oriented design and the problem formulation for technical applications (selection of net structures for Artificial Neural Networks, optimization using Evolutionary Algorithms with coding of potential solutions for real-world applications as individuals).

Content
Terms and definitions, application fields and examples

Biological foundations of neural nets

Artificial Neural Nets: neurons, Multi-Layer-Perceptrons, Radial-Basis-Function nets, Kohonen maps,
training strategies (Backpropagation, Levenberg-Marquardt)

Evolutionary Algorithms: Genetic Algorithms and Evolution Strategies, mutation, recombination, evaluation, selection, integration of local search strategies

Software practice (Gait-CAD, GLEAMKIT) and applications

Literature
S. Haykin: Neural Networks: A Comprehensive Foundation. Prentice Hall, 1999

T. Kohonen: Self-Organizing Maps. Berlin: Springer-Verlag, 1995

R. Rojas: Theorie der Neuronalen Netze. Berlin: Springer-Verlag, 1995

W. Jakob: Eine neue Methodik zur Erhöhung der Leistungsfähigkeit Evolutionärer Algorithmen
durch die Integration lokaler Suchverfahren. Forschungszentrum Karlsruhe, 2004

H.-P. Schwefel: Evolution and Optimum Seeking. New York: John Wiley, 1995

H.J. Holland: Adaptation in Natural and Artificial Systems. Ann Arbor, 1975

R. Mikut: Data Mining in der Medizin und Medizintechnik. Universitätsverlag Karlsruhe, 2008 (Internet, Kapitel 5.6)

Course: Computational Intelligence III [2106020]

Coordinators: Ralf Mikut
Part of the modules: SP 31: Mechatronics (p. 177)[SP_31_mach], SP 05: Calculation Methods in Mechanical Engineering (p. 162)[SP_05_mach], SP 18: Information Technology (p. 173)[SP_18_mach]

ECTS Credits	Hours per week	Term	Instruction language
3	2	Summer term	de

Learning Control / Examinations
Oral examination (1 hour)

Duration: 1 hours, also possible as an optional or part of a major subject

Auxilary means: none

Conditions
None.

Recommendations
None.

Learning Outcomes
The students are able to apply the methods of data analysis efficiently. They know the basic mathematical foundations for the analysis of single features and time series using classifiers, clustering and regression approaches. They are able to use various relevant methods as Bayes classifiers, Support Vector Machines, decision trees, fuzzy rulebases and they can adapt application scenarios (with data preprocessing and validation techniques) to real-world applications.

Content
Introduction and motivation

Terms and definitions (types of multidimensional features - time series and images, problem classes)

Application scenario: Problem formulation, feature extraction, evaluation, selection and transformation, distance measures, Bayes classifiers, Support-Vector-Machines, decision trees, clustering, regression, validation

Application (Software practice with Gait-CAD): Control of hand prostheses, energy prediction

Literature
Lecture notes (Internet)

Mikut, R.: Data Mining in der Medizin und Medizintechnik. Universitätsverlag Karlsruhe.
2008 (Internet)

Backhaus, K.; Erichson, B.; Plinke, W.; Weiber, R.: Multivariate Analysemethoden: Eine anwendungsorientierte Einführung. Berlin u.a.: Springer. 2000

Burges, C.: A Tutorial on Support Vector Machines for Pattern Recognition. Knowledge
Discovery and Data Mining 2(2) (1998), S. 121–167

Tatsuoka, M. M.: Multivariate Analysis. Macmillan. 1988

Mikut, R.; Loose, T.; Burmeister, O.; Braun, S.; Reischl, M.: Dokumentation der MATLAB-Toolbox Gait-CAD. Techn. Ber., Forschungszentrum Karlsruhe GmbH. 2006 (Internet)

Course: Digital Control [2137309]

Coordinators: Michael Knoop
Part of the modules: SP 31: Mechatronics (p. 177)[SP_31_mach], SP 18: Information Technology (p. 173)[SP_18_mach]

ECTS Credits	Hours per week	Term	Instruction language
4	2	Winter term	de

Learning Control / Examinations
Oral examination; duration: 30 minutes; no tools or reference materials may be used during the exam.

Conditions
Basic studies and preliminary examination; basic lectures in automatic control

Learning Outcomes
The lecture intoduces key methods for the analysis and design of digital feedback control systems. Starting point is the discretisation of linear, continuous-time models. State space based and z-transform based controller design techniques are presented for discrete-time, single-input single-output systems. Furthermore, plants with dead-time and deadbeat design are covered.

Content
1. Introduction into digital control:
Motivation for digital implementation of controllers Structure of digital feedback control loops Sample and hold units
2. State space analysis and design:
Discretisation of continuous-time systems Discrete-time state space equations Stability - definition and criteria State feedback design by eigenvalue assignment PI state feedback controller Luenberger observer, separation theorem Systems with dead-time Deadbeat design
3. Analysis and design based on z-transform: z-transform - definition and theorems Control loop description in the z domain
Stability criteria Root locus controller design Transfer of continuous-time controllers into discrete-time controllers

Literature

- Lunze, J.: Regelungstechnik 2, 3. Auflage, Springer Verlag, Berlin Heidelberg 2005
- Unbehauen, H.: Regelungstechnik, Band 2: Zustandsregelungen, digitale und nichtlineare Regelsysteme. 8. Auflage, Vieweg Verlag, Braunschweig 2000
- Föllinger, O.: Lineare Abtastsysteme. 4. Auflage, R. Oldenbourg Verlag, München Wien 1990
- Ogata, K.: Discrete-Time Control Systems. 2nd edition, Prentice-Hall, Englewood Cliffs 1994
- Ackermann, J.: Abtastregelung, Band I, Analyse und Synthese. 3. Auflage, Springer Verlag, Berlin Heidelberg 1988

Course: Designing with numerical methods in product development [2161229]

Coordinators: Eckart Schnack
Part of the modules: SP 07: Dimensioning and Validation of Mechanical Constructions (p. 164)[SP_07_mach]

ECTS Credits	Hours per week	Term	Instruction language
4	2	Winter term	de

Learning Control / Examinations
Oral examination. Duration: 30 minutes.

Conditions
None.

Recommendations
None.

Learning Outcomes
The students are provided with a detailed overview of the numerical methods for product development in mechanical engineering. Account is taken of the fact that a modern development of products in mechanical engineering generally involves a multi-field approach: knowledge of thermodynamics, fluid mechanics, solid mechanics, electronics / electrics and magnetism are required. In addition, problems can be steady but are very often unsteady, i.e. time-dependent. All these aspects are incorporated into modern industrial software. In the lectures the fundamental methods used in the development of the software are introduced and discussed in detail. Students are provided with the tools to carry out the design process on a computer using existing industrial software. It is also worth noting that beside the finite element and the boundary element methods, structural optimisation with shape and topological optimisation must be taken into account. Structural optimisation will play an increasingly important role in the future.

Content
Overview of the numeric process: finite difference methods, finite volume methods. Finite element methods. Boundary element method (BEM). Thermodynamic processes. Flow dynamic processes. Solid dynamics. Nonlinear field behaviour. These methods are summarised at the end of the course, and a holistic concept for design processes is developed.

Literature
Lecture notes (available in the administration office, building 10.91, rm. 310)

Course: Designing with composites [2162255]

Coordinators: Eckart Schnack
Part of the modules: SP 26: Materials Science and Engineering (p. 175)[SP_26_mach], SP 13: Strength of Materials/ Continuum Mechanics (p. 170)[SP_13_mach]

ECTS Credits	Hours per week	Term	Instruction language
4	2	Summer term	de

Learning Control / Examinations
Oral examination. Duration: 30 minutes.

Conditions
None.

Recommendations
None.

Learning Outcomes
The aim is to gain understanding of laminated composite materials with a wide variety of applications in the aerospace and automotive industries. The terminology used for modern composites will be introduced and the students will gain an understanding of lamina, laminae and laminate. In addition they will gain understanding of the transformation properties between a single-layer and a multi-layer coordinate system. They will understand new aspects of composites such as the piezo-electric monitoring of composite materials.

Content
Short overview of the definition of modern composite materials. Fundamental structure of industrial composites. Definition of the mixture rules for fibre and matrix materials. Calculation of a wide variety of transformations between lamina, laminae and laminate for different coordinate systems. Derivation of the relevant differential equations for composites.

Literature
Lecture notes available in the administration office, building 10.91, rm. 310

Course: Dynamics of mechanical Systems with tribological Contacts [2162207]

Coordinators: Hartmut Hetzler
Part of the modules: SP 05: Calculation Methods in Mechanical Engineering (p. 162)[SP_05_mach], SP 09: Dynamic Machine Models (p. 165)[SP_09_mach]

ECTS Credits	Hours per week	Term	Instruction language
4	2	Summer term	de

Learning Control / Examinations
oral exam., 30min

Conditions
None.

Learning Outcomes
This lectures gives an introduction in to basic aspects of mechanical systems with contacts. Here, the tribological contact properties must be respected as well, since it affects the contact behaviour.
The course begins with the phyisical-mathematical description and adresses common solution strategies. By several example problems typcial dynamic phenomena are discussed.

Content
* Introduction into contact kinematics
* kinetics of mechanical systems with frictional unilateral contacts
* mathematical solution strategies
* introduction into contact mechanics
* normal contact (Hertzian contact, rough surfaces, constitutive contact laws)
* impacts (Newton's Impact law, wave effects)
* friction induced vibrations (stick-slip, squeal, ...)
* lubricated contacts: Reynold's Equation, rotors in fluid film bearings, EHD-contacts

Literature
list of literature will be handed out

Course: [2163111]

Coordinators: Alexander Fidlin
Part of the modules: SP 09: Dynamic Machine Models (p. 165)[SP_09_mach], SP 05: Calculation Methods in Mechanical Engineering (p. 162)[SP_05_mach], SP 02: Powertrain Systems (p. 161)[SP_02_mach]

ECTS Credits	Hours per week	Term	Instruction language
8	4	Winter term	de

Learning Control / Examinations
Oral examination

Duration: 30 min (optional subject)
20 min (major subject)

Means are not allowed

Conditions
None.

Recommendations
Powertrain Systems Technology A: Automotive Systems
Machine Dynamics
Vibration theory

Learning Outcomes

- To obtain the basic skills in dynamic modelling of the vehicle powertrain including the most important components, driving situations and requirements

Content

- Main components of the vehicle powertrain and their modelling
- Typical driving situations
- Problemoriented models for particular driving situations
- System analysis and optimization with respect to dynamic behavior

Literature

- Dresig H. Schwingungen mechanischer Antriebssysteme, 2. Auflage, Springer, 2006
- Pfeiffer F., Mechanical System Dynamics, Springer, 2008
- Laschet A., Simulation von Antriebssystemen:Modellbildung der Schwingungssysteme und Beispiele aus der Antriebstechnik, Springer, 1988

Course: Introduction to Industrial Engineering [2109041]

Coordinators: Gert Zülch
Part of the modules: SP 52: Production Management (p. 182)[SP_52_mach]

ECTS Credits	Hours per week	Term	Instruction language
4	2	Summer term	en

Learning Control / Examinations
Oral exam, length: 30 minutes
(only in English)

Allowed resource materials: none

Conditions
None.

Recommendations

- Willingness to learn interdisciplinarily (Technique, Economy, Legal regulations, Informatics . . .)
- Basic understanding of technical products
- Some knowledge about manufacturing techniques
- Basics of mathematical statistics

Learning Outcomes

- Knowledge about organisational structures of production enterprises
- Insights into order processing
- Initial knowledge about planning processes

Content

1. Introduction to the course
2. Objectives and process models
3. Market analysis, product design, and production programme
4. Analysis of processes
5. Production planning and control
6. Planning of resources
7. Quality management
8. Product utilisation and recycling
9. Principles of project management
10. Management systems

Literature
Learning material:
Handout online on: https://ilias.rz.uni-karlsruhe.de/goto_rz-uka_cat_29099.html

Literature:

- KRAJEWSKI, Lee J.; RITZMAN, Larry P.: Operations Management: Strategy and Analysis. London: Prentice Hall, 4th ed. 2003.
- VOLLMANN, Thomas E.; BERRY, William L.; WHYBARK, D. Clay; JACOBS, F. Robert: Manufacturing Planning and Control Systems. New York NY: et al. McGraw-Hill, 5th ed. 2005.
- NAHMIAS, Steven: Production and Operations Analysis. New York NY: McGraw-Hill/Irwin, 4th ed. 2001.
- HOPP, Wallace J.; SPEARMAN, Mark L.: Factory Physics. New York NY: McGraw-Hill, 2nd ed. 2000.

Please refer to the latest edition.

Course: Introduction to Automotive Lightweight Technology [2113101]

Coordinators: Frank Henning
Part of the modules: SP 50: Rail System Technology (p. 181)[SP_50_mach]

ECTS Credits	Hours per week	Term	Instruction language
4	2	Winter term	de

Learning Control / Examinations
verbally
duration: 30 - 60 min
auxiliary means: none

Conditions
none

Recommendations
none

Learning Outcomes
Introduction to automotive lightweight design. Becoming acquainted with established strategies and construction methods as well as materials for automotive lightweight design.

Content
Strategies for lightweight design, construction methods, metallic materials for lightweight design, introduction to polymers

Course: Introduction to the Finite Element Method [2162282]

Coordinators: Thomas Böhlke
Part of the modules: SP 05: Calculation Methods in Mechanical Engineering (p. 162)[SP_05_mach], SP 13: Strength of Materials/ Continuum Mechanics (p. 170)[SP_13_mach], SP 07: Dimensioning and Validation of Mechanical Constructions (p. 164)[SP_07_mach]

ECTS Credits	Hours per week	Term	Instruction language
4	2	Summer term	de

Learning Control / Examinations
depending on choice according to acutal version of study regulations
Additives as announced

Conditions
None.

Recommendations
None.

Learning Outcomes
The students can effectively apply the finite element method (FEM) for structural and temperature analysis. They know the mathematical and mechanical foundations of FEM. The students can set up the weak formulation of boundary value problems and the linear system of the FEM as well. They know different numerical solution methods for linear systems. The students are thus well prepared for a job in construction or computing divisions.

Content

- introduction and motivation
- elements of tensor calculus
- the initial-boundary-value-problem of linear thermoconductivity
- the boundary-value-problem of linear elastostatic
- spatial discretization for 3D problems
- solution of the boundary-value-problem of elastostatic
- numerical solution of linear systems
- element types
- error estimation

Literature
lecture notes
Fish, J., Belytschko, T.: A First Course in Finite Elements, Wiley 2007 (*enthält eine Einführung in ABAQUS*)

Course: Introduction to Ceramics [2125755]

Coordinators: Michael Hoffmann
Part of the modules: SP 07: Dimensioning and Validation of Mechanical Constructions (p. 164)[SP_07_mach], SP 26: Materials Science and Engineering (p. 175)[SP_26_mach]

ECTS Credits	Hours per week	Term	Instruction language
4	2	Winter term	de

Learning Control / Examinations
oral
20 min
Auxiliary means:none

Conditions
None.

Learning Outcomes
The lecture gives an overview of the relationship among processing, microstructure and properties of ceramics. Important processing routes and characterization methods will be discussed on various examples. The course is arranged in the following units:

Content
Atomic bonding in solids
Crystal structures and structural imperfections
Surfaces, interfaces and grain boundaries
Binary and ternary phase diagrams
Structure of glass
Characterization and processing of ceramic powders
Shaping methods (pressing, slip casting, injection molding)
Densification and grain growth (sintering)
Introduction to fracture mechanics, strength and failure probability of brittle materials
Materials behavior at high temperatures (creep, oxidation)
Toughening mechanisms
Methods for microstructural characterization

Literature
H. Salmang, H. Scholze, Keramik, Teil I: Allgemeine Grundlagen und wichtige Eigenschaften, Teil II: Keramische Werkstoffe, Springer Verlag, Berlin, (1982).

W.D. Kingery, H.K. Bowen, D.R. Uhlmann, Introduction to Ceramics, John Wiley & Sons, New York, (1976).

D. Munz, T. Fett, Mechanisches Verhalten keramischer Werk- stoffe, Springer Verlag, (1989).

Course: Introduction to Theory of Materials [2182732]

Coordinators: Marc Kamlah
Part of the modules: SP 13: Strength of Materials/ Continuum Mechanics (p. 170)[SP_13_mach]

ECTS Credits	Hours per week	Term	Instruction language
4	2	Summer term	de

Learning Control / Examinations
oral exam 30 minutes

Conditions
Engineering Mechanics; Advanced Mathematics

Learning Outcomes
Classes of constitutive material behaviour and its mathematical representation

Content
Following a brief introduction into continuum mechanics at small deformations, the classification into elastic, viscoelastic, plastic and viscoplastic material behaviour is discussed. Then, the corresponding constituve models are motivated and mathematically formulated. As far as possible, their properties are demonstrated by means of elementary analytical solutions.
In the lab, the behavior of the discussed constitutive material laws are investigated for simple geometries and loading situations with the finite element program ABAQUS.

Literature
[1] Peter Haupt: Continuum Mechanics and Theory of Materials, Springer
[2] ABAQUS Manual

Course: Introduction to the Mechanics of Composite Materials [2182734]

Coordinators: Yingyuan Yang
Part of the modules: SP 26: Materials Science and Engineering (p. 175)[SP_26_mach]

ECTS Credits	Hours per week	Term	Instruction language
4	2	Summer term	de

Learning Control / Examinations
oral exam 30 minutes

Conditions
Solid Mechanics

Learning Outcomes
The students could analyze the stresses und strength of a structure with composite materials. Using the advantages of composite materials, the students could make optimization and design in a light structure.

Content

- Introduction to composite materials, applied examples in the industry
- Micromechanical behaviour of a lamina
- Macromechanical behaviour of a lamina
- Macromechanical behaviour of a laminate (I):
  classical lamination theory
- Macromechanical behaviour of a laminate (II):
  stiffness / stress analysis
- Strength of laminates, failure criteria in laminates
- Optimization and Design of fiber reinforced composite materials

Literature
[1] Robert M. Jones (1999), Mechanics of Composite Materials
[2] Valery V. Vasiliev & Evgeny V. Morozov (2001), Mechanics and Analysis of Composite Materials, ISBN: 0-08-042702-2
[3] Helmut Schürmann (2007), Konstruieren mit Faser-Kunststoffverbunden, Springer, ISBN: 978-3-540-72189-5 .

Course: Introduction into Mechatronics [2105011]

Coordinators: Georg Bretthauer, Albert Albers
Part of the modules: SP 50: Rail System Technology (p. 181)[SP_50_mach]

ECTS Credits	Hours per week	Term	Instruction language
6	3	Winter term	de

Learning Control / Examinations
Written examination, oral examination or certification of participation depending on the “Studienplan” resp. “Prüfungs- und Studienordnung (SPO)”

Conditions
None.

Learning Outcomes
Mechatronics is an interdisciplinary field, based on classical mechanical and electrical engineering as well as automation science and technology and computer science. The main activities focus on integral system development with technical components connected via an intelligent control system. In this regard simulation of mechanical and electrical systems becomes important for rapid and efficient development. First part of the lecture provides a survey of mechatronics. Subsequently the architecture of mechatronic systems is described. Furthermore fundamentals of modeling of mechanical, pneumatic, hydraulic, electrical and electronic components are discussed. Finally optimization methods, e. g. adaptive controllers, are presented. In the second part of the lecture basics of development methods as well as the characteristics of the development of mechatronic products are described. A further important item is the presentation of the system concept of mechatronics in comparison to conventional mechanical systems. The contents of the course are explained using examples for mechatronic products in the area of automotive engineering.

Content
Part I: Modeling and optimization (Prof. Bretthauer)

Introduction
Architecture of mechatronic systems
Modeling of mechatronic systems
Optimization of mechatronic systems
Perspective

Part II: Development and design (Prof. Albers)

Introduction
Development method for mechatronic products
Examples

Literature
Heimann, B.; Gerth, W.; Popp, K.: Mechatronik. Leipzig: Hanser, 1998

Isermann, R.: Mechatronische Systeme - Grundlagen. Berlin: Springer, 1999

Roddeck, W.: Einführung in die Mechatronik. Stuttgart: B. G. Teubner, 1997

Töpfer, H.; Kriesel, W.: Funktionseinheiten der Automatisierungstechnik. Berlin: Verlag Technik, 1988

Föllinger, O.: Regelungstechnik. Einführung in die Methoden und ihre Anwendung. Heidelberg: Hüthig, 1994

Bretthauer, G.: Modellierung dynamischer Systeme. Vorlesungsskript. Freiberg: TU Bergakademie, 1997

Course: Introduction into the multi-body dynamics [2162235]

Coordinators: Wolfgang Seemann

Part of the modules: SP 02: Powertrain Systems (p. 161)[SP_02_mach], SP 09: Dynamic Machine Models (p. 165)[SP_09_mach], SP 31: Mechatronics (p. 177)[SP_31_mach], SP 05: Calculation Methods in Mechanical Engineering (p. 162)[SP_05_mach]

ECTS Credits	Hours per week	Term	Instruction language
5	3	Summer term	de

Learning Control / Examinations

Written exam

Optional subject: oral, 30 min.
Major Subject: oral, 20 min.

Conditions

None.

Learning Outcomes

Mechanisms, vehicles and industrial robots are examples of multibody systems. For dynamics simulations expressions for kinematical quantities and formulations of equations of motion are required which make it easy to switch from one system to another. Efficient methods are described.
The course is mainly divided in two parts: kinematics on the one hand and different possibilities to derive the equations of motion on the other hand.

Content

The role of multibody systems in engineering, kinematics of a single rigid body, Kinematics of multibody systems, rotation matrix, angular velocity, derivatives in different reference systems, holonomic and non-holonomic constraints, Newton-Euler's equations, principle of d'Alembert, principle of virtuel power, Lagrange's equations, Kane's equations, structure of the equations of motion

Literature

Wittenburg, J.: Dynamics of Systems of Rigid Bodies, Teubner Verlag, 1977
Roberson, R. E., Schwertassek, R.: Dynamics of Multibody Systems, Springer-Verlag, 1988
de Jal'on, J. G., Bayo, E.: Kinematik and Dynamic Simulation of Multibody System.
Kane, T.: Dynamics of rigid bodies.

Course: Basics Operation Systems of Ground Born Guided Systems [19306]

Coordinators: Eberhard Hohnecker, Peter Gratzfeld, Hohnecker
Part of the modules: SP 50: Rail System Technology (p. 181)[SP_50_mach]

ECTS Credits	Hours per week	Term	Instruction language
4	2	Winter term	de

Learning Control / Examinations

- Oral examination
- Duration: 20 minutes
- No tools or reference materials may be used during the exam.

Conditions
none

Recommendations
none

Learning Outcomes
The students have a fundamental knowledge about logistics and operation in railway systems.

Content

- Operating basics
- Train control
- Capacity and operation quality of lines and stations

Media
All slides can be bought.

Literature

1. Fiedler: Grundlagen der Bahntechnik, Werner Verlag Düsseldorf
2. Pachl: Systemtechnik des Schienenverkehrs; Teubner-Verlag Stuttgart

Course: Operation Systems of Ground Born Guided Systems [19321]

Coordinators: Eberhard Hohnecker, Peter Gratzfeld, Hohnecker
Part of the modules: SP 50: Rail System Technology (p. 181)[SP_50_mach]

ECTS Credits	Hours per week	Term	Instruction language
4	2	Summer term	de

Learning Control / Examinations

- Oral examination
- Duration: 20 minutes
- No tools or reference materials may be used during the exam.

Conditions
none

Recommendations
none

Learning Outcomes
The students have a deepened knowledge about national and international operating and signalling systems.

Content

- National and international operating systems
- National and international signalling systems
- Driverless operation
- Safety case of new operating systems

Media
All slides can be bought.

Literature
Pachl: Systemtechnik des Schienenverkehrs; Teubner-Verlag Stuttgart

Course: Electronic Business for industrial Companies [2149650]

Coordinators: Anette Weisbecker
Part of the modules: SP 38: Production Systems (p. 178)[SP_38_mach], SP 17: Information Management (p. 172)[SP_17_mach]

ECTS Credits	Hours per week	Term	Instruction language
4	2	Winter term	de

Learning Control / Examinations
oral exam, 30 min

Conditions
None.

Learning Outcomes

Content
This lecture leads to the technical bases and a general survey for applications of electronic business in industrial enterprises.
Students get acquainted with the technical bases of electronic business and will be able to develop new applications in practice. Furthermore they will learn the ability to evaluate the benefit of new applications of information technologies referring electronic business in industrial enterprises.
1. Electronic Business
2. Product Information Managment (PIM)
3. Portals for Business Clients and Employees
4. Supply Chain Management (SCM)
5. Customer Relationship Management (CRM)
6. Mobile Computing
7. Production Networks
8. E-Collaboration / E-Engineering
9. Service Engineering
10. Teleservice

Course: Electric Rail Vehicles [2114346]

Coordinators: Peter Gratzfeld
Part of the modules: SP 50: Rail System Technology (p. 181)[SP_50_mach]

ECTS Credits	Hours per week	Term	Instruction language
4	2	Summer term	de

Learning Control / Examinations

- Oral examination
- Duration: 20 minutes
- No tools or reference materials may be used during the exam.

Conditions
none

Recommendations
none

Learning Outcomes

- The students know the history of electric traction in railway transportation from the very beginning to the modern locomotives with three-phase induction motors.
- They know the basics of railway transportation, the different kinds of traction and the basic concepts of rail cars.
- They understand the design and the mode of operation of classic and modern rail cars, know the components of the main power circuit and the different kinds of drives.
- They are informed about new developments in the field of electric railway vehicles.

Content

- History of electric traction with railway vehicles
- Basics of railway transportation, kinds of traction and concepts of rail cars
- Mode of operation and design of electric locomotives
- Axle drives and transmission of the tractive effort to the rails
- Modern developments of electric traction

Media
All slides are available for download.

Literature
A bibliography is available for download.

Course: Elements of Technical Logistics [2117096]

Coordinators: Martin Mittwollen
Part of the modules: SP 05: Calculation Methods in Mechanical Engineering (p. 162)[SP_05_mach], SP 44: Technical Logistics (p. 179)[SP_44_mach]

ECTS Credits	Hours per week	Term	Instruction language
6	4	Winter term	de

Learning Control / Examinations
after each lesson period; oral / written (if necessary) => (look at "Studienplan Maschinenbau", version of xx.xx.2011)

Conditions
LV 2117095 must be passed successfully - examination dates are sequenced accordingly

Learning Outcomes
The student:

- knows about elements and systems of technical logistics
- knows about structures and function of special conveying machines
- knows about material flow systems
- and is able to equip material flow systems with applicable machines

Content
material flow systems and their (conveying) technical components
mechanical behaviour of conveyors;
structure and function of conveyor machines; elements of intralogistics (belt conveyor, racks, automatic guided vehicles, fan-in, bifurcation, and etc.)
sample applications and calculations in addition to the lectures inside practical lectures

Media
supplementary sheets,projector, blackboard

Literature
recommendations during lectures

Course: Energy efficient intralogistic systems [2117500]

Coordinators: Frank Schönung
Part of the modules: SP 09: Dynamic Machine Models (p. 165)[SP_09_mach], SP 02: Powertrain Systems (p. 161)[SP_02_mach], SP 44: Technical Logistics (p. 179)[SP_44_mach], SP 15: Fundamentals of Energy Technology (p. 171)[SP_15_mach]

ECTS Credits	Hours per week	Term	Instruction language
4	2	Winter term	de

Learning Control / Examinations
oral,30 min, examination dates after the end of each lesson period

Conditions
None.

Recommendations
None.

Learning Outcomes
The student has basics for the analysis and the design of energy and resource efficient intralogistic systems for production and distribution.

Content
The main focuses of the course are:

- green supply chain
- processes in Intralogistic systems
- evaluation of energy consumption of conveyors
- modeling of conveying systems
- methods for energy savings
- approaches for energy efficiency increasing of continuous and discontinuous conveyors
- dimensioning energy efficient drives
- new approaches for resource efficient conveying systems.

Media
presentations, black board

Literature
None.

Remarks
none

Course: Development Project for Machine Tools and Industrial Handling [2149903]

Coordinators: Jürgen Fleischer
Part of the modules: SP 38: Production Systems (p. 178)[SP_38_mach]

ECTS Credits	Hours per week	Term	Instruction language
4	2	Winter term	de

Learning Control / Examinations
Performance is assessed in the form of one oral examination (30 min) during the lecture-free period. The examination will take place once every semester and can be retaken at every official examination date.

Conditions
Can only be taken with the lecture machine tools and industrial handling.
Only five students are able to take part.

Learning Outcomes
The student

- has knowledge about the application of machine tools.
- comprehends the assembly and the operation purpose of the major components of a machine tool.
- is able to apply methods of selection and assessment of production machines to new tasks.
- is able to assess the dimensioning of a machine tool.

Content
As part of this lecture, a development project in the field of machine tools and handling equipment is carried out by students under supervision. It covers current problems of an involved industrial partner..

Course: Experimental Modelling [2106031]

Coordinators: Lutz Gröll
Part of the modules: SP 31: Mechatronics (p. 177)[SP_31_mach]

ECTS Credits	Hours per week	Term	Instruction language
3	2	Summer term	de

Learning Control / Examinations

Conditions

None.

Learning Outcomes

Content

Course: Metallographic Lab Class, Metallographic Lab Class, Ferrous Materials [2175588]

Coordinators: Katja Poser, Alexander Wanner
Part of the modules: SP 07: Dimensioning and Validation of Mechanical Constructions (p. 164)[SP_07_mach], SP 26: Materials Science and Engineering (p. 175)[SP_26_mach]

ECTS Credits	Hours per week	Term	Instruction language
4	3	Winter / Summer Term	

Learning Control / Examinations
Colloquium with every experiment, Laborjournal

Conditions
basic knowledge in materials science (e.g. lecture materials science I and II)

Learning Outcomes
The students in this lab class gain access to metallography and is working methods as well as insights into the possibilities, correlations and results of light-microscopic testing of metallic materials at an elementary basis. They learn in several experiments about the correlations between structure and mechanical properties by using light-microscopic evaluation, the preparation of samples and microstructural development.

Content
Light microscope in metallography

metallographic sections of metallic materials

Investigation of the microstructure of unalloyed steels and cast iron

Structure development of steels with accelerated cooling from the austenite area

Investigation of structures of alloyed steels

Investigation of failures Qualitative structural analysis

Structural testing of copper-based alloys

Structural testing of technically relevant non-ferrous metals
(aluminium-based, nickel-based, titanium-based and tin-based alloys)

Literature
E. Macherauch: Praktikum in Werkstoffkunde, 10th edition, 1992

H. Schumann: Metallographie, 13th edition, Deutscher Verlag für Grundstoffindustrie, 1991

Literature List will be handed out with each experiment

Course: Metallographic Lab Class, Non-Ferrous Materials [2175589]

Coordinators: Katja Poser, Alexander Wanner
Part of the modules: SP 07: Dimensioning and Validation of Mechanical Constructions (p. 164)[SP_07_mach], SP 26: Materials Science and Engineering (p. 175)[SP_26_mach]

ECTS Credits	Hours per week	Term	Instruction language
4	3	Winter / Summer Term	

Learning Control / Examinations
Colloquium with every experiment, Laborjournal

Conditions
basic knowledge in materials science (e.g. lecture materials science I and II)

Learning Outcomes
The students in this lab class gain access to metallography and is working methods as well as insights into the possibilities, correlations and results of light-microscopic testing of metallic materials at an elementary basis. They learn in several experiments about the correlations between structure and mechanical properties by using light-microscopic evaluation, the preparation of samples and microstructural development.

Content
Light microscope in metallography

metallographic sections of metallic materials

Investigation of the microstructure of unalloyed steels and cast iron

Structure development of steels with accelerated cooling from the austenite area

Investigation of structures of alloyed steels

Investigation of failures Qualitative structural analysis

Structural testing of copper-based alloys

Structural testing of technically relevant non-ferrous metals
(aluminium-based, nickel-based, titanium-based and tin-based alloys)

Literature
E. Macherauch: Praktikum in Werkstoffkunde, 10th edition, 1992

H. Schumann: Metallographie, 13th edition, Deutscher Verlag für Grundstoffindustrie, 1991

Literature List will be handed out with each experiment

Course: Welding Lab Course, in groupes [2173560]

Coordinators: Volker Schulze
Part of the modules: SP 07: Dimensioning and Validation of Mechanical Constructions (p. 164)[SP_07_mach]

ECTS Credits	Hours per week	Term	Instruction language
4	3	Winter term	de

Learning Control / Examinations
Certificate to be issued after evaluation of the lab class report

Conditions
certtificate of attendance for Welding technique I

Learning Outcomes
During the lab class a survey of current welding processes and their suitability for joining different materials is given. An important goal of the lab class is to understand and to evaluate the advantages and disadvantages of the individual procedures.

Content
Gas welding of steels with different weld geometries
Gas welding of cast iron, nonferrous metals
Brazing of aluminum
Electric arc welding with different weld geometries
Gas welding according to the TIG, MIG and MAG procedures

Literature
distributed during the lab attendance

Course: Driving Dynamics Evaluation within the Global Vehicle Simulation [2114850]

Coordinators: Bernhard Schick
Part of the modules: SP 12: Automotive Technology (p. 168)[SP_12_mach]

ECTS Credits	Hours per week	Term	Instruction language
4	2	Summer term	de

Learning Control / Examinations
Oral Examination

Duration: 30 up to 40 minutes

Auxiliary means: CarMaker Simulation Environment

Conditions
none

Learning Outcomes
The students have an overview of the vehicle dynamics simulation, the model parametrization and the related data sources. They have good knowledge about vehicle dynamics test methods and related execution of virtual test driving (open loop, closed loop). They are able to evaluate driving behavior based on self-created results. They have achieved knowledge about influences and interactions of components such as tires, suspension, kinematics and compliance, roll bars, steering, brakes, mass distribution and powertrain and they have the qualification to design components with regard to global vehicle behavior.

Content
1. Testing and evaluation methods
2. Fundamentals of vehicle dynamics simulation
3. Execution of virtual test driving and evaluation of the results
4. Influence of several components and optimization of global driving behavior

Literature
1. Reimpell, J.: Fahrwerktechnik: Grundlagen, Vogel Verlag, 1995
2. Unrau, H.-J.: Scriptum zur Vorlesung “Fahreigenschaften I”
3. Unrau, H.-J.: Scriptum zur Vorlesung “Fahreigenschaften II”
4. IPG: User Guide CarMaker

Course: Handling Characteristics of Motor Vehicles I [2113807]

Coordinators: Hans-Joachim Unrau
Part of the modules: SP 12: Automotive Technology (p. 168)[SP_12_mach], SP 09: Dynamic Machine Models (p. 165)[SP_09_mach]

ECTS Credits	Hours per week	Term	Instruction language
4	2	Winter term	de

Learning Control / Examinations
Verbally

Duration: 30 up to 40 minutes

Auxiliary means: none

Conditions
None.

Recommendations
None.

Learning Outcomes
The students know the basic connections between drivers, vehicles and environment. They can build up a vehicle simulation model, with which forces of inertia, aerodynamic forces and tyre forces as well as the appropriate moments are considered. They have proper knowledge in the area of tyre characteristics, since a special meaning comes to the tire behavior during driving dynamics simulation.

Content
1. Problem definition: Control loop driver - vehicle - environment (e.g. coordinate systems, modes of motion of the car body and the wheels)

2. Simulation models: Creation from motion equations (method according to D'Alembert, method according to Lagrange, programme packages for automatically producing of simulation equations), model for handling characteristics (task, motion equations)

3. Tyre behavior: Basics, dry, wet and winter-smooth roadway

Literature
1. Willumeit, H.-P.: Modelle und Modellierungsverfahren in der Fahrzeugdynamik,
B. G. Teubner Verlag, 1998

2. Heißing, B.; Ersoy, M.: Fahrwerkhandbuch, Vieweg Verlag 2007

3. Gnadler, R.; Unrau, H.-J.: Reprint collection to the lecture Handling Characteristics of Motor Vehicles I

Course: Handling Characteristics of Motor Vehicles II [2114838]

Coordinators: Hans-Joachim Unrau
Part of the modules: SP 12: Automotive Technology (p. 168)[SP_12_mach], SP 09: Dynamic Machine Models (p. 165)[SP_09_mach]

ECTS Credits	Hours per week	Term	Instruction language
4	2	Summer term	de

Learning Control / Examinations
Oral Examination

Duration: 30 up to 40 minutes

Auxiliary means: none

Conditions
None.

Recommendations
None.

Learning Outcomes
The students have an overview of common test methods, with which the handling of vehicles is gauged. They are able to interpret results of different stationary and transient testing methods. Apart from the methods, with which e.g. the driveability in curves or the transient behaviour from vehicles can be registered, also the influences from cross-wind and from uneven roadways on the handling characteristics are well known. They are familiar with the stability behavior from single vehicles and from vehicles with trailer.

Content
1. Vehicle handling: Bases, steady state cornering, steering input step, single sine, double track switching, slalom, cross-wind behavior, uneven roadway

2. stability behavior: Basics, stability conditions for single vehicles and for vehicles with trailer

Literature
1. Zomotor, A.: Fahrwerktechnik: Fahrverhalten, Vogel Verlag, 1991
2. Heißing, B.; Ersoy, M.: Fahrwerkhandbuch, Vieweg Verlag 2007

3. Gnadler, R. Unrau, H.-J.: Reprint collection to the lecture Handling Characteristics of Motor Vehicles II

Course: Vehicle Comfort and Acoustics I [2113806]

Coordinators: Frank Gauterin
Part of the modules: SP 12: Automotive Technology (p. 168)[SP_12_mach], SP 09: Dynamic Machine Models (p. 165)[SP_09_mach], SP 48: Internal Combustion Engines (p. 180)[SP_48_mach]

ECTS Credits	Hours per week	Term	Instruction language
4	2	Winter term	de

Learning Control / Examinations
Oral Examination

Duration: 30 up to 40 minutes

Auxiliary means: none

Conditions
None.

Recommendations
None.

Learning Outcomes
The students know what are noise and vibration, how they are generated, and how they are perceived by human beings.
They have knowledge about the requirements given by users and the public. They know which components of the vehicle are participating in which way on noise and vibration phenomenon and how they could be improved.

Content
1. Perception of noise and vibrations

3. Fundamentals of acoustics and vibrations

3. Tools and methods for measurement, computing, simulation and analysis of noise and vibrations

4. The relevance of tire and chasis for the acoustic and mechanical driving comfort:
phenomena, influencing parameters, types of construction, optimization of components and systems, conflict of goals, methods of development

An excursion will give insights in the development practice of a car manufacturer or a system supplier.

Literature
1. Michael Möser, Technische Akustik, Springer, Berlin, 2005

2. Russel C. Hibbeler, Technische Mechanik 3, Dynamik, Pearson Studium, München, 2006

3. Manfred Mitschke, Dynamik der Kraftfahrzeuge, Band B: Schwingungen, Springer, Berlin, 1997

The script will be supplied in the lectures

Course: Vehicle Comfort and Acoustics II [2114825]

Coordinators: Frank Gauterin
Part of the modules: SP 12: Automotive Technology (p. 168)[SP_12_mach], SP 09: Dynamic Machine Models (p. 165)[SP_09_mach], SP 48: Internal Combustion Engines (p. 180)[SP_48_mach]

ECTS Credits	Hours per week	Term	Instruction language
4	2	Summer term	de

Learning Control / Examinations
Oral Examination

Duration: 30 up to 40 minutes

Auxiliary means: none

Conditions
None.

Recommendations
None.

Learning Outcomes
The students have knowledge about the noise and vibration properties of the chassis components and the drive train. They know what kind of noise and vibration phenomena do exist, what are the generation mechanisms behind, which components of the vehicle participate in which way and how could they be improved. They have knowledge in the subject area of noise emission of automobiles: Noise impact, legal requirements, sources and influencing parameters, component and system optimization, target conflicts and development methods.

Content
1. Summary of the fundamentals of acoustics and vibrations

2. The relevance of road surface, wheel imperfections, springs, dampers, brakes, bearings and bushings, suspensions, engines and drive train for the acoustic and mechanical driving comfort:
- phenomena
- influencing parameters
- types of construction
- optimization of components and systems
- conflicts of goals
- methods of development
3. Noise emission of motor vehicles
- noise stress
- sound sources and influencing parameters
- legal restraints
- optimization of components and systems
- conflict of goals
- methods of development

Literature
The script will be supplied in the lectures.

Course: Vehicle Mechatronics I [2113816]

Coordinators: Dieter Ammon
Part of the modules: SP 12: Automotive Technology (p. 168)[SP_12_mach]

ECTS Credits	Hours per week	Term	Instruction language
4	2	Winter term	de

Learning Control / Examinations
Oral examination

Duration: 30 minutes

Auxiliary means: none

Conditions
None.

Recommendations
None.

Learning Outcomes
The students have an overview of the system science field of mechatronics and its application in the area of vehicle conception, especially in the context of vehicle system dynamics. They know the tools and methods for a systematical analysis, conception, and design of mechatronic systems, focussing on mechatronically extended suspension systems.

Content
1. Introduction: Mechatronics in vehicle technology
2. Vehicle Control systems
Brake- and traction controls (ABS, ASR, automated power train controls)
Active and semiactive suspension systems, active stabilizor bars
Vehicle dynamics controls, driver assistence systems
3. Modelling technology
Mechanics - multi body dynamics
Electrical and electronical systems, control systems
Hydraulics
Interdisciplinary coupled systems
4. Computer simulation technology
Numerical integration methods
Quality (validation, operating areas, accuracy, performance)
Simulator-coupling (hardware-in-the-loop, software-in-the-loop)
5. Systemdesign (example: brake control)
Demands, requirements (funktion, safety, robustness)
Problem setup (analysis - modelling - model reduction)
Solution approaches
Evaluation (quality, efficiency, validation area, concept ripeness)

Literature
1. Ammon, D., Modellbildung und Systementwicklung in der Fahrzeugdynamik, Teubner, Stuttgart, 1997
2. Mitschke, M., Dynamik der Kraftfahrzeuge, Bände A-C, Springer, Berlin, 1984ff
3. Miu, D.K., Mechatronics - Electromechanics and Contromechanics, Springer, New York, 1992
4. Popp, K. u. Schiehlen, W., Fahrzeugdynamik - Eine Einführung in die Dynamik des Systems Fahrzeug-Fahrweg, Teubner, Stuttgart, 1993
5. Roddeck, W., Einführung in die Mechatronik, Teubner, Stuttgart, 1997
6. Zomotor, A., Fahrwerktechnik: Fahrverhalten, Vogel, Würzburg, 1987

Course: Automotive Vision [2138340]

Coordinators: Christoph Stiller, Martin Lauer
Part of the modules: SP 12: Automotive Technology (p. 168)[SP_12_mach], SP 31: Mechatronics (p. 177)[SP_31_mach], SP 50: Rail System Technology (p. 181)[SP_50_mach], SP 18: Information Technology (p. 173)[SP_18_mach]

ECTS Credits	Hours per week	Term	Instruction language
4	2	Summer term	de

Learning Control / Examinations
Oral examination

Duration: 30 minutes

no reference materials

Conditions
Fundamentals in measurement, system and control theory, e.g. from the lecture “Measurement and Control Systems”

Learning Outcomes
Machine perception and interpretation of the environment for the basis for the generation of intelligent behaviour. Especially visual perception opens the door to novel automotive applications. First driver assistance systems can already improve safety, comfort and efficiency in vehicles. Yet, several decades of research will be required to achieve an automated behaviour with a performance equivalent to a human operator. The lecture addresses students in mechanical engineering and related subjects who intend to get an interdisciplinary knowledge in a state-of-the-art technical domain. Machine vision, vehicle kinematics and advanced information processing techniques are presented to provide a broad overview on ßeeing vehicles’. Application examples from cutting-edge and future driver
assistance systems illustrate the discussed subjects.

Content
1. Driver assistance systems
2. Image acquisition and discretization
3. Image signal processing
4. Stochastic image models
5. Stereo vision and image sequence processing
6. Tracking
7. Lane recognition
8. Obstacle recognition

Literature
TBA

Course: Composites for Lightweight Design [2114052]

Coordinators: Frank Henning
Part of the modules: SP 50: Rail System Technology (p. 181)[SP_50_mach]

ECTS Credits	Hours per week	Term	Instruction language
4	2	Summer term	de

Learning Control / Examinations
verbally
duration: 30 - 60 min
auxiliary means: none

Conditions
none

Recommendations
none

Learning Outcomes
Becoming acquainted with composite materials and their application in automotive lightweight design.

Content
Textile reinforcements; processing, finishing and joining of composites; design guidelines; test methods and repair; recycling

Course: manufacturing technology [2149657]

Coordinators: Volker Schulze
Part of the modules: SP 10: Engineering Design (p. 166)[SP_10_mach], SP 38: Production Systems (p. 178)[SP_38_mach]

ECTS Credits	Hours per week	Term	Instruction language
8	4	Winter term	de

Learning Control / Examinations
Performance is assessed in the form of one written examination (180 min) during the lecture-free period. The examination will take place once every semester and can be retaken at every official examination date.

Conditions
None.

Learning Outcomes
The student
• is able to name the different manufacturing methods and to explain their functions
• is able to classify the manufacturing methods by their general structure and functionality according to specific main groups
• is able to perform a process selection based on the methods he/she has learned about and their characteristics
• is able to identify the correlation between different methods
• is able to evaluate the different methods against specific applications on the basis of technical and economical aspects

Content
The objective of the lecture is to look at manufacturing engineering within the wider context of production engineering, to provide an overview over the different manufacturing methods and to impart detailed process knowledge of the common methods. The lecture covers the basic principles of manufacturing engineering and deals with the manufacturing methods according to their classification into main groups on the basis of technical and economical aspects. The lecture is completed with topics such as process chains in manufacturing.
The following topics will be covered:
• Introduction
• Quality control
• Primary processing (casting, plastics engineering, sintering, generative manufacturing processes),
• Forming (sheet-metal forming, massive forming, plastics engineering),
• Cutting (machining with geometrically defined and geometrically undefined cutting edges, separating, abrading)
• Joining
• Coating
• Heat treatment and surface treatment
• Process chains in manufacturing
• Work preparation

Media
Slides and lecture notes for the manufacturing technology lecture will be made available through ilias.

Literature
lecture notes

Course: [2193003]

Coordinators: Damian Cupid, Peter Franke
Part of the modules: SP 26: Materials Science and Engineering (p. 175)[SP_26_mach]

ECTS Credits	Hours per week	Term	Instruction language
4	3	Winter term	de

Learning Control / Examinations

Conditions

None.

Learning Outcomes

Content

Course: Finite Elements for Field- and Time Dependent Problems [19110]

Coordinators: Karl Schweizerhof, Schweizerhof
Part of the modules: SP 13: Strength of Materials/ Continuum Mechanics (p. 170)[SP_13_mach]

ECTS Credits	Hours per week	Term	Instruction language
3	2	Summer term	

Learning Control / Examinations

Conditions
None.

Learning Outcomes

Content

Course: Fluid-Structure-Interaction [2154401]

Coordinators: Torsten Schenkel
Part of the modules: SP 05: Calculation Methods in Mechanical Engineering (p. 162)[SP_05_mach]

ECTS Credits	Hours per week	Term	Instruction language
4	2	Summer term	

Learning Control / Examinations

Conditions
None.

Learning Outcomes

Content

Remarks
Lecture will be given starting summer semester 2012

Course: Fluid Technology [2114093]

Coordinators: Marcus Geimer
Part of the modules: SP 24: Energy Converting Engines (p. 174)[SP_24_mach]

ECTS Credits	Hours per week	Term	Instruction language
4	2/2	Winter term	de

Learning Control / Examinations
The assessment consists of an oral exam (20 min) taking place in the recess period. The exam takes place in every semester. Re-examinations are offered at every ordinary examination date.

Conditions
None.

Learning Outcomes
The students will be able to

- know and understand physical principles of fluid power systems
- know the current components and their operating mode
- know the advantages and disadvantages of different components
- dimension the components for a given purpose
- calculate simple systems

Content
In the range of hydrostatics the following topics will be introduced:

- Hydraulic fluids
- Pumps and motors
- Valves
- Accessories
- Hydraulic circuits.

In the range of pneumatics the following topics will be introduced:

- Compressors
- Motors
- Valves
- Pneumatic circuits.

Literature
Scritum for the lecture *Fluidtechnik*
Institute of Vehicle System Technology
downloadable

Course: Foundry Technology [2174575]

Coordinators: Christian Wilhelm
Part of the modules: SP 26: Materials Science and Engineering (p. 175)[SP_26_mach]

ECTS Credits	Hours per week	Term	Instruction language
4	2	Summer term	de

Learning Control / Examinations
oral

duration: 20 - 30 minutes

no notes

Conditions
Required: WK 1+2

Learning Outcomes
Basic knowledge from the field of casting technology for mechanical engineers; the focus is placed on moulding materials, moulding processes, casting materials and
metallurgy. Special notes of virtual casting develoment.

Content
Moulding and casting processes
Solidifying of melts
Castability
Fe-Alloys
Non-Fe-Alloys
Moulding and additive materials
Core production
Sand reclamation
Feeding technology
Design in casting technology
Casting simulation
Foundry Processes

Literature
Reference to literature, documentation and partial lecture notes given in lecture

Course: Global Production and Logistics - Part 1: Global Production [2149610]

Coordinators: Gisela Lanza
Part of the modules: SP 38: Production Systems (p. 178)[SP_38_mach]

ECTS Credits	Hours per week	Term	Instruction language
4	2	Winter term	de

Learning Control / Examinations
oral exam

Conditions
None.

Recommendations
Basic knowledge of production planning

Learning Outcomes
The student
• understands the challenges and fields of action of companies operating at the global level
• is able to apply the methods for the structuring and design of global networks he/she has learned about to new problems
• is able to analyse opportunities and risks and give a thorough evaluation.

Content
The lecture explains the challenges and the fields of action companies operating at the global level are faced with as well as the most important aspects of global production networks. Firstly, the economic and legal background is discussed along with opportunities and risks. The focus of the lecture is on a methodical approach to the structuring and design of global networks and also includes a strategy for the selection of production sites. Site-specific adjustments to product design and to production technology are also covered. The special characteristics and requirements of global procurement, research & development and sales and marketing are dealt with in detail.

Main topics of the lecture:
1. Introduction: history, motivation and goals, risks
2. General conditions
3. Global distribution
4. Site selection
5. Site-specific production adjustments
6. Development of a new production site
7. Global procurement
8. Structuring global production networks
9. Managing global production networks
10. Global research and development
11. Outlook

Literature
Abele, E. et al: Global Production – A Handbook for Strategy and Implementation, Springer 2008

Course: Global Production and Logistics - Part 2: Global Logistics [2149600]

Coordinators: Kai Furmans
Part of the modules: SP 38: Production Systems (p. 178)[SP_38_mach]

ECTS Credits	Hours per week	Term	Instruction language
4	2	Winter term	de

Learning Control / Examinations
oral / written (if necessary) => (see “Studienplan Maschinenbau”, version of 7.7.2010)

Conditions
Prerequisites: “Logistics – Organisation, Design and Control of Logistics Systems”.

Recommendations
none

Learning Outcomes
The student

- will have sound knowledge about planning and operations of global supply chains and will be able to use simple models for planning,
- will be familiar with the requirements and characteristics of global trade and transport.

Content
Characteristics of global trade

- Incoterms
- Customs clearance, documents and export control

Global transport and shipping

- Maritime transport, esp. container handling
- Air transport

Modeling of supply chains

- SCOR model
- Value stream analysis

Location planning in cross-border-networks

- Application of the Warehouse Location Problem
- Transport Planning

Inventory Management in global supply chains

- Stock keeping policies

Inventory management considering lead time and shipping costs

Media
presentations, black board

Literature
Elective literature:

- Arnold/Isermann/Kuhn/Tempelmeier. HandbuchLogistik, Springer Verlag, 2002 (Neuauflage in Arbeit)
- Domschke. Logistik, Rundreisen und Touren,Oldenbourg Verlag, 1982

- Domschke/Drexl. Logistik, Standorte, OldenbourgVerlag, 1996
- Gudehus. Logistik, Springer Verlag, 2007
- Neumann-Morlock. Operations-Research,Hanser-Verlag, 1993
- Tempelmeier. Bestandsmanagement in SupplyChains, Books on Demand 2006
- Schönsleben. IntegralesLogistikmanagement, Springer, 1998

Remarks
none

Course: Size effects in micro and nanostructures materials [2181744]

Coordinators: Peter Gumbsch, Daniel Weygand, Christoph Eberl, Patric Gruber, Martin Dienwiebel
Part of the modules: SP 26: Materials Science and Engineering (p. 175)[SP_26_mach]

ECTS Credits	Hours per week	Term	Instruction language
4	2	Winter term	de

Learning Control / Examinations
oral exam 30 minutes

Conditions
compulsory preconditions: none

Learning Outcomes
The student will be confronted to the limits of classical material behaviour, observed in nano and micrometer sized structured materials. New processing routes, experimental testing methods and modelling tools will be presented.

Content
Modern topics in the mechanics of materials are presented.

1. Nanotubes
* production routes, properties
* application
2. cermics
* defect statistics
3. size effect in metallic structures
* thin film mechanics
* micro pillar
* modelling:
discrete dislocation dynamic
4. nanocontact:
* gecko
* hierachical structures
5. nanotribology
* contact, friction: simple and multiple contacts
* radio nucleid technique

Literature
Folien

Course: Fundamentals of Energy Technology [2130927]

Coordinators: DanGabriel Cacuci, Florin Badea
Part of the modules: SP 15: Fundamentals of Energy Technology (p. 171)[SP_15_mach]

ECTS Credits	Hours per week	Term	Instruction language
8	4	Summer term	

Learning Control / Examinations

Conditions

None.

Learning Outcomes

Content

Course: Automotive Engineering I [2113805]

Coordinators: Frank Gauterin, Hans-Joachim Unrau
Part of the modules: SP 10: Engineering Design (p. 166)[SP_10_mach], SP 12: Automotive Technology (p. 168)[SP_12_mach], SP 48: Internal Combustion Engines (p. 180)[SP_48_mach]

ECTS Credits	Hours per week	Term	Instruction language
8	4	Winter term	de

Learning Control / Examinations
Verbally

Duration: 45 up to 60 minutes

Auxiliary means: none

Conditions
None.

Recommendations
None.

Learning Outcomes
The students know the movements and the forces at the vehicle and are familiar with active and passive security. They have proper knowledge about operation of engines and alternative drives, the necessary transmission between engine and drive wheels and the power distribution. They have an overview of the components necessary for the drive and the calculation methods for sizing. They are able to lay out the appropriate modules of a vehicle.

Content
1. Driving mechanics: Driving resistances and driving performances, mechanics of the longitudinal and transverse forces, collision mechanics

2. Engine: Classification, comparison processes, real processes, waste gas emission, alternative drives

3. Transmission: Clutches (e.g. friction clutch, visco clutch), transmission (e.g. mechanical transmission, hydraulic fluid transmission)

4. Power transmission and distribution: drive shafts, cardon joints, differentials

Literature
1. Reimpell, J.: Fahrwerktechnik: Fahrzeugmechanik, Vogel Verlag, 1992

2. Braes, H.-H.; Seiffert, U.: Handbuch Kraftfahrzeugtechnik, Vieweg&Sohn Verlag, 2005

3. Gnadler, R.: Script to the lecture 'Automotive Engineering I'

Course: Automotive Engineering II [2114835]

Coordinators: Frank Gauterin, Hans-Joachim Unrau
Part of the modules: SP 12: Automotive Technology (p. 168)[SP_12_mach], SP 48: Internal Combustion Engines (p. 180)[SP_48_mach]

ECTS Credits	Hours per week	Term	Instruction language
4	2	Summer term	de

Learning Control / Examinations
Oral Examination

Duration: 30 up to 40 minutes

Auxiliary means: none

Conditions
None.

Recommendations
None.

Learning Outcomes
The students have an overview of the modules, which are necessary for the road holding of a motor vehicle and the power transmission between vehicle bodywork and roadway. They have knowledge of different wheel suspensions, the tyres, the steering elements and the brakes. They know different execution forms, the function and the influence on the driving or brake behavior. They are able to construct the appropriate components correctly.

Content
1. Chassis: Wheel suspensions (rear axles, front axles, kinematics of axles), tyres, springs, damping devices
2. Steering elements: Steering elements of single vehicles and of trailers
3. Brakes: Disc brake, drum brake, retarder, comparison of the designs

Literature
1. Reimpell, J.: Fahrwerktechnik: Grundlagen, Vogel Verlag, 1995
2. Burckhardt, M.: Bremsdynamik und Pkw-Bremsanlagen, Vogel Verlag, 1991
3. Gnadler, R.: Script to the lecture 'Automotive Engineering II'

Course: Grundlagen der Herstellungsverfahren der Keramik und Pulvermetallurgie [2193010]

Coordinators: Rainer Oberacker
Part of the modules: SP 26: Materials Science and Engineering (p. 175)[SP_26_mach]

ECTS Credits	Hours per week	Term	Instruction language
4	2	Winter term	de

Learning Control / Examinations
oral;
duration: 30 minutes
KeineHilfe;

Conditions
None.

Learning Outcomes
The lecture is focused on basic aspects of powder technology used in ceramic and powder metallurgy (PM) processing. Learning target: Detailed skills of system- and process parameters which control shaping of
-dry powders
-pasts
-suspensions

Content
Overview on the ceramic/PM fabrication process
Materials produced by powder based technologies
Powder characteristics and powder characterization
Shaping by dry pressing
Control and shaping of powder supensions and pasts

Literature
Brook, R. J.: Processing of Ceramics I+II, VCH Weinheim, 1996

German, R.M.: Powder Metallurgy Science, Metal Powder Ind. Fed., 1994

Thümmler, F., Oberacker, R.: Introduction to Powder Metallurgy,
Inst. of Materials, London, 1993

Course: Fundamentals of catalytic exhaust gas aftertreatment [2134138]

Coordinators: Egbert Lox
Part of the modules: SP 12: Automotive Technology (p. 168)[SP_12_mach], SP 24: Energy Converting Engines (p. 174)[SP_24_mach], SP 48: Internal Combustion Engines (p. 180)[SP_48_mach]

ECTS Credits	Hours per week	Term	Instruction language
4	2	Summer term	de

Learning Control / Examinations
oral examination, Duration: 40 min., no auxiliary means

Conditions
none

Recommendations
Combustion Engines A or B helpful

Learning Outcomes
The student get an overview over the scientific fundamentals of the catalytic exhaust gas aftertreatment, as well as the technical, political and economical parameters of its application in engines for passenger cars and HD vehicles.

At first the students find out which emissions are formed in combustion engines, why these emissions are helth-related critical and which measures the legislator has established to reduce the emissions.

In the following the assembly of an exhaust gas aftertreatment system is explained.

The economic conditions of this technology are discussed regarding prices and treatment of noble metals.

Content
1. kind and source of emissions
2. emission legislation
3. principal of catalytic exhaust gas aftertreatment (EGA)
4. EGA at stoichiometric gasoline engines
5. EGA at gasoline engines with lean mixtures
6. EGA at diesel engines
7. economical basic conditions for catalytic EGA

Literature
Lecture notes available in the lectures

1. "Environmental Catalysis" Edited by G.Ertl, H. Knötzinger, J. Weitkamp Wiley-VCH Verlag GmbH, Weinheim, 1999 ISBN 3-527-29827-4
2. "Cleaner Cars- the history and technology of emission control since the 1960s" J. R. Mondt Society of Automotive Engineers, Inc., USA, 2000 Publication R-226, ISBN 0-7680-0222-2
3. "Catalytic Air Pollution Control - commercial technology" R. M. Heck, R. J. Farrauto John Wiley & Sons, Inc., USA, 1995 ISBN 0-471-28614-1
4. "Automobiles and Pollution" P. Degobert Editions Technic, Paris, 1995 ISBN 2-7108-0676-2
5. "Reduced Emissions and Fuel Consumption in Automobile Engines" F. Schaeder, R. van Basshuysen, Springer Verlag Wien New York, 1995 ISBN 3-211-82718-8
6. "Autoabgaskatalysatoren : Grudlagen - Herstellung - Entwicklung - Recycling - Ökologie" Ch. Hagelüken und 11 Mitautoren, Expert Verlag, Renningen, 2001 ISBN 3-8169-1932-4

Course: Foundations of nonlinear continuum mechanics [2181720]

Coordinators: Marc Kamlah
Part of the modules: SP 13: Strength of Materials/ Continuum Mechanics (p. 170)[SP_13_mach]

ECTS Credits	Hours per week	Term	Instruction language
4	2	Winter term	de

Learning Control / Examinations
oral exam 30 minutes

Conditions
Engineering Mechanics - Advanced Mathematics

Learning Outcomes
General kinematics of large deformations, general structure of continuum theories

Content
* Mathematical foundations: tensor algebra, tensor analysis
* Kinematics: motion, derformation and strains at large deformations, geometrical linearization
* Balance laws: general structure of balance laws, balance laws of continuum mechanics
* Special theories of continuum mechanics

Literature
lecture notes

Course: Basics of Technical Logistics [2117095]

Coordinators: Martin Mittwollen, Linsel
Part of the modules: SP 05: Calculation Methods in Mechanical Engineering (p. 162)[SP_05_mach], SP 44: Technical Logistics (p. 179)[SP_44_mach]

ECTS Credits	Hours per week	Term	Instruction language
6	4	Winter term	de

Learning Control / Examinations
after each lesson period; oral / written (if necessary) => (look at “Studienplan Maschinenbau”, version of 7.7.2010)

Conditions
None.

Recommendations
None.

Learning Outcomes
The student:

- knows about processes and machines of technical logistics
- is able to handle fundamental structures and the impacts
- is able to refer to industrially used machines and
- practices the calculation on applying knowledge from lessons.

Content
Bases effect model of conveyor machines made for the change of position and orientation; conveyor processes; identification systems; drives; mechanical behaviour of conveyors; structure and function of conveyor machines; elements of intralogistics (belt conveyor, racks, automatic guided vehicles, fan-in, bifurcation)
sample applications and calculations in addition to the lectures inside practical lectures

Media
supplementary sheets,projector, blackboard

Literature
Recommendations during lessons

Course: Fundmentals of Combustion I [2165515]

Coordinators: Ulrich Maas
Part of the modules: SP 24: Energy Converting Engines (p. 174)[SP_24_mach]

ECTS Credits	Hours per week	Term	Instruction language
4	2	Winter term	de

Learning Control / Examinations
Oral
Duration: 30 min.

Conditions
None

Recommendations
None

Learning Outcomes
Based on the explanation of the fundamental concepts and observed phenomena in combustion, this lecture studies the experimental analysis and the mathematical description of laminar and turbulent flames. The lecture aims at giving insights in the fundamental physico-chemical processes during combustion, in particular with regard to technical combustion systems e.g. engines, gas turbines, furnaces.

Content
Fundamental concepts ans phenomena
Experimental analysis of flames
Conservation equations for laminar flat flames
Thermodynamics of combustion processes
Transport phenomena
Chemical reactions
Chemical kinetics mechanisms
Laminar premixed flames
Laminar diffusion flames

Media
Blackboard and Powerpoint presentation

Literature
Lecture notes,
Combustion - Physical and Chemical Fundamentals, Modeling and Simulation, Experiments, Pollutant Formation, authors: U. Maas, J. Warnatz, R.W. Dibble, Springer-Lehrbuch, Heidelberg 1996

Course: Fundamentals of combustion II [2166538]

Coordinators: Ulrich Maas
Part of the modules: SP 48: Internal Combustion Engines (p. 180)[SP_48_mach], SP 15: Fundamentals of Energy Technology (p. 171)[SP_15_mach], SP 24: Energy Converting Engines (p. 174)[SP_24_mach]

ECTS Credits	Hours per week	Term	Instruction language
4	2	Summer term	de

Learning Control / Examinations
Oral
Duration: 30 min.

Conditions
None

Recommendations
None

Learning Outcomes
Based on the contents of the lecture "Fundamentals of Combustion I", this lecture studies particular issues such as ignition processes, engine knock and pollutant formation.

Content
Ignition processes
Three dimensional Navier-Stokes equations for reacting flows
Tubulent reactive flows
Turbulent non-premixed flames
Turbulent premixed flames
Combustion of liquid and solid fuels
Engine knock
NOx formation
Formation of hydrocarbons and soot

Media
Blackboard and Powerpoint presentation

Literature
Lecture notes;
Combustion - Physical and Chemical Fundamentals, Modeling and Simulation,Experiments, Pollutant Formation; Authors: U. Maas, J. Warnatz, R.W. Dibble, Springer; Heidelberg, Karlsruhe, Berkley 2006

Course: Basics of Ground Born Guided Systems [19066]

Coordinators: Eberhard Hohnecker, Peter Gratzfeld, Hohnecker
Part of the modules: SP 50: Rail System Technology (p. 181)[SP_50_mach]

ECTS Credits	Hours per week	Term	Instruction language
4	3	Summer term	de

Learning Control / Examinations

- Oral examination
- Duration: 20 minutes
- No tools or reference materials may be used during the exam.

Conditions
none

Recommendations
none

Learning Outcomes
The students know the complexity of "Ground Borne Guided Systems".

Content

- Definitions
- Track guidance and vehicle dynamics
- Vehicles
- Alignment and layout of lines
- Track construction

Media
All slides can be bought.

Literature
Zilch, Diederichs, Katzenbach (Hrsg.): Handbuch für Bauingenieure, Springer-Verlage 2001

Course: Basics and Methods for Integration of Tires and Vehicles [2114843]

Coordinators: Günter Leister
Part of the modules: SP 12: Automotive Technology (p. 168)[SP_12_mach]

ECTS Credits	Hours per week	Term	Instruction language
4	2	Summer term	

Learning Control / Examinations
Oral Examination

Duration: 30 up to 40 minutes

Auxiliary means: none

Conditions
Knowledge in automotive engineering

Learning Outcomes
The students are informed about the interactions of tires, chassis and road. They have an overview of the processes regarding the tire development. They have knowledge of the physical relationships.

Content
1. The role of the tire in a vehicle
2. Tire geometrie, Package and load capacity, Book of requirement
3. Mobility strategy, Minispare, runflat systems and repair kit.
4. Project management: Costs, weight, planning, documentation
5. Tire testing and tire properties: Forces and Moments
6. Tire modes and sound
7. Tire presssure: Indirect and direct measuring systems
8. Tire testing subjective and objective

Literature
Manuscript to the lecture

Course: Fundamentals for Design of Motor-Vehicles Bodies I [2113814]

Coordinators: Horst Dietmar Bardehle
Part of the modules: SP 10: Engineering Design (p. 166)[SP_10_mach], SP 12: Automotive Technology (p. 168)[SP_12_mach]

ECTS Credits	Hours per week	Term	Instruction language
2	1	Winter term	de

Learning Control / Examinations
Oral examination

Duration: 30 minutes

Auxiliary means: none

Conditions
None.

Recommendations
None.

Learning Outcomes
The students have an overview of the fundamental possibilities for design and manufacture of motor-vehicle bodies. They know the complete process, from the first idea, through the concept to the dimensioned drawings (e.g. with FE-methods). They have knowledge about the fundamentals and their correlations, so that the design of relevant assemblies can be performed to the required demands.

Content
1. History and design

2. Aerodynamics

3. Design methods (CAD/CAM, FEM)

4. Manufacturing methods of body parts

5. Fastening technologie

6. Body in white / body production, body surface

Literature
1. Automobiltechnische Zeitschrift ATZ, Friedr. Vieweg & Sohn Verlagsges. mbH, Wiesbaden
2. Automobil Revue, Bern (Schweiz)
3. Automobil Produktion, Verlag Moderne Industrie, Landsberg

Course: Fundamentals for Design of Motor-Vehicles Bodies II [2114840]

Coordinators: Horst Dietmar Bardehle
Part of the modules: SP 10: Engineering Design (p. 166)[SP_10_mach], SP 12: Automotive Technology (p. 168)[SP_12_mach]

ECTS Credits	Hours per week	Term	Instruction language
2	1	Summer term	de

Learning Control / Examinations
Oral examination

Duration: 30 minutes

Auxiliary means: none

Conditions
None.

Recommendations
None.

Learning Outcomes
The students know that, often the design of seemingly simple detail components can result in the solution of complex problems. They have knowledge in testing procedures of body properties. They have an overview of body parts such as bumpers, window lift mechanism and seats. They understand, as well as, parallel to the normal electrical system, about the electronic side of a motor vehicle. They have knowledge in project management.

Content
1. Body properties/testing procedures

2. External body-parts

3. Interior trim

4. Compartment air conditioning

5. Electric and electronic features

6. Crash tests

7. Project management aspects, future prospects

Literature
1. Automobiltechnische Zeitschrift ATZ, Friedr. Vieweg & Sohn Verlagsges. mbH,
Wiesbaden
2. Automobil Revue, Bern (Schweiz)
3. Automobil Produktion, Verlag Moderne Industrie, Landsberg

Course: Fundamentals in the Development of Commercial Vehicles I [2113812]

Coordinators: Jörg Zürn
Part of the modules: SP 10: Engineering Design (p. 166)[SP_10_mach], SP 12: Automotive Technology (p. 168)[SP_12_mach]

ECTS Credits	Hours per week	Term	Instruction language
2	1	Winter term	de

Learning Control / Examinations
Oral examination

Duration: 30 minutes

Auxiliary means: none

Conditions
None.

Recommendations
None.

Learning Outcomes
The students have proper knowledge about the process of commercial vehicle development starting from the concept and the underlying original idea to the real design. They know that the customer requirements, the technical realisability, the functionality and the economy are important drivers.
The students are able to develop parts and components. Furthermore they have knowledge about different cap concepts, the interior and the interior design process.

Content
1. Introduction, definitions, history
2. Development tools
3. Complete vehicle
4. Cab, bodyshell work
5. Cab, interior fitting
6. Alternative drive systems
7. Drive train
8. Drive system diesel engine
9. Intercooled diesel engines

Literature
1. Marwitz, H., Zittel, S.: ACTROS – die neue schwere Lastwagenbaureihe von Mercedes-Benz, ATZ 98, 1996, Nr. 9

2. Alber, P., McKellip, S.: ACTROS – Optimierte passive Sicherheit, ATZ 98, 1996

3. Morschheuser, K.: Airbag im Rahmenfahrzeug, ATZ 97, 1995, S. 450 ff.

Course: Fundamentals in the Development of Commercial Vehicles II [2114844]

Coordinators: Jörg Zürn
Part of the modules: SP 10: Engineering Design (p. 166)[SP_10_mach], SP 12: Automotive Technology (p. 168)[SP_12_mach]

ECTS Credits	Hours per week	Term	Instruction language
2	1	Summer term	de

Learning Control / Examinations
Oral examination

Duration: 30 minutes

Auxiliary means: none

Conditions
None.

Recommendations
None.

Learning Outcomes
The students are able to create general vehicle concepts tailored for different areas of application. They know the advantages and disadvantages of different drives. Furthermore they are familiar with components, such as transfer box, propeller shaft, powered and non-powered frontaxle etc. Beside other mechanical components, such as chassis, axle suspension and braking system, also electric and electronic systems are known.

Content
1. Gear boxes of commercial vehicles
2. Intermediate elements of the drive train
3. Axle systems
4. Front axles and driving dynamics
5. Chassis and axle suspension
6. Braking System
7. Systems
8. Excursion

Literature
1. Schittler, M., Heinrich, R., Kerschbaum, W.: Mercedes-Benz Baureihe 500 – neue V-Motorengeneration für schwere Nutzfahrzeuge, MTZ 57 Nr. 9, S. 460 ff., 1996

2. Robert Bosch GmbH (Hrsg.): Bremsanlagen für Kraftfahrzeuge, VDI-Verlag, Düsseldorf, 1. Auflage, 1994

3. Rubi, V., Strifler, P. (Hrsg. Institut für Kraftfahrwesen RWTH Aachen): Industrielle Nutzfahrzeugentwicklung, Schriftenreihe Automobiltechnik, 1993

Course: Fundamentals of Automobile Development I [2113810]

Coordinators: Rolf Frech
Part of the modules: SP 10: Engineering Design (p. 166)[SP_10_mach], SP 12: Automotive Technology (p. 168)[SP_12_mach]

ECTS Credits	Hours per week	Term	Instruction language
2	1	Winter term	de

Learning Control / Examinations
Written examination

Duration: 90 minutes

Auxiliary means: none

Conditions
None.

Recommendations
None.

Learning Outcomes
The students have an overview of the fundamentals of the development of automobiles. They know the development process, the national and the international legal requirements that are to be met. They have knowledge about the thermo-management, aerodynamics and the design of an automobile.

Content
1. Process of automobile development
2. Conceptual dimensioning and design of an automobile
3. Laws and regulations – National and international boundary conditions
4. Aero dynamical dimensioning and design of an automobile I
5. Aero dynamical dimensioning and design of an automobile II
6. Thermo-management in the conflict of objectives between styling, aerodynamic and packaging guidelines I
7. Thermo-management in the conflict of objectives between styling, aerodynamic and packaging guidelines II

Literature
The scriptum will be provided during the first lessons

Course: Fundamentals of Automobile Development II [2114842]

Coordinators: Rolf Frech
Part of the modules: SP 10: Engineering Design (p. 166)[SP_10_mach], SP 12: Automotive Technology (p. 168)[SP_12_mach]

ECTS Credits	Hours per week	Term	Instruction language
2	1	Summer term	de

Learning Control / Examinations
Written examination

Duration: 90 minutes

Auxiliary means: none

Conditions
None.

Recommendations
None.

Learning Outcomes
The students are familiar with the selection of appropriate materials and the choice of adequate production technology. They have knowledge of the acoustical properties of the automobiles, covering both the interior sound and exterior noise. They have an overview of the testing procedures of the automobiles. They know in detail the evaluation of the properties of the complete automobile.

Content
1. Application-oriented material and production technology I
2. Application-oriented material and production technology II
3. Overall vehicle acoustics in the automobile development
4. Drive train acoustics in the automobile development
5. Testing of the complete vehicle
6. Properties of the complete automobile
7. Excursion

Literature
The scriptum will be provided during the first lessons.

Course: Advanced Methods in Strength of Materials [2161252]

Coordinators: Thomas Böhlke
Part of the modules: SP 07: Dimensioning and Validation of Mechanical Constructions (p. 164)[SP_07_mach], SP 05: Calculation Methods in Mechanical Engineering (p. 162)[SP_05_mach], SP 13: Strength of Materials/ Continuum Mechanics (p. 170)[SP_13_mach]

ECTS Credits	Hours per week	Term	Instruction language
4	2	Winter term	de

Learning Control / Examinations
depending on choice according to acutal version of study regulations
Additives as announced

Conditions
None.

Recommendations
None.

Learning Outcomes
The students can effectively apply the methods of advanced strength of materials. The students especially master the description of the strength characteristics of materials, the elastic, plastic and the hardening behaviour of metallic materials. The students can apply the failure description by deformation localization, damage or fracture. The students know the basics of bearing structures.

Content

- basics of tensor calculus
- elasticity theory
- application of elasticity: linear elastic fracture mechanics
- application of elasticity: bearing structures
- plasticity theory
- application of plasticity: stability of materials

Literature
Gummert, P.; Reckling, K.-A.: Mechanik. Vieweg 1994. Gross, D.; Seelig, T.: Bruchmechanik. Springer 2002. Hibbeler, R.C: Technische Mechanik 2 - Festigkeitslehre. Pearson Studium 2005. Parkus, H.: Mechanik der festen Körper. Springer 1988.

Course: [23321]

Coordinators: Martin Doppelbauer
Part of the modules: SP 12: Automotive Technology (p. 168)[SP_12_mach], SP 02: Powertrain Systems (p. 161)[SP_02_mach], SP 31: Mechatronics (p. 177)[SP_31_mach]

ECTS Credits	Hours per week	Term	Instruction language
4	2+1	Winter term	de

Learning Control / Examinations

Conditions

None.

Learning Outcomes

Content

Course: Hydraulic Fluid Machinery I (Basics) [2157432]

Coordinators: Martin Gabi
Part of the modules: SP 24: Energy Converting Engines (p. 174)[SP_24_mach], SP 15: Fundamentals of Energy Technology (p. 171)[SP_15_mach]

ECTS Credits	Hours per week	Term	Instruction language
8	4	Winter term	de

Learning Control / Examinations
Oral examination
Duration: 30 minutes
No tools or reference materials may be used during the exam.

Conditions
none

Recommendations
none

Learning Outcomes
The lecture introduces the basics of Hydraulic Fluid Machinery (pumps, fans, water- and wind-turbines, hydrodynamic transmissions). The different types and shapes are presented. The basic equations for the preservation of mass, momentum and energy are discussed. Velocity schemes in typical cascades are shown, the Euler equation of fluid machinery and performance characteristics are deduced.
Similarities and dimensionless parameters are discussed. Fundamental aspects of operation and cavitation are shown.

Content
1. Introduction
2. Basic equations
3. System analysis
4. Elementary Theory (Euler's equation of Fluid Machinery)
5. Operation and Performance Characteristics
6. Similarities, Specific Values
7. Control technics
8. Wind Turbines, Propellers
9. Cavitation
10. Hydrodynamic transmissions and converters

Literature

1. Fister, W.: Fluidenergiemaschinen I & II, Springer-Verlag
2. Bohl, W.: Strömungsmaschinen I & II . Vogel-Verlag
3. Gülich, J.F.: Kreiselpumpen, Springer-Verlag
4. Pfleiderer, C.: Die Kreiselpumpen. Springer-Verlag
5. Carolus, T.: Ventilatoren. Teubner-Verlag
6. Kreiselpumpenlexikon. KSB Aktiengesellschaft
7. Zierep, J., Bühler, K.: Grundzüge der Strömungslehre. Teubner-Verlag

Course: Hydraulic Fluid Machinery II [2158105]

Coordinators: Saban Caglar, Martin Gabi
Part of the modules: SP 24: Energy Converting Engines (p. 174)[SP_24_mach], SP 15: Fundamentals of Energy Technology (p. 171)[SP_15_mach]

ECTS Credits	Hours per week	Term	Instruction language
4	2	Summer term	de

Learning Control / Examinations
Oral examination
Duration: 30 minutes
No tools or reference materials may be used during the exam.

Conditions
Hydraulic Fluid Machinery I (Basics)

Recommendations
none

Learning Outcomes
Based on the lecture Fluid Machinery I (Basics, Prof. Gabi) aspects of operation characteristics and design of pumps, fans and turbines are discussed.

Content
Rotodynamic pumps and fans of different types of construction
Water turbines
Wind turbines
Hydrodynamic drives

Literature

1. Fister, W.: Fluidenergiemaschinen I & II, Springer-Verlag
2. Siegloch, H.: Strömungsmaschinen, Hanser-Verlag
3. Pfleiderer, C.: Kreiselpumpen, Springer-Verlag
4. Carolus, T.: Ventilatoren, Teubner-Verlag
5. Bohl, W.: Ventilatoren, Vogel-Verlag
6. Raabe, J.: Hydraulische Maschinen, VDI-Verlag
7. Wolf, M.: Strömungskupplungen, Springer-Verlag
8. Hau, E.: Windkraftanlagen, Springer-Verlag

Course: Industrial aerodynamics [2153425]

Coordinators: Thomas Breitling
Part of the modules: SP 12: Automotive Technology (p. 168)[SP_12_mach]

ECTS Credits	Hours per week	Term	Instruction language
4	2	Winter term	de

Learning Control / Examinations
oral

Duration: 30 minutes

no auxiliary means

Conditions
None.

Learning Outcomes
This compact lecture deals with flow, mixing and combustion phenomena with significance in vehicle development. A special focus is set on the optimization of external car and truck aerodynamics, thermal comfort in passenger compartments, analyses of cooling flows and improvement of charge motion, mixing and combustion in piston engines.
These fields are explained in their phenomenology, the corresponding theories are discussed and the tools for measurement and simulation are introduced and demonstrated.
The focus of this lecture is on industry relevant methods for analyses and description of forces, flow structures, turbulence, flows with heat transfer and phase transition and reactive flows. In addition an introduction to modern methods in accuracy control and efficiency improvement of numerical methods for industrial use is given.
The integration and interconnection of the methods in the development processes are discussed examplaryly.
An excursion to the DaimlerChrysler wind tunnel and the research and development centers is planned.

Content
Einführung

Industriell eingesetzte Strömungsmeßtechnik

Strömungssimulation in der Industrie, Kontrolle des numerischen Fehlers und verwendete Turbulenzmodelle

Kühlströmungen

Strömung, Gemischbildung und Verbrennung bei direkteinspritzenden Dieselmotoren

Strömung, Gemischbildung und Verbrennung bei Ottomoten

Fahrzeugumströmung

Klimatisierung/Thermischer Komfort

Aeroakustik

Aerodynamik und Höchstleistungsrechnen

Literature
keine Angabe

Course: Information Systems in Logistics and Supply Chain Management [2118094]

Coordinators: Christoph Kilger
Part of the modules: SP 17: Information Management (p. 172)[SP_17_mach], SP 18: Information Technology (p. 173)[SP_18_mach]

ECTS Credits	Hours per week	Term	Instruction language
4	2	Summer term	de

Learning Control / Examinations
oral / written (if necessary) => (see “Studienplan Maschinenbau”, version of 7.7.2010)
examination aids: none

Conditions
none

Recommendations
none

Learning Outcomes
The student:

- knows information systems for logistics processes
- is able to identify the requirements of a supply chain and choose an appropriate information system.

Content
1) Overview of logistics systems and processes
2) Basic concepts of information systems and information technology
3) Introduction to IS in logistics: Overview and applications
4) Detailed discussion of selected SAP modules for logistics support

Media
presentations

Literature
Stadtler, Kilger: Supply Chain Management and Advanced Planning, Springer, 4. Auflage 2008

Remarks
none

Course: Informationstechnik in der industriellen Automation [23144]

Coordinators: Peter Bort, Bort
Part of the modules: SP 31: Mechatronics (p. 177)[SP_31_mach]

ECTS Credits	Hours per week	Term	Instruction language
3	2	Summer term	

Learning Control / Examinations

Conditions
None.

Learning Outcomes

Content

Course: Informationsverarbeitung in mechatronischen Systemen [2105022]

Coordinators: Michael Kaufmann
Part of the modules: SP 18: Information Technology (p. 173)[SP_18_mach]

ECTS Credits	Hours per week	Term	Instruction language
3	2	Winter term	

Learning Control / Examinations

Conditions
None.

Learning Outcomes

Content

Course: Information Processing in Sensor Networks [24102]

Coordinators: Uwe Hanebeck, Hanebeck
Part of the modules: SP 18: Information Technology (p. 173)[SP_18_mach]

ECTS Credits	Hours per week	Term	Instruction language
4	3	Winter term	

Learning Control / Examinations

Conditions
None.

Learning Outcomes

Content

Course: Integrated measurement systems for fluid mechanics applications [2171486]

Coordinators: Klaus Dullenkopf, Mitarbeiter
Part of the modules: SP 15: Fundamentals of Energy Technology (p. 171)[SP_15_mach]

ECTS Credits	Hours per week	Term	Instruction language
4	5	Winter / Summer Term	de

Learning Control / Examinations
Group colloquia for each topic

Duration: approximentely 10 minutes

no tools or reference materials may be used

Conditions
none

Learning Outcomes
This course provides the opportunity to gain both a theoretical and practical understanding of the fundamentals of computer aided measurements. Each section includes a PC exercise.

Content
The laboratory course offers an introduction into the acquisition of basic test data in fluid mechanics applications as well as a basic hands-on training for the application of modern PC based data acquisition methods. The combination of lectures about measurement techniques, sensors, signal converters, I/O systems, bus systems, data acquisition, handling and control routines and tutorials for typical fluid mechanics applications allows the participant to get a comprehensive insight and a sound knowledge in this field. The graphical programming environment LabVIEW from National Instruments is used in this course as it is one of the standard software tools for data acquisition worldwide.
Basic design of measurements systems

- Logging devices and sensors
- Analog to digital conversion
- Program design and programming methods using LabView
- Data handling
- Bus systems
- Design of a computer aided data acquisition system for pressure, temperature and derived parameters
- frequency analysis

Literature
Germer, H.; Wefers, N.: Meßelektronik, Bd. 1, 1985
LabView User Manual
Hoffmann, Jörg: Taschenbuch der Messtechnik, 6., aktualisierte. Aufl. , 2011

Remarks
Registration during the lecture period via the website.

Course: Integrated production planning [2150660]

Coordinators: Gisela Lanza
Part of the modules: SP 38: Production Systems (p. 178)[SP_38_mach]

ECTS Credits	Hours per week	Term	Instruction language
8	4	Summer term	de

Learning Control / Examinations
Performance is assessed in the form of one written examination during the lecture-free period. The examination will take place once every semester and can be retaken at every official examination date.

Conditions
None.

Learning Outcomes
The student
• has knowledge of the content covered by this lecture and understands the challenges and the fields of action of integrated production planning,
• is able to apply the methods of integrated production planning he/she has learned about to new problems,
• is able to analyse and evaluate the suitability of the methods, procedures and techniques he/she has learned about for a specific problem.

Content
Planning factories within the context of value networks and integrated production systems (Toyota etc.) requires an integrated perspective for the consideration of all functions included in the “factory” system. This includes the planning of manufacturing systems including the product, the value network and factory production, and the examination of SOPs, the running of a factory and maintenance. Content and theory covered by this lecture are completed with many examples from industry and exercises based on real-life situations and conditions.
Main topics covered by the lecture:
1. The basic principles of production planning
2. Links between product planning and production planning
3. Integrating a production site into a production network
4. Steps and methods of factory planning
5. Approach to the integrated planning of manufacturing and assembly plants
6. Layout of production sites
7. Maintenance
8. Material flow
9. Digital factory
10. Process simulation for material flow optimisation
11. Start-up

Course: IT for facility logistics [2118083]

Coordinators: Frank Thomas
Part of the modules: SP 02: Powertrain Systems (p. 161)[SP_02_mach], SP 18: Information Technology (p. 173)[SP_18_mach], SP 17: Information Management (p. 172)[SP_17_mach], SP 31: Mechatronics (p. 177)[SP_31_mach], SP 44: Technical Logistics (p. 179)[SP_44_mach]

ECTS Credits	Hours per week	Term	Instruction language
6	4	Summer term	de

Learning Control / Examinations
oral / written (if necessary) => (see "Studienplan Maschinenbau", version of 7.7.2010)

examination aids: none

Conditions
None.

Recommendations
None.

Learning Outcomes
The student:

- knows automation technologie for material flow and the information technology necessary,
- knows how to handle risks of failure,
- knows practical implementations and is able to use his knowledfe for exercises.

Content
This lecture, with exercises, treats automation technology in material flow as well as the information technology that has a direct relationship with it. In the first few chapters, an overview is given of the motors and conveying technology elements used in materials handling, and the sensors required for the purpose are explained. The target control types as well as the topic of coding techniques (barcodes etc) are treated in detail. Material flow controls are defined based on
these chapters. Among other things, the functions of a stored-memory controller are explained in this section. Hierarchically classified control structures and
their integration in network structures are considered in detail. The principles of communications systems (bus systems etc.) are supplemented with information on
the use of the Internet as well as data warehousing strategies. An overview of modern logistics systems, especially in stores administration, illustrates new
problem solution strategies in the area of information technology for logistics systems. After an analysis of the causes for system failures, measures are worked
out for reducing the risks of failure. Furthermore, the objectives, task areas as well as various scheduling strategies in the area of transport management and
control are presented. Worthwhile information on Europe-wide logistics concepts round off this practice-oriented lecture series.
The presentation of the lectures will be multimedia-based. Exercises repeat and extend the knowledge principles imparted in the lectures and illustrate the
subject with practical examples.

- Electrical drives (DC, AC asynchronous, EC, linear motors)
- Contact-less proximity switches (inductive, capacitive, optical, acoustic)
- Coding technology (target controllers, codes, laser, CCD sensors, reading techniques, mobile data media)
- Material flow control (stored-program controllers, material flow controllers, flexible information systems)

- Communications systems (principles, bus systems, Internet, Data Warehouse)
- Material flow control and administration systems (stores administration, failure safety and data storage)
- Transport management (objectives, components, tasks, task areas, scheduling strategies, stacking management systems)
- Euro-logistics

Literature
Detailed script available from Script Sales, updated and enhanced annually.
CD-ROM with PowerPoint presentation of the lectures and exercises at the end of the semester available from the lecturer, updated and enhanced annually.

Remarks
none

Course: Nuclear Energy [2130921]

Coordinators: DanGabriel Cacuci, Florin Badea
Part of the modules: SP 15: Fundamentals of Energy Technology (p. 171)[SP_15_mach]

ECTS Credits	Hours per week	Term	Instruction language
4	2	Summer term	

Learning Control / Examinations

Conditions
None.

Learning Outcomes

Content

Course: Cogitive Automobiles - Laboratory [2138341]

Coordinators: Christoph Stiller, Martin Lauer, Bernd Kitt
Part of the modules: SP 44: Technical Logistics (p. 179)[SP_44_mach]

ECTS Credits	Hours per week	Term	Instruction language
3	2	Summer term	de

Learning Control / Examinations
Colloquia, final race

Conditions
Lectures "Automotive Vision" and "Behaviour Generation for Vehicles" have to be attended in parallel. Basic knowledge of a programming language is a plus.

Learning Outcomes
The laboratory accompanies the lectures "Automotive Vision" and "Behaviour Generation for Vehicles". It will provide the opportunity of turning theoretical skills taught in the lecture to practice. The laboratory is divided into four groups with a maximum number of five students in each group. During the lessons you will be supervised by scientific staff.
The lecture addresses students in mechanical engineering and related subjects who intend to get an interdisciplinary knowledge in a state-of-the-art technical domain. Machine vision, vehicle kinematics and advanced information processing techniques are presented to provide a broad overview on "seeing vehicles". Each group is given the task to extract lane markings from video images and generate a suitable trajectory which the vehicle should follow. Apart from technical aspects in a highly innovative field of automotive technology, participants have the opportunity of gathering important qualifications as i.e. implementation skills, acquisition and comprehension of suitable literature, project and team work.

Content
1. Lane recognition
2. Object detection
3. Vehicle lateral control
4. Vehicle longitudinal control
5. Collision avoidance

Literature
TBA

Course: Design with Plastics [2174571]

Coordinators: Christian Bonten
Part of the modules: SP 10: Engineering Design (p. 166)[SP_10_mach], SP 26: Materials Science and Engineering (p. 175)[SP_26_mach]

ECTS Credits	Hours per week	Term	Instruction language
4	2	Summer term	de

Learning Control / Examinations
oral duration: 20 - 30 min. aids: none

Conditions
none, recomm. 'Polymer Engineering I'

Learning Outcomes
In a first step, the students will be enabled to distinguish plastics from other 'classic' materials, like metal, wood and ceramics. They will understand the chemical differences, differences in melt behaviour as well as in solid condition. The students will understand the main plastics processes (injection moulding, extrusion, blow moulding, compression moulding), the main joining techniques (welding, glueing, screws, snapfits) as well as the main rapid prototyping techniques. In the main part of the lecture, the students will get the chance to apply this theoretic background on real plastics parts. The students will be able to discuss plastics parts´ economical production with the variety of plastics processing technologies. Also technological risks and counter measures will be discussed. Additionally, the students will be able to decide the right plastics material, the right manufacturing process as well as the right joining technology. Finally, the students will be able to distinguish between good and bad design of plastics parts.

Content
Structure and properties of polymeric materials, Properties of the solid body and influences on these, Processing of plastics, Design under consideration of load, manufacturing process, material, Calculation of plastic parts, Integration of function and process steps

Literature
Scriptum will be handed out during the lecture. Additional recommendations Bonten: „Kunststofftechnik für Designer“, Bonten: „Produktentwicklung“, Michaeli: 'Introduction into plastics processing“, Gebhardt: „Rapid Prototyping“ (all published at Carl Hanser Publishers)

Course: Design Principles and Materials for High-Temperature Components [2185578]

Coordinators: Wanner et al.
Part of the modules: SP 10: Engineering Design (p. 166)[SP_10_mach], SP 26: Materials Science and Engineering (p. 175)[SP_26_mach], SP 48: Internal Combustion Engines (p. 180)[SP_48_mach]

ECTS Credits	Hours per week	Term	Instruction language
4	4	Winter term	

Learning Control / Examinations

Conditions
None.

Learning Outcomes

Content

Course: Lightweight Engineering Design [2146190]

Coordinators: Albert Albers, Norbert Burkardt

Part of the modules: SP 12: Automotive Technology (p. 168)[SP_12_mach], SP 07: Dimensioning and Validation of Mechanical Constructions (p. 164)[SP_07_mach], SP 10: Engineering Design (p. 166)[SP_10_mach], SP 05: Calculation Methods in Mechanical Engineering (p. 162)[SP_05_mach], SP 09: Dynamic Machine Models (p. 165)[SP_09_mach]

ECTS Credits	Hours per week	Term	Instruction language
4	2	Summer term	de

Learning Control / Examinations
oral examination

Duration:
20 minutes (Bachelor/Master)
Auxiliary means: none

Conditions
None.

Recommendations
None.

Learning Outcomes
Lightweight design is one of the key technologies in material and energy efficiency as well as environmental and climate protection. The lecture covers diversified fundamentals of lightweight design and their context to the product development process and the associated complex interrelations.
Moreover, this lecture is intended to give students a profound understanding in classical and modern leightweight design. Additionally, guest speakers from industry will present lightweight design from an practical point of view.

Content
General aspects of leightweight design, lightweight strategies, construction methods, design principles, lightweight construction, stiffening techniques, lightweight materials, virtual product engineering, bionics, joining techniques, validation, recycling

Media
Beamer

Literature
- Klein, B.: Leichtbau-Konstruktion. Vieweg & Sohn Verlag, 2007
- Wiedemann, J.: Leichtbau: Elemente und Konstruktion, Springer Verlag, 2006
- Harzheim, L.: Strukturoptimierung. Grundlagen und Anwendungen. Verlag Harri Deutsch, 2008

Remarks
Lecture slides are available via eLearning-Platform ILIAS.

Course: Vibration of continuous systems [2161214]

Coordinators: Hartmut Hetzler
Part of the modules: SP 09: Dynamic Machine Models (p. 165)[SP_09_mach], SP 05: Calculation Methods in Mechanical Engineering (p. 162)[SP_05_mach]

ECTS Credits	Hours per week	Term	Instruction language
4	2	Winter term	de

Learning Control / Examinations
oral exam., 30min

Conditions
None.

Learning Outcomes

Content
This lecture is on vibrations of continuous systems. After an introduction into the topic and a definition of basic concepts and calculation approaches, 1-parametric continua (strings, bars) and 2-parametric continua (membranes, plates) are discussed into detailed. Based on these basic models, a brief outlook to more complex geometries is given. Beyond these basis issues more advanced topics (like elastic rotors) are discussed as well.

Literature
Literature recommendations are given in the lecture.

Course: Correlation Methods in Measurement and Control [2137304]

Coordinators: Franz Mesch
Part of the modules: SP 18: Information Technology (p. 173)[SP_18_mach]

ECTS Credits	Hours per week	Term	Instruction language
4	2	Winter term	de

Learning Control / Examinations
Oral examination

Duration: 30 minutes

no reference materials

Conditions

- Fundamentals of the lecture “Measurement and Control Systems”
- Basic background in probability and statistics

Learning Outcomes
Description of temporal stochastic processes, correlation and spectral analysis and corresponding estimation methods.

Content
1. Introduction
2. Stochastic processes
3. Correlation functions and power density spectra of stationary processes
4. Stochastic processes in linear systems
5. Sampling and smoothing
6. Stochastic processes in non-linear systems
7. Estimation of stochastic parameters
8. Optimal linear systems
9. Signal detection
10. Applications in measurement

Literature

- Papoulis, A: Probability, Random Variables, and Stochastic Processes. McGraw-Hill Book

Comp. Newe York, 3. Aufl., 1991

- Brigham, E. O.: The Fast Fourier Transform and its Applications. Prentice-Hall Englewood

Cliffs, New Jersey, 1988

- Umdruck ’Zusammenstellung der wichtigsten Formeln’

Course: Motor Vehicle Laboratory [2115808]

Coordinators: Michael Frey, Mohanad El-Haji
Part of the modules: SP 12: Automotive Technology (p. 168)[SP_12_mach]

ECTS Credits	Hours per week	Term	Instruction language
4	2	Winter / Summer Term	de

Learning Control / Examinations
Colloquium before each experiment
After completion of the experiments: written examination
Duration: 90 minutes
Auxiliary means: none

Conditions
None.

Recommendations
None.

Learning Outcomes
The students have deepen their knowledge on motor vehicles acquired in lectures and can apply it practically. They have an overview of the applied measuring technique and can execute and analyse measurements for the handling of given problem definitions.

Content
1. Determination of the driving resistances of a passenger vehicle on a roller dynamometer; measurement of the engine performance of the test vehicle

2. Investigation of a twin-tube and a single-tube shock absorber

3. Behavior of car tyres under longitudinal forces and lateral forces

4. Behavior of car tires on wet road surface

5. Rolling resistance, energy dissipation and high-speed strength of car tires

6. Investigation of the moment transient characteristic of a Visco clutch

Literature
1. Matschinsky, W: Radführungen der Straßenfahrzeuge, Verlag TÜV Rheinland, 1998

2. Reimpell, J.: Fahrwerktechnik: Fahrzeugmechanik, Vogel Verlag, 1992

3. Gnadler, R.: Documents to the Motor Vehicle Laboratory

Course: Micro manufacturing laboratory [2149670]

Coordinators: Volker Schulze, Christoph Ruhs
Part of the modules: SP 31: Mechatronics (p. 177)[SP_31_mach]

ECTS Credits	Hours per week	Term	Instruction language
4	5	Winter term	de

Learning Control / Examinations
Participate the practicle tests and complete the colloquia successfully.

Conditions
None.

Recommendations
Knowledge in CAD and machining technologies are usefule.

Learning Outcomes
The microproduction technique laboratory teachs basic knowledge in the subject of micro production and of the whole process chain for the manufacturing of smallest parts using molding processes

Content
Following manufacturing technologies will be teached:
Micromilling
Micro-EDM
Microlaserablation
LIGA
Micromolding
Micrometrology
As an example for the process chain, a demonstrator will be designed, developed and produced.

Literature
None.

Course: Warehousing and distribution systems [2118097]

Coordinators: Kai Furmans, Christian Huber
Part of the modules: SP 44: Technical Logistics (p. 179)[SP_44_mach]

ECTS Credits	Hours per week	Term	Instruction language
4	2	Summer term	de

Learning Control / Examinations
oral / written (if necessary) => (see “Studienplan Maschinenbau”, version of 7.7.2010)

Conditions
none

Recommendations
logistics lecture

Learning Outcomes
The student:

- understands material and information processes in warehouse and distribution systems
- he is able to evaluate them quantitatively.

Content

- Control and organisation of distribution centers
- Analytical models for analysing and dimensioning of warehouse systems
- Distribution Center Reference Model (DCRM)
- Lean Distribution
- The processes from receiving to shipping
- Planning and controlling
- Distribution networks

Media
presentations, black board

Literature
ARNOLD, Dieter, FURMANS, Kai (2005)
Materialfluss in Logistiksystemen, 5. Auflage, Berlin: Springer-Verlag
ARNOLD, Dieter (Hrsg.) et al. (2008)
Handbuch Logistik, 3. Auflage, Berlin: Springer-Verlag
BARTHOLDI III, John J., HACKMAN, Steven T. (2008)
Warehouse Science
GUDEHUS, Timm (2005)
Logistik, 3. Auflage, Berlin: Springer-Verlag
FRAZELLE, Edward (2002)
World-class warehousing and material handling, McGraw-Hill
MARTIN, Heinrich (1999)
Praxiswissen Materialflußplanung: Transport, Hanshaben, Lagern, Kommissionieren, Braunschweig, Wiesbaden: Vieweg
WISSER, Jens (2009)
Der Prozess Lagern und Kommissionieren im Rahmen des Distribution Center Reference Model (DCRM); Karlsruhe : Universitätsverlag
A comprehensive overview of scientific papers can be found at:

ROODBERGEN, Kees Jan (2007)
Warehouse Literature

Remarks
none

Course: Laser in automotive engineering [2182642]

Coordinators: Johannes Schneider
Part of the modules: SP 12: Automotive Technology (p. 168)[SP_12_mach], SP 26: Materials Science and Engineering (p. 175)[SP_26_mach]

ECTS Credits	Hours per week	Term	Instruction language
4	2	Summer term	de

Learning Control / Examinations
oral examination (30 min)

no tools or reference materials

Conditions
None.

Recommendations
None.

Learning Outcomes
Based on a short description of the physical basics of laser technology the lecture reviews the most important high power lasers and their various applications in automotive engineering.

Content
physical basics of laser technology

laser beam sources (Nd:YAG-, CO2-, diode-laser)

beam properties, guiding and shaping

basics of materials processing with lasers

laser applications in automotive engineering

economical aspects

savety aspects

Literature
W. M. Steen: Laser Material Processing, 2010, Springer
F. K. Kneubühl, M. W. Sigrist: Laser, 2008, Vieweg+Teubner
H. Hügel, T. Graf: Laser in der Fertigung, 2009, Vieweg+Teubner
R. Poprawe: Lasertechnik für die Fertigung, 2005, Springer
W. T. Silfvast: Laser Fundamentals, 2008, Cambridge University Press
J. Schneider: Skript zur Vorlesung „Physikalische Grundlagen der Lasertechnik“

Course: Leadership and Product Development [2145184]

Coordinators: Andreas Ploch
Part of the modules: SP 10: Engineering Design (p. 166)[SP_10_mach], SP 02: Powertrain Systems (p. 161)[SP_02_mach]

ECTS Credits	Hours per week	Term	Instruction language
4	2	Winter term	

Learning Control / Examinations
oral exam

Conditions
None.

Learning Outcomes
The target of the lecture is to convey the main elements of leadership theories, methods and management development basics as well as the bordering topics of change management, intercultural competences, team work and corporate governance.

Content

- Leadership theories
- Management tools
- Communication as management tool
- Change management
- Management development and MD-Programs
- Assessment center and management audits
- Team work, team development und team roles
- Intercultural competences
- Leadership and ethics, Corporate Governance
- Executive Coaching

Lectures of industrial experts

- MD-program-concepts, Binder-Fröhlich, Daimler AG, ExecutiveManagement Development
- Executive Search, Grünewald, Grünewald-Consulting

Course: Laboratory Exercise in Energy Technology [2171487]

Coordinators: Hans-Jörg Bauer, Ulrich Maas, Klaus Dullenkopf, Heiner Wirbser
Part of the modules: SP 15: Fundamentals of Energy Technology (p. 171)[SP_15_mach]

ECTS Credits	Hours per week	Term	Instruction language
4	4	Winter / Summer Term	de

Learning Control / Examinations
Discussion of the documented results with the assistents

Duration: 30 minutes

no tools or reference materials may be used

Conditions
none

Recommendations
none

Learning Outcomes
This lab class on energy technology provides all interested students the opportunity to learn about scientific research. Students participate in selected current projects. Experimental, design and theoretical tasks are offered. The lab class is concluded with an evaluation and written documentation of the results.

Content

- Micro gas turbine
- Several test rigs for the investigation of heat transfer at thermally high loaded components
- Optimization of components of the internal air and oil system
- Characterization of spray diffusors
- Investigation of pollutant and noise emission as well as reliability and material deterioration
- Exhaust gas treatment
- Exhaust gas turbocharger

Remarks
Registration within the first two weeks of the lecture periode.

Course: Logistics - organisation, design and control of logistic systems [2118078]

Coordinators: Kai Furmans
Part of the modules: SP 09: Dynamic Machine Models (p. 165)[SP_09_mach]

ECTS Credits	Hours per week	Term	Instruction language
6	4	Summer term	de

Learning Control / Examinations
oral / written (if necessary) => (see “Studienplan Maschinenbau”, version of 7.7.2010)

examination aids: none

Conditions
None.

Recommendations
None.

Learning Outcomes
The student:

- has the basis knowledge necessary to understand logistic systems,
- he knows algorithms and is able to apply them to logistic problems.

Content
multistage logistic process chains
transport chain in logistic networks
distribution processes
distribution centers
logistics of production systems
dependencies between production and road traffic
information flow
cooperative strategies (like kanban, just-in-time, supply chain management)

Media
presentations, black board

Literature
None.

Remarks
none

Course: Automotive Logistics [2118085]

Coordinators: Kai Furmans
Part of the modules: SP 38: Production Systems (p. 178)[SP_38_mach]

ECTS Credits	Hours per week	Term	Instruction language
4	2	Summer term	de

Learning Control / Examinations
oral / written (if necessary) => (see “Studienplan Maschinenbau”, version of 7.7.2010)

Conditions
None.

Recommendations
None.

Learning Outcomes
The student:

- knows about essential logistic questions, in a complex production network. As an example the automobile industry is used.
- is able to apply practical solutions for logistic problems in this area.

Content

- Logistic questions within the automobile industry
- basic model of automobile production and distribution
- relation with the suppliers
- Disposition and physical execution
- Vehicle production in the interaction of shell, paint shop and assembly
- Sequence planning
- Assembly supply
- vehicle distribution and linkage with selling processes
- Physical execution, planning and control

Media
presentations, black board

Literature
None.

Remarks
none

Course: Machine Vision [2137308]

Coordinators: Christoph Stiller, Martin Lauer
Part of the modules: SP 18: Information Technology (p. 173)[SP_18_mach]

ECTS Credits	Hours per week	Term	Instruction language
8	4	Winter term	de

Learning Control / Examinations
Oral examination

Duration: 30 minutes

no reference materials

Conditions
Basic studies and preliminary examination; fundamentals in measurement, system and control theory, e.g. from the lecture “Measurement and Control Systems”

Learning Outcomes
Machine vision (or computer vision) describes the computer supported solution of visual tasks similar to a human. The technical domain machine vision incorporates numerous research areas like optics, digital image processing, 3D measurement technology and pattern recognition. One main focus is image understanding having the goal to gather the meaning of an image and draw conclusions from this semantic meaning. The subjects in the course machine vision are similar to the standard image processing procedure. The students shall acquire an overview on major Machine Vision methods and gather practical experience from computer exercises and experiments.

Content
1. Illumination
2. Image acquisition
3. Image preprocessing
4. Feature extraction
5. Stereo Vision
6. Robust parameter estimation
7. Classification and interpretation

Literature
Main results are summarized in pdf-file. Further recommendations will be presented in the lecture.

Course: Leadership and Conflict Management (in German) [2110017]

Coordinators: Hans Hatzl
Part of the modules: SP 10: Engineering Design (p. 166)[SP_10_mach]

ECTS Credits	Hours per week	Term	Instruction language
4	2	Summer term	de

Learning Control / Examinations
Oral exam, length: 30 minutes
(only in German)

Allowed resource materials: none

Conditions

- Compact course
- Limited number of participants
- Students of the International Department will be preferred
- Registration in the ifab-office necessary
- Compulsory attendance during the whole lecture

Recommendations

- Knowledge of Work science and economics is usefull

Learning Outcomes

- Knowledge about techniques for management and leadership
- Preparation for the management and leadership in the job

Content

1. Introduction to the course
2. Goal definition and goal achievement
3. Management techniques within planning
4. Communication and information
5. Decision-making
6. Leadership and co-operation
7. Self management
8. Conflict management
9. Case studies

Literature
Learning material:
Handout online on: https://ilias.rz.uni-karlsruhe.de/goto_rz-uka_cat_29099.html

Literature:

- ALLHOFF, D.-W.; ALLHOFF, W.: Rhetorik und Kommunikation. Regensburg: Bayerischer Verlag für Sprechwissenschaft, 2000.
- ARMSTRONG, M.: Führungsgrundlagen. Wien, Frankfurt/M.: Ueberreuter, 2000.
- BUCHHOLZ, G.: Erprobte Management-Techniken. Renningen-Malmsheim : expert-Verlag, 1996.
- RICHARDS, M. D.; GREENLAW, P. S.: Management Decision Making. Homewood: Irwin, 1966.
- SCHNECK, O.: Management-Techniken, Frankfurt/M., New York: Campus Verlag, 1996.

Please refer to the latest edition.

Course: Machine Dynamics [2161224]

Coordinators: Carsten Proppe

Part of the modules: SP 48: Internal Combustion Engines (p. 180)[SP_48_mach], SP 31: Mechatronics (p. 177)[SP_31_mach], SP 02: Powertrain Systems (p. 161)[SP_02_mach], SP 05: Calculation Methods in Mechanical Engineering (p. 162)[SP_05_mach], SP 07: Dimensioning and Validation of Mechanical Constructions (p. 164)[SP_07_mach]

ECTS Credits	Hours per week	Term	Instruction language
5	3	Winter term	de

Learning Control / Examinations
Written examination (compulsory subject), auxiliary means: own manuscripts
Oral examination (optional subject) , no auxiliary means allowed

Conditions
none

Recommendations
none

Learning Outcomes
Application of engineering-oriented calculation methods in order to model and to understand dynamic effects in rotating machinery, e.g., runup, stationary operation of rigid rotors including balancing, transient and stationary behavior of flexible rotors, critical speeds, dynamics of slider-crank mechanisms, torsional oscillations.

Content
1. Introduction
2. Machine as mechatronic system
3. Rigid rotors: equations of motion, transient and stationary motion, balancing
4. Flexible rotors: Laval rotor (equations of motion, transient and stationary behavior, critical speed, secondary effects), refined models)
5. Slider-crank mechanisms: kinematics, equations of motion, mass and power balancing

Literature
Biezeno, Grammel: Technische Dynamik, 2. Edition, 1953

Holzweißig, Dresig: Lehrbuch der Maschinendynamik, 1979

Dresig, Vulfson: Dynamik der Mechanismen, 1989

Course: Machine Dynamics II [2162220]

Coordinators: Carsten Proppe

Part of the modules: SP 48: Internal Combustion Engines (p. 180)[SP_48_mach], SP 02: Powertrain Systems (p. 161)[SP_02_mach], SP 07: Dimensioning and Validation of Mechanical Constructions (p. 164)[SP_07_mach], SP 31: Mechatronics (p. 177)[SP_31_mach], SP 05: Calculation Methods in Mechanical Engineering (p. 162)[SP_05_mach]

ECTS Credits	Hours per week	Term	Instruction language
4	2	Summer term	

Learning Control / Examinations
oral exam, no auxiliary means allowed

Conditions
none

Recommendations
Machine Dynamics

Learning Outcomes
Ability to build detailed models in the machine dynamcs: Continuum models, fluid structure interaction, stability analyses

Content
• hydrodynamic bearings
• rotating shafts in hydrodynamic bearings
• belt drives
• virbation of turbine blades

Literature
R. Gasch, R. Nordmann, H. Pfützner: Rotordynamik, Springer, 2006

Course: Material flow in logistic systems [2117051]

Coordinators: Kai Furmans
Part of the modules: SP 38: Production Systems (p. 178)[SP_38_mach], SP 44: Technical Logistics (p. 179)[SP_44_mach]

ECTS Credits	Hours per week	Term	Instruction language
6	3	Winter term	de

Learning Control / Examinations
oral / written (if necessary) => (see “Studienplan Maschinenbau”, version of 7.7.2010)

Conditions
none

Recommendations
Recommended compulsory optional subject:
Stochastics in mechanical engineering

Learning Outcomes
The student:

- understands material flow processes and knows how to plan material flow systems,
- is able to model material flow systems in simple models,
- he knows how to determine essential performance indicators like throughput, utilization, etc.

Content

- elements of material flow systems (conveyor elements, fork, join elements)
- models of material flow networks using graph theory and matrices
- queueing theory, calculation of waiting time, utilization
- warehouseing and order-picking

Media
presentations, black board, book

Literature
Arnold, Dieter; Furmans, Kai : Materialfluss in Logistiksystemen; Springer-Verlag Berlin Heidelberg, 2009

Remarks
none

Course: Materials and processes for the lightweight production of car bodies [2149669]

Coordinators: HansJosef Haepp
Part of the modules: SP 12: Automotive Technology (p. 168)[SP_12_mach]

ECTS Credits	Hours per week	Term	Instruction language
4	2	Winter term	de

Learning Control / Examinations
oral Examination

Conditions
None.

Learning Outcomes
Teaching of practical experience in the manufacture for automotive lightweight construction, with special consideration of metallic lightweight materials and innovative manufacturing processes.

Content
1. Introduction
- Motivation / Goals for the weight reduction of car body constructions
2. options to reduce vehicle weight
- lightweight with materials, lightweight production, lightweight construction, concept lightweight and form lightweight
3. Lightweight Materials
- Requirements for lightweight construction materials from the perspective of vehicle development
- Requirements for lightweight construction materials from the viewpoint of production
- Development of materials for steel, aluminum and magnesium
- Plastics for the vehicle structure and the outer body
4. Production Lightweight
- Joining in the body with special reference to composite construction
- Quality assurance of joining
5. Corrosion protection components for body weight reduction
- Corrosion protection on the substrate production
- Corrosion protection materials / procedures in vehicle painting
6. Summary / Outlook

Literature
lecture notes (download)

Course: Mathematical Methods in Dynamics [2161206]

Coordinators: Carsten Proppe

Part of the modules: SP 07: Dimensioning and Validation of Mechanical Constructions (p. 164)[SP_07_mach], SP 05: Calculation Methods in Mechanical Engineering (p. 162)[SP_05_mach], SP 13: Strength of Materials/ Continuum Mechanics (p. 170)[SP_13_mach], SP 09: Dynamic Machine Models (p. 165)[SP_09_mach]

ECTS Credits	Hours per week	Term	Instruction language
4	2	Winter term	de

Learning Control / Examinations
written examination (compulsory subject), auxiliary means: own manuscripts allowed
oral examination (optional subject) no auxiliary means allowed

Conditions
none

Recommendations
none

Learning Outcomes
The students know the mathematical methods of dynamics precisely. They are able to use the basic mathematical methods for modelling the dynamical behaviour of elastic and rigid bodies.
The students have a basic understanding of the description of kinematics and kinetics of bodies. They also master the alternative formulations based on weak formulations and variational methods and the approximate solution methods for numerical calculations of the moving behaviour of elastic bodies.

Content
Dynamics of continua:
Concept of continuum, geometry of continua, kinematics and kinetics of continua

Dynamics of rigid bodies:
Kinematics and kinetics of rigid bodies

Variational principles:
Priniciple of virtual work, variational calculations, Principle of Hamilto

Approximate solution methods:
Methods of weighted residuals, method of Ritz

Applications

Literature
Lecture notes (available online)

J.E. Marsden, T.J.R. Hughes: Mathematical foundations of elasticity, New York, Dover, 1994

P. Haupt: Continuum mechanics and theory of materials, Berlin, Heidelberg, 2000

M. Riemer: Technische Kontinuumsmechanik, Mannheim, 1993

K. Willner: Kontinuums- und Kontaktmechanik : synthetische und analytische Darstellung, Berlin, Heidelberg, 2003

J.N. Reddy: Energy Principles and Variational Methods in applied mechanics, New York, 2002

A. Boresi, K.P. Chong, S. Saigal: Approximate solution methods in engineering mechanics, New York, 2003

Course: Mathematical Methods in Strength of Materials [2161254]

Coordinators: Thomas Böhlke
Part of the modules: SP 05: Calculation Methods in Mechanical Engineering (p. 162)[SP_05_mach], SP 13: Strength of Materials/ Continuum Mechanics (p. 170)[SP_13_mach], SP 07: Dimensioning and Validation of Mechanical Constructions (p. 164)[SP_07_mach]

ECTS Credits	Hours per week	Term	Instruction language
4	2	Winter term	de

Learning Control / Examinations
depending on choice according to acutal version of study regulations
Additives as announced

Conditions
None.

Recommendations
None.

Learning Outcomes
The students can effectively and precise apply the mathematical methods of strength of materials.
They master the basic principles of tensor algebra and tensor analysis for a continuum mechanical modelling of materials. They know how to apply methods of continuum mechanics for dimensioning of work pieces.

Content
Tensor algebra

- vectors; basis transformation; dyadic product; tensors of 2nd order
- properties of 2nd order tensors: symmetry, anti-symmetry, orthogonality etc.
- eigenvalue problem, theorem of Cayley-Hamilton, invariants; tensors of higher order
- tensor algebra in curvilinear coordinate systems
- tensor analysis in curvilinear coordinate systems
- Differentiation of tensor functions

Application of tensor calculus in strength of materials

- kinematics of infinitesimal and finite deformations
- transport theorem, balance equations, stress tensor
- theory of elasticity
- thermo-elasticity
- theory of plasticity

Literature
lecture notes
Bertram, A.: Elasticity and Plasticity of Large Deformations - an Introduction. Springer 2005.
Liu, I-S.: Continuum Mechanics. Springer, 2002.
Schade, H.: Tensoranalysis.Walter de Gruyter, New York, 1997.
Wriggers, P.: Nichtlineare Finite-Element-Methoden. Springer, 2001.

Course: Mathematical methods of vibration theory [2162241]

Coordinators: Wolfgang Seemann
Part of the modules: SP 09: Dynamic Machine Models (p. 165)[SP_09_mach], SP 05: Calculation Methods in Mechanical Engineering (p. 162)[SP_05_mach]

ECTS Credits	Hours per week	Term	Instruction language
5	3	Summer term	de

Learning Control / Examinations
written (compulsory subject), oral (optional subject)

Duration: 3 hours (compulsory subject), 30 minutes (optional subject), 20 minutes (major subject)

Allowed during exam: own scripts, literature (compulsory subject), none (optional subject or major subject)

Conditions
Technische Mechanik III, IV / Engineering Mechanics III, IV

Learning Outcomes
The course presents several mathematical methods to analyze dynamical systems in the time and the frequency domain. In the first part, methods to solve ordinary single differential equations are discussed where attention is focused to non-periodic excitation. Systems of ordinary differential equations are considered next. Also partial differential equations (including the derivation of boundary value problems by Hamilton's principle) are treated. Analytical methods are emphasized but some selected approximate methods are dealt with as well. An introduction into the dynamic stability theory is also given.

Content
Linear, time-invariant, ordinary single differential equations: homogeneous solution; harmonic, periodic and non-periodic excitations; Duhamel's integral; Fourier and Laplace transform; introduction into the theory of distributions; Systems of ordinary differential equations: matrix notation, eigenvalue theory, fundamental matrix, forced vibrations via modal expansion and transition matrix; Introduction into the dynamic stability theory; Partial differential equations: solution in product form, eigenvalue theory, modal expansion using Ritz series; Variational methods, Hamilton's principle, boundary value problems representing vibrating continua; Perturbation methods

Literature
Riemer, Wedig, Wauer: Mathematische Methoden der Technischen Mechanik

Course: Mathematical Methods in Structural Mechanics [2162280]

Coordinators: Thomas Böhlke
Part of the modules: SP 26: Materials Science and Engineering (p. 175)[SP_26_mach], SP 07: Dimensioning and Validation of Mechanical Constructions (p. 164)[SP_07_mach], SP 05: Calculation Methods in Mechanical Engineering (p. 162)[SP_05_mach], SP 13: Strength of Materials/ Continuum Mechanics (p. 170)[SP_13_mach]

ECTS Credits	Hours per week	Term	Instruction language
4	2	Summer term	de

Learning Control / Examinations
depending on choice according to acutal version of study regulations
Additives as announced

Conditions
None.

Recommendations
None.

Learning Outcomes
Ther students can effectively and precisely apply the mathematical methods of structural mechanics. They master the basic principles of variational calculus and the variational principles of mechanics. They know different homogenization methods in order to describe materials with microstructure.

Content
Basics of variational calculus

- functionals; Frechet-differential; Gateaux-differential; maximum or minimum problems
- lemma of variational calculus and Lagrange delta-process; Euler-

Lagrange-equations
Applications: Principals of continuums mechanics

- variational principals in mechanics; variational formulierung of boundary value problem of elastostatic
- method of Ritz; finite element method

Applications: Homogenization methods for materials with microstructure

- mesoscopic and macroskopic stress and strain measures
- Homogenization of elastic properties I: elementary Voigt and Reuss bounds; Hashin-Shtrikman bounds
- Homogenization of elastic properties II: estimation of effectiv elastic properties

Literature
Vorlesungsskript
Gummert, P.; Reckling, K.-A.: Mechanik. Vieweg 1994.
Gross, D., Seelig, T.: Bruchmechanik – Mit einer Einführung in die Mikromechanik.
Springer 2002.
Klingbeil, E.: Variationsrechnung, BI Wissenschaftsverlag, 1977
Torquato, S.: Random Heterogeneous Materials. Springer, 2002.

Course: Mechanics of laminated composites [2161983]

Coordinators: Eckart Schnack
Part of the modules: SP 26: Materials Science and Engineering (p. 175)[SP_26_mach]

ECTS Credits	Hours per week	Term	Instruction language
4	2	Winter term	

Learning Control / Examinations
Oral examination. Duration: 30 minutes.

Conditions
none

Recommendations
none

Learning Outcomes
In the first part of the course the students are introduced to the definition of modern composites. The terms 'lamina', 'laminae' and 'laminate' are explained in detail with reference to examples. The students are then able to classify modern composites, particularly when they use these materials to design machine structures. As by definition the material data are directionally dependent, different transformations are discussed so that the students can understand the structural behaviour and participate in the design of the materials.

Content
Definition of composites, definition of static and kinematic groups. Definition of material laws. Transformation of the state values of composites and transformation of the material properties for the coordinate systems in the design of machine structures.

Literature
Lecture notes (available in the administration office, building 10.91, rm. 310)

Course: Mechanics and Strengths of Polymers [2173580]

Coordinators: Bernd-Steffen von Bernstorff (Graf), von Bernstorff
Part of the modules: SP 26: Materials Science and Engineering (p. 175)[SP_26_mach]

ECTS Credits	Hours per week	Term	Instruction language
4	2	Winter term	

Learning Control / Examinations
oral examination

Duration: 20 - 30 minutes

no notes

Conditions
basic knowledge in materials science (e.g. lecture materials science I and II)

Learning Outcomes
Introduction to molecular structure, morphology and process parameters and their influence on the mechanics, strength and failure mechanisms of polymeric materials and composites. The strength and design of engineering parts exposed to complex loadings and loading histories will be derived.

Content
Molecular structure and morphology of polymers, temperature- and time dependency of mechanical behavior, viscoelasticity, time/temperature- superposition principle, yielding, crazing and fracture of polymers, failure criterions, impact and dynamic loading, corresponding principle, tough/brittle-transition, introduction to the principles of fiber reinforcement and multiple cracking in composites

Literature
A literature list, specific documents and partial lecture notes shall be handed out during the lecture.

Course: Mechanics in Microtechnology [2181710]

Coordinators: Christoph Eberl, Patric Gruber
Part of the modules: SP 31: Mechatronics (p. 177)[SP_31_mach]

ECTS Credits	Hours per week	Term	Instruction language
4	2	Winter term	de

Learning Control / Examinations
oral exam 30 minutes

Conditions
compulsory preconditions: none

Learning Outcomes
Understanding of:

- Mechanical phenomena in Small dimensions
- Material science and engineering for microsystems
- Mechanical micro-sensors
- Micro-actuators

Content
1. Introduction: Application and Processing of Microsystems
2. Scaling Effects
3. Fundamentals: Stress and Strain, (anisotropic) Hooke‘s Law
4. Fundamentals: Mechanics of Beams and Membranes
5. Thin Film Mechanics: Origin and Role of Mechanical Stresses
6. Characterization of Mechanical Properties of Thin Films and Small Structures: Measurement of Stresses and Mechnical Parameters such as Young'sModulus and YieldDtrength; Thin Film Adhesion and Stiction
7. Transduction: Piezo-resistivity, Piezo-electric Effect, Elektrostatics,...
8. Aktuation: Inverse Piezo-electric Effect, Shape Memory, Elektromagnetic Actuation,. . .

Literature
Folien,
1. M. Ohring: „The Materials Science of Thin Films“, Academic Press, 1992
2. L.B. Freund and S. Suresh: „Thin Film Materials“
3. M. Madou: Fundamentals of Microfabrication“, CRC Press 1997
4. M. Elwenspoek and R. Wiegerink: „Mechanical Microsensors“ Springer Verlag 2000
5. Chang Liu: Foundations of MEMS, Illinois ECE Series, 2006

Course: Laboratory mechatronics [2105014]

Coordinators: Albert Albers, Georg Bretthauer, Carsten Proppe, Christoph Stiller
Part of the modules: SP 10: Engineering Design (p. 166)[SP_10_mach], SP 31: Mechatronics (p. 177)[SP_31_mach], SP 18: Information Technology (p. 173)[SP_18_mach]

ECTS Credits	Hours per week	Term	Instruction language
4	3	Winter term	de

Learning Control / Examinations
Certification of participation or oral examination depending on the "Studienplan" resp. "Prüfungs- und Studienordnung (SPO)" / IPEK: partial exmanination with grade

Conditions
None.

Learning Outcomes
A manipulator as an examplary mechatronic system is used to practise the contents of the stage II - lectures on mechatronics. The laboratory course comprises simulation, bus communication, measurement instrumentation, control engineering and programming. Instead of separate experiments the laboratory course continuously handles with the several aspects of the manipulator system. The final aim is to integrate the different subsystems to a working compound system.

Content
Part I
Control, programming and simulation of robots
CAN-Bus communication
Image processing / machine vision
Dynamic simulation of robots in ADAMS

Part II
Solution of a complex problem in team work

Literature
Manuals for the laboratory course on Mechatronics

Course: Human Robot Cooperation [24154]

Coordinators: Burghart
Part of the modules: SP 31: Mechatronics (p. 177)[SP_31_mach]

ECTS Credits	Hours per week	Term	Instruction language
3	2	Winter term	

Learning Control / Examinations

Conditions

None.

Learning Outcomes

Content

Course: Measurement II [2138326]

Coordinators: Christoph Stiller
Part of the modules: SP 31: Mechatronics (p. 177)[SP_31_mach], SP 18: Information Technology (p. 173)[SP_18_mach]

ECTS Credits	Hours per week	Term	Instruction language
4	2	Summer term	de

Learning Control / Examinations
oral examination

Duration: 30 minutes

no reference material

Conditions
Fundamentals in measurement, system and control theory, e.g. from the lecture "Measurement and Control Systems"

Learning Outcomes
The capabilities of modern sensor technology pave the way for novel applications in engineering. Especially digital measurement techniques may be used even in very complex environments and thus have strong impact on technological progress. Stochastic models of measurement processes form the basis for meaningful information processing and provide a valuable tool for engineering. This interdisciplinary lecture addresses students in mechanical engineering and related subjects. The lecture gives an overview of digital technology and stochastics. These areas form the basics of estimation methods that can be embedded elegantly in the theory of state observers. Applications in signal processing for modern environmental perception (video, Lidar, Radar) illustrate the discussed subjects.

Content
1. Amplifiers
2. Digital technology
3. Stochastic modeling for measurement applications
4. Estimation
5. Kalman Filter
6. Environmental perception

Literature
Various Scripts

Course: Analysis tools for combustion diagnostics [2134134]

Coordinators: Uwe Wagner
Part of the modules: SP 48: Internal Combustion Engines (p. 180)[SP_48_mach], SP 05: Calculation Methods in Mechanical Engineering (p. 162)[SP_05_mach], SP 15: Fundamentals of Energy Technology (p. 171)[SP_15_mach]

ECTS Credits	Hours per week	Term	Instruction language
4	2	Summer term	de

Learning Control / Examinations
oral examination, Duration: 0,5 hours, no auxiliary means

Conditions
none

Recommendations
Combustion Engines A helpful

Learning Outcomes
The students get to know state-of-the-art methods to analyse the process in combustion engines. Both, special measuring techniques such as optical and laser analysis and thermodynamical modelling of the engine process is covered.

Content
energy balance at the engine
energy conversion in the combustion chamber
thermodynamics of the combustion process

flow velocities

flame propagation

special measurement techniques

Literature
Lecture notes available in the lectures

Course: Methodic Development of Mechatronic systems [2145180]

Coordinators: Albert Albers, Wolfgang Burger
Part of the modules: SP 10: Engineering Design (p. 166)[SP_10_mach], SP 31: Mechatronics (p. 177)[SP_31_mach], SP 02: Powertrain Systems (p. 161)[SP_02_mach]

ECTS Credits	Hours per week	Term	Instruction language
4	2	Winter term	de

Learning Control / Examinations
Oral examination

Conditions
none

Learning Outcomes
The development of mechatronic systems implies interdisciplinary work in teams. Often there are typical problems and misunderstandings due to different ways of working and thinking of mechanical engineers, electronics engineers and computer scientists. In order to avoid these problems and to cross the boarders between different disciplines, one has to build up an at least basic understanding of the methods and problems of other co-workers. Especially the team leader has to be able to understand the problems of his team members and to moderate in case of misunderstandings. This lecture aims at students with their concentration on mechatronics. It provides insights into the mindsets and problem solving strategies of electronics engineers and computer scientists and explains the basic terms and tools of future colleagues. Also typical problems arising from diverse interdependencies of social and technical systems are discussed. Additionally issues like quality assurance in mechatronics products, safety and reliability and team-management are covered.

Content

- Introduction - from market to product
- Typical activities during the development of electronic components, traps and problems
- Interfaces between mechanics / electronics / software / human user
- Typical activities during the development of software, traps and problems
- Failure modes and mechanisms of electronic circuits
- Failure modes and verification of software
- Quality assurance of mechatronic systems
- Human interfacing problems, team-management

Literature
Manuals for the lecture available

Course: Modelling of Microstructures [2183702]

Coordinators: Britta Nestler

Part of the modules: SP 26: Materials Science and Engineering (p. 175)[SP_26_mach], SP 05: Calculation Methods in Mechanical Engineering (p. 162)[SP_05_mach], SP 13: Strength of Materials/ Continuum Mechanics (p. 170)[SP_13_mach]

ECTS Credits	Hours per week	Term	Instruction language
4	2	Winter / Summer Term	de

Learning Control / Examinations
We regularly hand out exercise sheets. The individual solutions will be corrected.
Exam: oral 30 minutes or written.

Conditions
None.

Learning Outcomes
The students are introduced into the fundamentals of liquid-solid and solid-solid phase transformations. We discuss microstructures such as dendrites, eutectics and peritectics and consider the specific physics of heat and mass transport combined with the particular phase transformation. We study polycrystalline grain structures and examine the motion of interfaces and the effect of various external fields. Next, we learn the method of phase-field modelling for simulation of microstructure formation processes. As an extension of the phase-field modelling for phase transitions, we get to know the coupling with other field variables. The course will be combined with practical excercises.

Content
The course consists of a lecture and exercise classes. The aim is an introduction to the simulation of phase transformations and microstructure formation under the influence of different physical quantities. Contents are:
- fundamentals of phase transformation and microstructure evolution
- polycrystalline grain structures
- heat and mass diffusion
- phase-field modelling and simulation
- extension of phase-field modelling to include other physical fields

Media
Black board and slides.

Literature
Fundamentals of Solidification, Kurz and Fisher
Theory of Solidification, Davis.
The science of crystallization: microscopic interfacial phenomena, W. A. Tiller -> Only special reading
Transport phenomena in metallurgy, G.H. Geiger and D. R. Poirier
Transport Phenomena, R. Bird, W. Stewart, E. Lightfoot
Kinetics of Materials , W. Craig Carter
Physical Metallurgy, Porter and Easterling
Construction of binary phase diagrams, R. Haansen
Introduction to the thermodynamics of materials, David. R. Gaskell
Numerical recipes in C

Course: Mobile Machines [2113073]

Coordinators: Marcus Geimer
Part of the modules: SP 10: Engineering Design (p. 166)[SP_10_mach]

ECTS Credits	Hours per week	Term	Instruction language
8	4	Summer term	de

Learning Control / Examinations
oral examination.

Conditions
Knowledge in Fluid Power is required.

Recommendations
It is recommended to attend the course *Fluid Power Systems* [2114093] beforehand.

Learning Outcomes
The students will learn the basic structure and construction of mobile machines. The basis will be practically introduced by consultants from industry area. Thereby, the typical working process will be described.

Content

- Introduction of the required components and machines
- Basics of the structure of the whole system
- Practical insight in the development techniques

Media
Lecture notes.

Course: Mobility Concepts of Rail Transportation in 2030 [2115915]

Coordinators: Peter Gratzfeld
Part of the modules: SP 50: Rail System Technology (p. 181)[SP_50_mach]

ECTS Credits	Hours per week	Term	Instruction language
4	2	Winter term	de

Learning Control / Examinations
Written report and oral exam

Conditions
Attendance is mandatory during the whole seminar.

Recommendations
none

Learning Outcomes

- The students learn about the innovationprocess of an international company in rail industry.
- They exercise advanced creativity techniques.
- They learn and deepen key qualifications like communication skills, presentation skills, moderation techniques and team work.

Content

- Company presentation
- Long term development of society and environment (megatrends), impact on railways and rail industry
- Creating, elaborating and discussing innovative ideas by using the tool "Zukunftswerkstatt"
- Final presentations

Media
All material is available for download (Ilias-platform).

Literature
Literatur will be provided during the course.

Remarks

- This seminar is a 5-day block course.
- Number of participants is limited.
- A registration is necessary.
- For further information please look at the website.

Course: [2134139]

Coordinators: Frank Kirschbaum
Part of the modules: SP 48: Internal Combustion Engines (p. 180)[SP_48_mach]

ECTS Credits	Hours per week	Term	Instruction language
		Summer term	

Learning Control / Examinations

Conditions

None.

Learning Outcomes

Content

Course: Modelling and Simulation [2183703]

Coordinators: Britta Nestler
Part of the modules: SP 26: Materials Science and Engineering (p. 175)[SP_26_mach], SP 05: Calculation Methods in Mechanical Engineering (p. 162)[SP_05_mach], SP 13: Strength of Materials/ Continuum Mechanics (p. 170)[SP_13_mach]

ECTS Credits	Hours per week	Term	Instruction language
4	2	Winter / Summer Term	de

Learning Control / Examinations
We regularly hand out exercise sheets. In addition, the course will be accompanied by practical exercises at the computer.
written examination: 90 minutes

Conditions
None.

Learning Outcomes
The students learn fundamental algorithms and numerical methods of particular importance for materials simulations. The course introduces solution techniques for dynamical systems and partial differential equations. The methods are applied to describe heat and mass diffusion processes and to model microstructure formation (e.g. phase-field method). The next aim is to learn adaptive and parallel algorithms. The students will get familiar with fundamental concepts of high performance computations. Practical experience is obtained by the integrated exercises.

Content
The course gives an introduction to modelling and simulation techniques.
The following topics are included:
- splines, interpolation methods, Taylor series
- finite difference method
- dynamical systems
- numerics of partial differential equations
- mass and heat diffusion
- microstructure simulation
- parallel and adaptive algorithms
- high performance computing
- practical exercises

Media
Slides and black board. The slides will be provided as a manuscript for the course.

Literature
Scientific Computing, G. Golub and J.M. Ortega (B.G.Teubner Stuttgart 1996)

Course: Modern Concepts of Control [2105024]

Coordinators: Lutz Gröll, Groell
Part of the modules: SP 31: Mechatronics (p. 177)[SP_31_mach]

ECTS Credits	Hours per week	Term	Instruction language
3	2	Winter term	de

Learning Control / Examinations

Conditions

None.

Learning Outcomes

Content

Course: Engine laboratory (block course) [2134001]

Coordinators: Ulrich Spicher
Part of the modules: SP 48: Internal Combustion Engines (p. 180)[SP_48_mach]

ECTS Credits	Hours per week	Term	Instruction language
4	2	Summer term	de

Learning Control / Examinations
written documentation of every experiment, certificate of successful attendance, no grading

Conditions
Combustion Engines A

Learning Outcomes
The students learn to apply their theoretically aquired knowledge of the lectures by means of 5 practical engine experiments on modern test benches.

Content
5 engine experiments in up-to-date development projects

Literature
Description of experiments

Course: Engine measurement techniques [2134137]

Coordinators: Sören Bernhardt
Part of the modules: SP 48: Internal Combustion Engines (p. 180)[SP_48_mach], SP 18: Information Technology (p. 173)[SP_18_mach]

ECTS Credits	Hours per week	Term	Instruction language
4	2	Summer term	de

Learning Control / Examinations
oral examination, Duration: 0,5 hours, no auxiliary means

Conditions
None.

Recommendations
Combustion Engines A helpful

Learning Outcomes
Students get to know state-of-the-art measurement techniques for combustion engines. In particular basic techniques for measuring engine operating parameters such as torque, speed, power and temperature.

Possible measurement errors and abberations are discussed.

Furthermore techniques for measuring exhaust emissions, air/fuel ratio, fuel consumption as well as pressure indication for thermodynamic analysis are covered.

Content
Energy balance and conversion in combustion engines

test bench assembly

Measurement of basic engine parameters

Measurement of special engine parameters

Exhaust gas analysis

Literature
Lecture notes available in the lectures or in the 'Studentenhaus'

1. Grohe, H.:Messen an Verbrennungsmotoren
2. Bosch: Handbuch Kraftfahrzeugtechnik
3. Veröffentlichungen von Firmen aus der Meßtechnik
4. Hoffmann, Handbuch der Meßtechnik
5. Klingenberg, Automobil-Meßtechnik, Band C

Course: Novel actuators and sensors [2141865]

Coordinators: Manfred Kohl, Martin Sommer
Part of the modules: SP 02: Powertrain Systems (p. 161)[SP_02_mach], SP 31: Mechatronics (p. 177)[SP_31_mach]

ECTS Credits	Hours per week	Term	Instruction language
4	2	Winter term	de

Learning Control / Examinations

Conditions
None.

Learning Outcomes

Content

Literature

- Sensoren: “Sensors Update”, Volumes 1 und 2, Edited by H. Baltes, W.Göpel, J.Hesse, VCH, 1996, ISBN 3-527-29432-5
- Nanofasern: “Nanowires and Nanobelts”, Volume 2: Nanowires and Nanobelts of Functional Materials, Zhong Lin Wang, 2006, Springer, ISBN 10 0-387-28706-X

Course: Nonlinear vibrations [2162247]

Coordinators: Alexander Fidlin
Part of the modules: SP 09: Dynamic Machine Models (p. 165)[SP_09_mach], SP 05: Calculation Methods in Mechanical Engineering (p. 162)[SP_05_mach]

ECTS Credits	Hours per week	Term	Instruction language
8	4	Summer term	de

Learning Control / Examinations
Oral examination

Duration: 30 min (optional subject)
20 min (major subject)

Means are not allowed

Conditions
None.

Recommendations
Vibration theory, mathematical methods of vibration theory, dynamic stability

Learning Outcomes

- to learn the most usual nonlinear effects
- to learn the minimal models for these effects
- to be able to apply perturbation methods for the analysis of nonlinear systems
- to learn basics of the bifurcation theory
- to be able to identify dynamic chaos

Content

- dynamic systems
- basic ideas of asymptotic methods
- perturbation methods: Linstedt-Poincare, averaging, multiple scales
- limit cycles
- nonlinear resonance
- basics of the bifurcation analysis, bifurcation diagrams
- types of bifurcations
- discontinuous systems
- dynamic chaos

Literature

- Hagedorn P. Nichtlineare Schwingungen. Akademische Verlagsgesellschaft, 1978.
- Nayfeh A.H., Mook D.T. Nonlinear Oscillation. Wiley, 1979.
- Thomsen J.J. Vibration and Stability, Order and Chaos. McGraw-Hill, 1997.

- Fidlin A. Nonlinear Oscillations in Mechanical Engigeering. Springer, 2005.
- Bogoliubov N.N., Mitropolskii Y.A. Asymptotic Methods in the Theory of Nonlinear Oscillations. Gordon and Breach, 1961.
- Nayfeh A.H. Perturbation Methods. Wiley, 1973.
- Sanders J.A., Verhulst F. Averaging methods in nonlinear dynamical systems. Springer-Verlag, 1985.
- Blekhman I.I. Vibrational Mechanics. World Scientific, 2000.
- Moon F.C. Chaotic Vibrations – an Introduction for applied Scientists and Engineers. John Wiley & Sons, 1987.

Course: Computational Methods in Fluid Mechanics [2157441]

Coordinators: Franco Magagnato
Part of the modules: SP 24: Energy Converting Engines (p. 174)[SP_24_mach], SP 15: Fundamentals of Energy Technology (p. 171)[SP_15_mach]

ECTS Credits	Hours per week	Term	Instruction language
4	2	Winter term	de

Learning Control / Examinations
Oral examination
Duration: 30 minutes
No tools or reference materials may be used during the exam.

Conditions
none

Learning Outcomes
The lecture deals with up-to-date computational methods for the simulation of fluid flows for industrial applications. The selection of appropriate boundary and initial condition as well as the turbulence models will be discussed. With the help of test cases the mesh generation process will be explained. We discuss the convergence acceleration techniques like multigrid, implicit methods etc. as well as the applicability of these methods to parallel and vector processors. Problems of the mesh generation process occurring during the application of these methods will be shown. The lecture introduces some commercial codes like Fluent, Star-CD etc. as well as the research code SPARC. New aspects of the numerical simulations of fluid flows in the future like Large Eddy Simulation and Direct Numerical Smulation will be discussed.

Content
1. Governing Equations of Fluid Dynamics
2. Discretization
3. Boundary and Initial conditions
4. Turbulence Modelling
5. Mesh Generation
6. Numerical Methods
7. LES, DNS and Lattice Gas Methods
8. Pre- and Postprocessing
9. Examples of Numerical Methods for Industrial Applications

Media
Powerpoint presentation can be downloaded from https://ilias.rz.uni-karlsruhe.de/goto_rz-uka_crs_84185.html

Literature
Ferziger, Peric: Computational Methods for Fluid Dynamics. Springer-Verlag, 1999.
Hirsch: Numerical Computation of Internal and External Flows. John Wiley & Sons Inc., 1997.
Versteg, Malalasekera: An introduction to computational fluid dynamics. The finite volume method. John Wiley & Sons Inc., 1995

Course: Numerical simulation of reacting two phase flows [2169458]

Coordinators: Rainer Koch
Part of the modules: SP 15: Fundamentals of Energy Technology (p. 171)[SP_15_mach]

ECTS Credits	Hours per week	Term	Instruction language
4	2	Winter term	de

Learning Control / Examinations
Oral exam
Duration: approximately 30 minutes

no tools or reference materials are allowed

Conditions
None.

Recommendations
None.

Learning Outcomes
The course is devoted to diploma/master students and doctoral candidates of mechanical and chemical engineering. It gives an overview of the numerical methods used for CFD of single and two phase flows. The course introduces methods for reacting single and two phase flows, as they are typically found in gas turbines and piston engines operated by liquid fuel.

Content
1. Single phase flow: Basic equations of fluid dynamics, Turbulence: DNS, LES, RANS; Finite volume methods, Numerical solvers.

2. Two phase flows: Basics of atomisation, Characterisation of sprays, Numerical prediction of droplet movement, Numerical methods for predicitng of liquid disintegration (VoF, SPH), Numerical methods for secondary atomisation; Droplet evaporation

3. Reacting flows: Combustion models; Single droplet combustion, Spray combustion.

Literature
Lecture notes

Course: Numerical Fluid Mechanics [2153408]

Coordinators: Torsten Schenkel
Part of the modules: SP 05: Calculation Methods in Mechanical Engineering (p. 162)[SP_05_mach]

ECTS Credits	Hours per week	Term	Instruction language
4	2	Winter term	de

Learning Control / Examinations
oral

Duration: 30 minutes

no auxiliary means

Conditions
None.

Learning Outcomes
The lecture is a guide to the fundamentals of numerical solution methods for the basic equations of fluid dynamics with the help of selected applications. Following the industrial technology programs, the numerical solution methods are presented in the fields of airfoil flows, aerodynamics of motor vehicles, fluid flow machinery and heat transfer problems. In detail the lecture deals with algorithms for geometry definition and grid generation as well as different numerical solution methods on various computer architectures.

The student knows the fundamental approaches to plan and perform a numerical simulation of fluid mechanical problems. He can analyse a simple fluid mechanical problem and transform it into a well posed mathematical-numerical model. Although the lecture can only cover the most important models and methods, the student is enabled to understand advanced texts and use them purposefully.

Content
Fluid flow problems: Aeronautics, automotive industry, fluid flow machinery, heat transfer.
Basic equations of fluid mechanics: Navier-Stokes equations, Reynolds equations, perturbation-differential equation.
Discretisation: Geometry definiton, grid generation, discretisation in space and time, behavior of errors, convergence, consistency and stability.
Numerical solution methods: Finite-difference, finite-volume, finite-element and spectral methods.
Computer architectures and techniques: Computers and data network, programming of vector and parallel computers.
Examples of numerical solutions: Flow around an airfoil, convective flow.

Literature
Oertel, H.: Strömungsmechanik, Vieweg-Verlag, 1999
Oertel, H., Laurien, E.: Numerische Strömungsmechanik, Springer-Verlag 1995

Course: Patents and Patent Strategies [2147160]

Coordinators: Rolf Einsele
Part of the modules: SP 12: Automotive Technology (p. 168)[SP_12_mach], SP 02: Powertrain Systems (p. 161)[SP_02_mach], SP 31: Mechatronics (p. 177)[SP_31_mach], SP 17: Information Management (p. 172)[SP_17_mach], SP 48: Internal Combustion Engines (p. 180)[SP_48_mach]

ECTS Credits	Hours per week	Term	Instruction language
4	2	Winter / Summer Term	de

Learning Control / Examinations
Oral Examen

Conditions
None.

Learning Outcomes
The goal of the lecture is to convey the basics of intellectual property rights and the industrial property right strategie at the Porsche AG .

Content
After basic explanation of the different types of intellectual property rights and the conditions and procedure for the granting of an intellectual property right, the importance of intellectual property is identified. Using examples and influence of Porsche AG project integrated strategies concerning intellectual property are deduced that meet the importance of these expectations.

Course: Photovoltaics [2130935]

Coordinators: Michael Powalla
Part of the modules: SP 15: Fundamentals of Energy Technology (p. 171)[SP_15_mach]

ECTS Credits	Hours per week	Term	Instruction language
6	3	Summer term	

Learning Control / Examinations

Conditions

None.

Learning Outcomes

Content

Course: Plasticity Theory [2162244]

Coordinators: Thomas Böhlke
Part of the modules: SP 26: Materials Science and Engineering (p. 175)[SP_26_mach], SP 05: Calculation Methods in Mechanical Engineering (p. 162)[SP_05_mach], SP 13: Strength of Materials/ Continuum Mechanics (p. 170)[SP_13_mach], SP 07: Dimensioning and Validation of Mechanical Constructions (p. 164)[SP_07_mach]

ECTS Credits	Hours per week	Term	Instruction language
4	2	Summer term	de

Learning Control / Examinations
oral examination

Conditions
None.

Recommendations
None.

Learning Outcomes
The students know the basics of elasticity and plasticity of large deformations. They master tensoralgebra and tensoranalysis as well as the kinematics of large deformations. The students can set up the balance equations in regular and irregular points. They can apply the principles of material theory. They know the fundamental equations of finite elasticity and finite plasicity. In the framework of plasticity the students know the theory of crystal plasticity.

Content

- tensor calculus, kinematics, balance equations
- principles of material theory
- finite elasticity
- infinitesimal elasto(visco)plasticity
- exact solutions ov infinitesimal Platicity
- finite elasto(visco)plasticity
- infinitesimal and finite crystal(visco)plasticity
- hardening and failure

Literature
Bertram, A.: Elasticity and Plasticity of Large Deformations - an Introduction. Springer 2005.
Liu, I-S.: Continuum Mechanics. Springer 2002.
Schade, H.: Tensoranalysis.Walter de Gruyter 1997.
Wriggers, P.: Nichtlineare Finite-Element-Methoden. Springer 2001.

Course: PLM in the Manufacturing Industry [2121366]

Coordinators: Gunter Meier
Part of the modules: SP 17: Information Management (p. 172)[SP_17_mach]

ECTS Credits	Hours per week	Term	Instruction language
4	2	Winter term	de

Learning Control / Examinations
Oral group examination, Duration 1 hour, Auxiliary Means: none

Conditions
None.

Recommendations
None.

Learning Outcomes
Students know essential aspects of PLM Processes which are exemplarily introduced with examples form Heidelberger Druckmaschinen.
Students know objects of the PLM Process and know the interconnection between CAD and PLM.
Students understand the procedure of PLM-installation in an industrial enterprise and occurring challenges concerning strategy, vendor selection and psychology.
They are able to create installation concepts for PLM systems in the scope of team exercises and explain the approaches in presentations.

Content
A description of systematic requirement engineering is given, based on the introduction of PLM-Processes and (Multi-) Project management in the product development process. By the introduction of a PLM-Project, Objects of the PLM Process like material master, bill of material, documents and classifications are explained. Furthermore a 3D-Process chain is introduced to show the implementation of technical modifications. Finally, specific aspects of the mechatronic development are introduced.

Literature
Lecture slides

Course: PLM-CAD workshop [2123357]

Coordinators: Jivka Ovtcharova
Part of the modules: SP 17: Information Management (p. 172)[SP_17_mach]

ECTS Credits	Hours per week	Term	Instruction language
4	4	Winter term	de

Learning Control / Examinations
Evaluation of Project Management, presentation of final results and demonstration of the vehicle in practice

Conditions
None

Recommendations
None

Learning Outcomes
The overall objective is to depict usage of collaborative product development in terms of product lifecycle management (PLM) and to accent additional benefit contrary to classic CAD driven development processes as well as comprehensive management of product and variant structures. Students will be presented in detail how product specific data like e.g. bill-of-materials or sketches can transparently and holisticly managed by the use of PLM and moreover, they will be taught how to automatize workflow management in product development.

Content
In the Workshop a LEGO vehicle will be conceived and developed within a project order through usage of modern PLM and CAD systems in the field of lifecycle engineering.
main topics are:

- Autonomous design in development teams with LEGO Mindstorms NXT
- 3D-CAD conceptual design of the vehicle using Siemens UGS NX
- Simulation of realistic product development by forming disjunct project teams extending cross locations
- Solving communication problems, inconsistencies of product models, unregulated data access a.s.o.
- Product Lifecycle oriented development using market-leading Siemens UGS Teamcenter Engineering PLM system

Literature
Script on-site only in german

Remarks
Conditions for participation are a short letter of motivation and a short CV covering information of previously performed studies resp. education as well as practical experience

Course: Polymer Engineering I [2173590]

Coordinators: Peter Elsner
Part of the modules: SP 26: Materials Science and Engineering (p. 175)[SP_26_mach], SP 07: Dimensioning and Validation of Mechanical Constructions (p. 164)[SP_07_mach]

ECTS Credits	Hours per week	Term	Instruction language
4	2	Winter term	de

Learning Control / Examinations
Oral examination

Duration: 20-30 Minutes

Conditions
None.

Learning Outcomes
The field of Polymer Engineering includes synthesis, material science, processing, construction, design, tool engineering, production technology, surface engineering and recycling. The aim is, to equip the students with knowledge and technical skills, and to use the material “polymer” meeting its requirements in an economical and ecological way.

Content
1. Economical aspects of polymers
2. Introductiom of mechanical,
chemical end electrical properties
3. Processing of polymers
(introduction)
4. Material science of polymers
5. Synthesis

Literature
Recommended literature and selected official lecture notes are provided in the lecture

Course: Laboratory “Laser Materials Processing” [2183640]

Coordinators: Johannes Schneider, Wilhelm Pfleging
Part of the modules: SP 26: Materials Science and Engineering (p. 175)[SP_26_mach]

ECTS Credits	Hours per week	Term	Instruction language
4	3	Winter / Summer Term	de

Learning Control / Examinations
presentation (15 min) and oral examination

no tools or reference materials

Conditions
None.

Recommendations
None.

Learning Outcomes
The laboratory covers 8 half-day experiments on various aspects of laser materials processing.

Content
safty aspects in laser processing

laser systems, beam shaping, beam characterization

hardening and remelting of cast iron, steel, aluminium

cutting of steel

surface refinement of ceramics by alloying and dispersing

welding of steel and aluminium

transmission welding of polymers

surface modification of polymers with respect to their wetting behaviour

surface texturing of steel and ceramics

drilling of steel, ceramic and polymers

Literature
W. M. Steen: Laser Material Processing, 2010, Springer
F. K. Kneubühl, M. W. Sigrist: Laser, 2008, Vieweg+Teubner
H. Hügel, T. Graf: Laser in der Fertigung, 2009, Vieweg+Teubner
R. Poprawe: Lasertechnik für die Fertigung, 2005, Springer
W. T. Silfvast: Laser Fundamentals, 2008, Cambridge University Press
J. Schneider: Skript zur Vorlesung „Physikalische Grundlagen der Lasertechnik“

Course: Lab Computer-aided methods for measurement and control [2137306]

Coordinators: Christoph Stiller, Philip Lenz
Part of the modules: SP 18: Information Technology (p. 173)[SP_18_mach]

ECTS Credits	Hours per week	Term	Instruction language
4	3	Winter term	de

Learning Control / Examinations
Colloquia

Conditions
Basic studies and preliminary examination; basic lectures in automatic control

Learning Outcomes
Powerful and cheap computation resources have led to major changes in the domain of measurement and control. Engineers in various fields are nowadays confronted with the application of computer-aided methods. This lab tries to give an insight into the modern domain of measurement and control by means of practically oriented and flexible experiments. Based on experiments on measurement instrumentation and digital signal processing, elementary knowledge in the domain of visual inspection and image processing will be taught. Thereby, commonly used software like MATLAB/Simulink will be used in both simulation and realization of control loops. The lab closes with selected applications, like control of a robot or supersonic computer tomography.

Content
1. Digital technology
2. Digital storage oscilloscope and digital spectrum analyzer
3. Supersonic computer tomography
4. Lighting and image acquisition
5. Digital image processing
6. Image interpretation
7. Control synthesis and simulation
8. Robot: Sensors
9 Robot: Actuating elements and path planning
The lap comprises 9 experiments.

Literature
Instructions to the experiments are available on the institute's website

Course: Mobile Robot Systems Lab [2146194]

Coordinators: Albert Albers, Markus Frietsch
Part of the modules: SP 10: Engineering Design (p. 166)[SP_10_mach], SP 02: Powertrain Systems (p. 161)[SP_02_mach]

ECTS Credits	Hours per week	Term	Instruction language
3	3	Summer term	

Learning Control / Examinations
Certification of participation / No optional subject!

Conditions
None.

Recommendations
Basic knowledge of electrical engineering, control engineering and computer science (programming)

Learning Outcomes
The theoretical contents of different lectures will be practiced based on the development of an exemplary mechatronic system, an omniweehl powered robot platform. The bandwidth involves simulation and measurement technology, open and closed-loop control and programming. The students will not deal with separated tasks, but work on the development of one platform during the whole semester. The objective of the lab is to successfully integrate and test all necessary components into one working system. At this not only professional skill but also soft skills like teamwork or communication abilities are practiced. Especially in mechatronics these capabilities are mandatory.

Content
Development of a mobile robot system:

- Sensors
- Modelling
- Programming (Matlab/Simulink, C, . . .)
- Development of electronic components
- Manufacturing
- System integration

Literature
Manuals for the laboratory available

Course: Lab course experimental solid mechanics [2162275]

Coordinators: Thomas Böhlke, Mitarbeiter
Part of the modules: SP 07: Dimensioning and Validation of Mechanical Constructions (p. 164)[SP_07_mach], SP 13: Strength of Materials/ Continuum Mechanics (p. 170)[SP_13_mach]

ECTS Credits	Hours per week	Term	Instruction language
2	2	Summer term	de

Learning Control / Examinations
attestation without grade

Conditions
None.

Recommendations
None.

Learning Outcomes
The students know the basic measurement techniques for determination of all material parameters necessary in linear thermoelasticity. They master the identification of important parameters of stress-strain-curves based on measurements under appropriate stress states. The students can define simply nonlinear material laws.

Content

- Experiments for determination of the five material constants of thermoelasticity
- Experiments for determination of parameters of the inelatic material behaviour

Literature
is announced during lab course

Course: Computational Methods in Fluid Mechanics (Exercise) [2157442]

Coordinators: Balazs Pritz
Part of the modules: SP 24: Energy Converting Engines (p. 174)[SP_24_mach], SP 15: Fundamentals of Energy Technology (p. 171)[SP_15_mach]

ECTS Credits	Hours per week	Term	Instruction language
4	2	Winter term	de

Learning Control / Examinations
Certificate of participation;
oral examination on request

Conditions
none

Learning Outcomes
This practical course serves as supplement of the lecture "Computational Methods for Fluid Dynamics". The methods as taught within the lecture, required for performing fluid dynamics calculations will be practised on PC. Fluid dynamics calculations include the geometry and mesh generation, the definition of boundary conditions, the calculation and the visualisation and interpretation of data. First, the single steps at the PC will be developed by using appropriate examples and software. Later on, full calculation cycles (starting with mesh generation through to data interpretation) will be performed within small groups, solving typical fluid flow problems.

Content
1. Brief introduction into Linux
2. Mesh generation for an example geometry
3. Data visualisation and interpretation of preset calculation results
4. Handling of the flow solver
5. Full calculation cycle I: Flat plate
6. Further calculation cycles

Literature
1. Lecture notes/handout
2. See literature list of lecture „Numerische Methoden der Strömungstechnik“

Course: Electrical Powertrains in Practice [23311]

Coordinators: Michael Braun, Braun
Part of the modules: SP 02: Powertrain Systems (p. 161)[SP_02_mach]

ECTS Credits	Hours per week	Term	Instruction language
3	2	Summer term	de

Learning Control / Examinations

Conditions
None.

Learning Outcomes

Content

Course: Pro/ENGINEER advanced [2123370]

Coordinators: Jivka Ovtcharova, Marina Mrkonjic
Part of the modules: SP 17: Information Management (p. 172)[SP_17_mach]

ECTS Credits	Hours per week	Term	Instruction language
2	2	Winter term	de

Learning Control / Examinations
Presentation of the results at the end of semester
and oral examination, duration: 10 min.

Conditions
None

Recommendations
Very good knowledge of Machine Design and basic skills in ProEngineer are required.

Learning Outcomes
In the workshop, a complete CAD model of a transmission is developed.
The design problem is worked out in small groups. Using a basic sketch the participants should independently design partial solutions, test and then integrate them into the overall solution. The advanced capabilities of Pro/E are dealt with. The design process should be simulated from idea to finished model.
The focus is on independent solution finding, teamwork, functional performance, production and design.

Content

- Use of advanced CAD techniques and ProE functionalities
- Development of selection criteria for the design method
- Integration of partial solutions into the overall solution
- Ensure the reusability of CAD models through parameterization and cataloging
- Validation
- Sheet metal forming
- kinematic simulation
- Animation

Remarks
For the workshop compulsory attendance exists.

Course: Product Lifecycle Management [2121350]

Coordinators: Jivka Ovtcharova
Part of the modules: SP 38: Production Systems (p. 178)[SP_38_mach], SP 17: Information Management (p. 172)[SP_17_mach]

ECTS Credits	Hours per week	Term	Instruction language
6	4	Winter term	de

Learning Control / Examinations
written examination
Duration:
1,5 hours

Auxiliary Means: none

Conditions
None.

Recommendations
None.

Learning Outcomes
The goal of PLM lecture is to provide an overview of management and organizational approach to product lifecycle management. The students:

- know the management concept of PLM, its objectives and are able to highlight the economic benefits of the PLM concept
- know provider of PLM solutions and can represent the current market situation
- Understand the need for an integrated and cross-departmental business process - from planning, portfolio construction and return of customer information, from the use phase to maintenance and recycling of products
- know the processes and functions needed to support the entire product life cycle
- become aware of the main operating software systems (PDM, ERP, SCM, CRM) and the mainstreaming of these systems
- develop techniques to successfully introduce the concept of Management PLM.

Content
Product Lifecycle Management (PLM) is an approach to the holistic and cross-company management and control of all product-related processes and data throughout the life cycle along the extended supply chain - from design and production to sales, to the dismantling and recycling.
Product Lifecycle Management is a comprehensive approach for effective and efficient design of the product life cycle. Based on all product information, which comes up across the entire value chain and across multiple partners, processes, methods and tools are made available to provide the right information at the right time, quality and the right place.
The course covers:

- A consistent description of all business processes that occur during the product life cycle (development, production, sales, dismantling, ...)
- the presentation of methods for the performance of the PLM business processes,
- explaining the most important corporate information systems to support the life cycle (PDM, ERP, SCM, CRM systems) to sample the software manufacturer SAP

Literature
Lecture slides.

V. Arnold et al: Product Lifecycle Management beherrschen, Springer-Verlag, Heidelberg, 2005.

J. Stark: Product Lifecycle Management, 21st Century Paradigm for Product Realisation, Springer-Verlag, London, 2006.

A. W. Scheer et al: Prozessorientiertes Product Lifecycle Management, Springer-Verlag, Berlin, 2006.

J. Schöttner: Produktdatenmanagement in der Fertigungsindustrie, Hanser-Verlag, München, 1999.

M.Eigner, R. Stelzer: Produktdaten Management-Systeme, Springer-Verlag, Berlin, 2001.

G. Hartmann: Product Lifecycle Management with SAP, Galileo press, 2007.

K. Obermann: CAD/CAM/PLM-Handbuch, 2004.

Course: Product, Process and Resource Integration in the Automotive Industry [2123364]

Coordinators: Sama Mbang
Part of the modules: SP 12: Automotive Technology (p. 168)[SP_12_mach], SP 17: Information Management (p. 172)[SP_17_mach]

ECTS Credits	Hours per week	Term	Instruction language
4	3	Summer term	de

Learning Control / Examinations
Oral examination, Durations: 20 min, Auxiliary Means: none

Conditions
None.

Recommendations
None.

Learning Outcomes
A considerable aspect of this lecture is to combine engineering knowledge with the practical, real industrial problems and applications.
Thus, the objectives of the lecture are:

- collaborative drafting of industrial and academic state of the art regarding the basics.
- specification of exigencies, requirements and concepts for an integrated CAx-process chain,
- introduction in the paradigms of the integrated process-oriented product development
- to convey practical industrial knowledge about the integrated product development in the automotive sector

The industrial focus of the lecture gives the students an insight into specific industrial implementation as well as the possibility to become acquainted with the industrial IT-applications, IT- and work processes in the automotive industry.

Content
The lecture

- Overview of product development in the automotive sector (process- and work cycle, IT-Systems)
- Integrated product models in the automotive industry (product, process and resource)
- New CAx modeling methods (intelligent feature technology, templates & functional modeling)
- Automation and knowledge-based mechanism for product design and production planning
- Product development in accordance with defined process and requirement (3D-master principle, tolerance models)
- Concurrent Engineering, shared working
- Enhanced concepts: the digital and virtual factory (application of virtual technologies and methods in the product development)
- Systems: CAD/CAM modeling (CATIA V5), planning (CATIA/DELMIA), archiving – PDM (CATIA/SmarTeam).

Additionally, A practical industrial project study is offered, which is based on an integrated application scenario (from design of production resources, over testing and validation method planning to the manufacturing and implementation of the production resources).
Since the student will be divided in small teams, this study will also teach the students about team word and distributed development.

Literature
Lecture slides

Remarks
Max. 20 students, registration necessary (ILIAS)

Course: Product Ergonomics (in German) [2109025]

Coordinators: Gert Zülch
Part of the modules: SP 10: Engineering Design (p. 166)[SP_10_mach]

ECTS Credits	Hours per week	Term	Instruction language
4	2	Winter term	de

Learning Control / Examinations
Oral exam, length: 30 minutes
(only in German)

Allowed resource materials: none

Conditions
None.

Recommendations

- Willingness to learn interdisciplinarily (Product design, Legal regulations Work physiology, Work psychology . . .)
- Knowledge of Technical design is usefull

Learning Outcomes

- Become proficient within the general terms of ergonomics
- Know legal regulations
- Know elementary methods and procedures
- Become proficient in applying ergonomic evaluation and judgement

Content

1. Introduction and case study
2. Terminology of ergonomics
3. Course of action of construction and legal regulations
4. Anthropometrical design (Body measures, functional dimensions, kinematics, statics, kinetics)
5. Design of Human-machine-interfaces (Functional design, readouts, adjustment mechanisms)
6. Evaluation of design solutions

Literature
Learning material:
Handout online on: https://ilias.rz.uni-karlsruhe.de/goto_rz-uka_cat_29099.html

Literature:

- BRUDER, Ralph (Hrsg.): Ergonomie und Design. Stuttgart: ergonomia Verlag, 2004.
- KIRCHNER, Johannes-Henrich; BAUM, Eckart: Ergonomie für Konstrukteure und Arbeitsgestalter. Hrsg.: REFA Verband für Arbeitsstudien und Betriebsorganisation. München: Carl Hanser Verlag, 1990.
- LANDAU, Kurt (Hrsg.): Good Practice. Stuttgart: ergonomia Verlag, 2003.
- LANDAU, Kurt (Hrsg.): Ergonomie Software Tools in Product and Workplace Design. Stuttgart Verlag ERGON, 2000.

- LAURIG, Wolfgang: Grundzüge der Ergonomie. Berlin, Köln: Beuth Verlag, 4. Auflage 1992.
- LUCZAK, Holger: Arbeitswissenschaft. Berlin u.a.: Springer-Verlag, 2. Auflage 1998.
- MERKEL, Torsten u.a.: Ergonomie-Lehrmodule für die Ausbildung von Konstrukteuren. Sankt Augustin: Verein zur Förderung der Arbeitssicherheit in Europa, 2008. (Kommission Arbeitsschutz und Normung, KAN-Bericht 42) http://www.kan.de/de/publikationen/kan-berichte/kan-berichte-anzeige/kandocs/9b6c0a0258/kanbericht/2695.html, Stand: 18.01.2011.
- SCHMIDTKE, Heinz (Hrsg.): Ergonomie. München, Wien: Carl Hanser Verlag, 3. Auflage 1998.
- SCHMIDT, Ludger; SCHLICK, Christopher M.; GROSCHE, Jürgen (Hrsg.): Ergonomie und Mensch-Maschine-Systeme. Berlin, Heidelberg: Springer-Verlag, 2008.

Please refer to the latest edition.

Course: Industrial Engineering I (in German) [2109028]

Coordinators: Gert Zülch
Part of the modules: SP 10: Engineering Design (p. 166)[SP_10_mach]

ECTS Credits	Hours per week	Term	Instruction language
4	2	Winter term	de

Learning Control / Examinations
Oral exam, length: 30 minutes
(only in German)

Allowed resource materials: none

Conditions
None.

Recommendations

- Willingness to learn interdisciplinarily (Technique, Economy, Legal regulations, Informatics ...)

Learning Outcomes

- Become proficient within the general terms of Production Management
- Know the basics of production planning and control

Content

1. Terminology
2. Departmental organisation
3. Process organisation
4. Product development and programme planning
5. Work preparation (Operations planning, Production planning and control)
6. Materials management

Literature
Learning material:
Handout online on: https://ilias.rz.uni-karlsruhe.de/goto_rz-uka_cat_29099.html

Literature:

- HACKSTEIN, Rolf: Produktionsplanung und -steuerung (PPS). Düsseldorf: VDI-Verlag, 1984.
- REFA - Verband für Arbeitsstudien und Betriebsorganisation (Hrsg.): Planung und Steuerung.
  - Teil 1: Grundbegriffe...
  - Teil 2: Programm und Auftrag...
  - Teil 3: Durchlaufzeit- und Terminermittlung...
  München: Carl Hanser Verlag, 1991. (Methodenlehre der Betriebsorganisation)
- WIENDAHL, Hans-Peter: Betriebsorganisation für Ingenieure. München, Wien: Carl Hanser Verlag, 7. Auflage 2010.

Please refer to the latest edition.

Course: Production Systems and Production Technology in Major Assembly Production [2150690]

Coordinators: VolkerMichael Stauch
Part of the modules: SP 12: Automotive Technology (p. 168)[SP_12_mach]

ECTS Credits	Hours per week	Term	Instruction language
4	2	Winter term	de

Learning Control / Examinations
oral exam

Conditions
None.

Recommendations
Attendance of the lecture 'Manufacturing Engineering' [2149657] is recommended prior to attending this lecture.

Learning Outcomes
The student
• understands the challenges a global automotive company is facing in current times
• knows the possibilities of modern manufacturing engineering and is aware of specific application examples from major assembly production
• is able to apply the methods and approaches covered by the lecture to problems from the context of the lecture.

Content
This lecture has a clear focus on real-life situations and conditions, provides many recent examples from industry and illustrates these examples by means of a study trip to Daimler's Untertürkheim plant. In addition to the technological aspects of major assembly production (engines, axles, transmissions), management-related aspects (HR management of approximately 20,000 employees), logistics-related aspects and other important general conditions (e.g. environmental requirements) will be addressed.

Main topics of the lecture:
• Facts and figures of the Daimler group and of the Untertürkheim plant
• Overview over the MDS and the major assembly process
• Powertrain systems
• Factory planning, start-up and total cost of ownership
• MPS - Mercedes Benz Production System
• Logistics
• Occupational health and safety and environmental protection
• Management and HR
• Quality management
• Study trip to the Untertürkheim plant

Literature
lecture notes

Course: Production Techniques Laboratory [2110678]

Coordinators: Kai Furmans, Jivka Ovtcharova, Volker Schulze, Gert Zülch, Research assitants of wbk, ifab und IFL
Part of the modules: SP 17: Information Management (p. 172)[SP_17_mach]

ECTS Credits	Hours per week	Term	Instruction language
4	3	Summer term	de

Learning Control / Examinations
Participate in practicle exercise courses and complete the colloquia successfully.

Conditions
Participation in the following lectures:
Informationssystems in logistics and supply chain management,
Material flow in logistic systems,
manufacturing technology,
Work Schience

Recommendations
none

Learning Outcomes
The student:

- knows the components of a modern factory are presented,
- ia able to gain a deeper understanding of these components by exercises.

Content
The production technique laboratory (PTL) is a collaboration of the institutes wbk, IFL, IMI and ifab.

1. Computer Aided Product Development
2. Production of parts with CNC turning machines
3. Controlling of production systems using PLCs
4. Workplace configuration
5. NN
6. Configuration of Display Work Stations
7. Time study
8. Optical identification in production and logistics
9. NN
10. Storage and order-picking systems
11. Computer communication in factory

Media
several

Literature
lecture notes

Remarks
none

Course: Project Workshop: Automotive Engineering [2115817]

Coordinators: Frank Gauterin
Part of the modules: SP 12: Automotive Technology (p. 168)[SP_12_mach]

ECTS Credits	Hours per week	Term	Instruction language
6	3	Winter / Summer Term	de

Learning Control / Examinations
Oral Examination

Duration: 30 up to 40 minutes

Auxiliary means: none

Conditions
None.

Learning Outcomes
The students are familiar with typical industrial development processes and working style. They are able to apply knowledge gained at the university to a practical task.

Content
During the Project Workshop Automotive Engineering a team of six persons will work on a task given by an German industrial partner using the instruments of project management. The task is relevant for the actual business and the results are intended to be industrialized after the completion of the project workshop.

The team will generate approaches in its own responsibility and will develop solutions for practical application. Coaching will be supplied by both, company and institute.

At the beginning in a start-up meeting goals and structure of the project will be specified. During the project workshop there will be weekly team meetings. Also a milestone meeting will be held together with persons from the industrial company. In a final presentation the project results will be presented to the company management and to institute representatives.

Literature
Steinle, Claus; Bruch, Heike; Lawa, Dieter (Hrsg.), Projektmanagement, Instrument moderner Innovation, FAZ Verlag, Frankfurt a. M., 2001, ISBN 978-3929368277

The scripts will be supplied in the start-up meeting.

Course: Development of Mobile Hydraulic Systems [2113071]

Coordinators: Gerhard Geerling
Part of the modules: SP 12: Automotive Technology (p. 168)[SP_12_mach]

ECTS Credits	Hours per week	Term	Instruction language
4	2	Winter term	de

Learning Control / Examinations
oral examination

Conditions
knowledge in the fluidics

Learning Outcomes
During the lecture the design and development of fluidic systems with special respect to the mobile hydraulics are to be mediated:

- marketing und development
- temperature regulation
- hydro-storage
- filtration

Content
Introduction to the application-oriented development of mobile hydraulic systems with practice-oriented applications.

Course: Project Management in Rail Industry [2115995]

Coordinators: Peter Gratzfeld
Part of the modules: SP 50: Rail System Technology (p. 181)[SP_50_mach]

ECTS Credits	Hours per week	Term	Instruction language
4	2	Winter term	de

Learning Control / Examinations

- Oral examination
- Duration: 20 minutes
- No tools or reference materials may be used during the exam.

Conditions
None

Recommendations
None

Learning Outcomes

- The students learn the basic of project management.
- They learn about the roles of project manager and project core team.
- They understand the project phases and know about processes and tools.
- They understand the governance process behind.

Content

- Project management system (project, project management, project phases, main processes and supporting processes, governance)
- Organization (organizational structure within a company, project organization, roles in a project organization)
- Main processes (project start, project plan, DPS, WBS, risk and opportunity management, change management, project closure)

Media
All slides are available for download (Ilias-platform).

Literature
A bibliography is available for download (Ilias-platform).

Remarks
None.

Course: Project management in Global Product Engineering Structures [2145182]

Coordinators: Peter Gutzmer

Part of the modules: SP 12: Automotive Technology (p. 168)[SP_12_mach], SP 31: Mechatronics (p. 177)[SP_31_mach], SP 48: Internal Combustion Engines (p. 180)[SP_48_mach], SP 17: Information Management (p. 172)[SP_17_mach], SP 10: Engineering Design (p. 166)[SP_10_mach], SP 02: Powertrain Systems (p. 161)[SP_02_mach]

ECTS Credits	Hours per week	Term	Instruction language
4	2	Winter term	de

Learning Control / Examinations

Oral examination
Duration: 20 minutes
Auxilary means: none

Conditions

none

Learning Outcomes

The management of projects is an factor of high significance for successfull companies. The course introduces the methods of the project management with the help of practical examples. Product development processes and the required organizational structures are also discussed. Participants learn to handle project management situations in global operating companies.

Content

- Product development process,
- Coordination of product development and handling of complexity,
- project management,
- matrix organization,
- planning / specification / target system,
- interaction of development and production

Literature

lecture notes

Course: Process Design and Industrial Engineering [2110036]

Coordinators: Sascha Stowasser
Part of the modules: SP 17: Information Management (p. 172)[SP_17_mach]

ECTS Credits	Hours per week	Term	Instruction language
4	2	Summer term	de

Learning Control / Examinations
Oral exam, length: 30 minutes
(only in German)

Allowed resource materials: none
There is the possibility to acquire the so-called "MTM-Grundschein" (non-academic certificat).

Conditions

- Compact course (one week full-time)
- Limited Number of Participants
- Registration in the ifab-office necessary
- Compulsory attendance during the whole lecture

Recommendations

- Knowledge of work science is usefull

Learning Outcomes

- Ability to design work operations and processes effecitvely and efficiently
- Instruction in methods of time study (MTM, Data acquisition etc.)
- Instruction in methods and principles of process design
- The Students are able to apply methods for the design of workplaces, work operations and processes.
- The Students are able to apply actual approaches of process and production organisation.

Content

1. Definition and terminology of process design and industrial engineering
2. Tasks of industrial engineering
3. Actual approaches of organisation of production (Holistic production systems, Guided group work et al.)
4. Methods and principles of industrial engineering and production systems
5. Case studies and exercises for process design

Media
Powerpoint, movies, exercises

Literature
Learning material:
Handout online on: https://ilias.rz.uni-karlsruhe.de/goto_rz-uka_cat_29099.html

Literature:

- BASZENSKI, Norbert: Methodensammlung zur Unternehmensprozessoptimierung. Köln: Wirtschaftsverlag Bachem, 3. Auflage 2008.
- BOKRANZ, Rainer; LANDAU, Kurt: Produktivitätsmanagement von Arbeitssystemen. Stuttgart: Schäffer Poeschel, 2006.
- Themenheft: Methodisches Produktivitätsmanagement: Umsetzung und Perspektiven. In: Zeitschrift angewandte Arbeitswissenschaft,Köln, 204(2010).
- NEUHAUS, Ralf: Produktionssysteme: Aufbau - Umsetzung - betriebliche Lösungen. Köln: Wirtschaftsverlag Bachem, 2008.
- ROTHER, Mike; SHOOK, John: Sehen lernen - mit Wertstromdesign die Wertschöpfung erhöhen und Verschwendung beseitigen. Aachen: Lean Management Institut, 2004.

Please refer to the latest edition.

Course: process simulation in forming operations [2161501]

Coordinators: Dirk Helm
Part of the modules: SP 13: Strength of Materials/ Continuum Mechanics (p. 170)[SP_13_mach]

ECTS Credits	Hours per week	Term	Instruction language
4	2	Winter term	

Learning Control / Examinations
oral examination (30 min)

Conditions
None.

Learning Outcomes
The student knows the most important forming operations and technological aspcets of them. He learns the elementary basis of modelling and simulating as well as of continuum mechanics and material theory. The students knows how to numerically solve initial-boundary-value problems using the finite element method.

Content
The lectures gives an introduction to simulation of formings processes of metallic materials and contains the basics of continuum mechanics, material theory and numerics.

Course: Advanced powder metals [2126749]

Coordinators: Rainer Oberacker
Part of the modules: SP 26: Materials Science and Engineering (p. 175)[SP_26_mach]

ECTS Credits	Hours per week	Term	Instruction language
4	2	Summer term	

Learning Control / Examinations
The assessment consists of an oral exam (20-30 min) taking place at the agreed date. The re-examination is offered upon agreement.

Conditions
Knowledge of basic material science is assumed. Therefore it is recommended to attend the courses Material Science I and Material Science II beforehand.

Learning Outcomes
The students know the basics of powder metallurgy. They are able to asses the conditions for applying either powder metallurgy or competing production methods. They have knowledge on production, properties and application of the most important PM materials.

Content
The lecture gives an overview on production, properties and application structural and functional powder metallurgy material. The following groups of materials are presented: PM High Speed Steels, Cemented Carbides, PM Metal Matrix Composites, PM Secialities, PM Soft Magnetic and Hard Magnetic Materials.

Literature
W. Schatt ; K.-P. Wieters ; B. Kieback. „.Pulvermetallurgie: Technologien und Werkstoffe“, Springer, 2007
R.M. German. “Powder metallurgy and particulate materials processing. Metal Powder Industries Federation, 2005
F. Thümmler, R. Oberacker. “Introduction to Powder Metallurgy”, Institute of Materials, 1993

Course: Quality Management [2149667]

Coordinators: Gisela Lanza
Part of the modules: SP 38: Production Systems (p. 178)[SP_38_mach], SP 44: Technical Logistics (p. 179)[SP_44_mach], SP 10: Engineering Design (p. 166)[SP_10_mach]

ECTS Credits	Hours per week	Term	Instruction language
4	2	Winter term	de

Learning Control / Examinations
Oral exams: Mechanical Engineering (Maschinenbaudiplom); Erasmus and Industrial Engineering (Wi.-Ing.): written examination

Conditions
None.

Learning Outcomes
The student
• has knowledge of the content covered by the lecture,
• understands the quality philosophies covered by the lecture,
• is able to apply the QM tools and methods he/she has learned about in the lecture to new problems from the context of the lecture,
• is able to analyse and evaluate the suitability of the methods, procedures and techniques he/she has learned about in the lecture for a specific problem.

Content
Based on the quality philosophies Total Quality Management (TQM) and Six Sigma, the lecture deals with the requirements of modern quality management. Within this context, the process concept of a modern enterprise and the process-specific fields of application of quality assurance methods are presented. The lecture covers the current state of the art in preventive and non-preventive quality management methods in addition to manufacturing metrology, statistical methods and service-related quality management. The content is completed with the presentation of certification possibilities and legal quality aspects.

Main topics of the lecture:
1. The term “quality”
2. Total Quality Management (TQM) and Six Sigma
3. Universal methods and tools
4. QM during early product stages – product definition
5. QM during product development and in procurement
6. QM in production – manufacturing metrology
7. QM in production – statistical methods
8. QM in service
9. Quality management systems
10. Legal aspects of QM

Literature
Lecture notes

Course: Computational Dynamics [2162246]

Coordinators: Carsten Proppe
Part of the modules: SP 13: Strength of Materials/ Continuum Mechanics (p. 170)[SP_13_mach]

ECTS Credits	Hours per week	Term	Instruction language
4	2	Summer term	

Learning Control / Examinations
Oral examination, no auxiliary means allowed

Conditions
none

Recommendations
none

Learning Outcomes
The lecture teaches the ability to compute solutions for problems in structure dynamics. For this purpose differential equations for the vibration of structure elements are presented and solved by means of numerical methods.

Content
1. Fundamentals of elasto-kinetics (Equations of motion, principle of Hamilton and principle of Hellinger-Reissner)
2. Differential equations for the vibration of structure elements (bars, plates)
3. Numerical solutions of the equations of motion
4. Numerical algorithms
5. Stability analyses

Literature
1. Lecture notes (in German) will be provided!
2. M. Géradin, B. Rixen: Mechanical Vibrations, Wiley, Chichester, 1997

Remarks
The course takes place every two years (in pair years).

Course: Computational Vehicle Dynamics [2162256]

Coordinators: Carsten Proppe
Part of the modules: SP 12: Automotive Technology (p. 168)[SP_12_mach], SP 50: Rail System Technology (p. 181)[SP_50_mach]

ECTS Credits	Hours per week	Term	Instruction language
4	2	Summer term	de

Learning Control / Examinations
Oral examination, no auxiliary means allowed

Conditions
none

Recommendations
none

Learning Outcomes
This course serves as an introduction to the computational modelling and simulation of the technical system road/vehicle. A method based perspective is taken, which allows for a unified treatment of various kinds of vehicles. The vehicle model is obtained by dividing the system into functional subsystems and defining interfaces between these subsystems. In the first part of the course, vehicle models will be developed based on models of the suspensions, the road, and the contact forces between road and vehicle. The focus of the second part of the course is on computational methods for linear and non-linear models of vehicle systems. The third part of the course discusses design criteria for stability, safety and ride comfort.The multi body dynamics software Simpack will be used.

Content
1. Introduction
2. Models of load bearing systems
3. Contact forces between wheels and roadway
4. Simulation of roadways
5. Vehicle models
6. Methods of calculation
7. Performance indicators

Literature
1. K. Popp, W. Schiehlen: Fahrzeugdynamik, B. G. Teubner, Stuttgart, 1993
2. H.-P. Willumeit: Modelle und Modellierungsverfahren in der Fahrzeugdynamik, B. G. Teubner, Stuttgart, 1998
3. H. B. Pacejka: Tyre and Vehicle Dynamics. Butterworth Heinemann, Oxford, 2002
4. K. Knothe, S. Stichel: Schienenfahrzeugdynamik, Springer, Berlin, 2003

Remarks
The course takes place every two years (impair years only).

Course: Computational Mechanics I [2161250]

Coordinators: Thomas Böhlke, Tom-Alexander Langhoff
Part of the modules: SP 05: Calculation Methods in Mechanical Engineering (p. 162)[SP_05_mach], SP 13: Strength of Materials/ Continuum Mechanics (p. 170)[SP_13_mach], SP 07: Dimensioning and Validation of Mechanical Constructions (p. 164)[SP_07_mach]

ECTS Credits	Hours per week	Term	Instruction language
5	2	Winter term	de

Learning Control / Examinations
oral examination

Conditions
None.

Recommendations
"Mathematical Methods in Strength of Materials" and "Introduction to the Finite Element Method"

Learning Outcomes
The students know the principles and the theory of the linear finite element method. They master die basic applications of the finite element method in solid mechanics and know the formulation as well as the numerical solution of linear two-dimensional problems.

Content

- numerical solution of linear systems
- basics of boundary value problems of linear elasticity
- solution methods of boundary value problem of linear elasticity;
- matrix displacement method
- variational principles of linear elasticity
- finite-element-technology for linear static problems

Literature
Simó, J.C.; Hughes, T.J.R.: Computational Inelasticity. Springer 1998.
Haupt, P.: Continuum Mechanics and Theory of Materials. Springer 2002.
Belytschko, T.; Liu,W.K.; Moran, B.: Nonlinear FE for Continua and Structures. JWS 2000.
W. S. Slaughter: The linearized theory of elasticity. Birkhäuser, 2002.
J. Betten: Finite Elemente für Ingenieure 2, Springer, 2004.

Course: Computational Mechanics II [2162296]

Coordinators: Thomas Böhlke, Tom-Alexander Langhoff
Part of the modules: SP 05: Calculation Methods in Mechanical Engineering (p. 162)[SP_05_mach], SP 13: Strength of Materials/ Continuum Mechanics (p. 170)[SP_13_mach], SP 07: Dimensioning and Validation of Mechanical Constructions (p. 164)[SP_07_mach]

ECTS Credits	Hours per week	Term	Instruction language
5	2	Summer term	de

Learning Control / Examinations
oral examination

Conditions
Successful participation in lecture Computational Mechanics I

Learning Outcomes
The students can effectively use the theoretical basics of inelastic mechanical material behaviour and master the numerical implementation. They know the weak formulation of two-dimensional non-linear problems of solid mechanics and obatin a numerical solution of the discretized equations using the Finite-Element-Method. They know the basics of numerics of nonlinear systems, kinematics and balanve equations of non-linear solid mechanics, of finite elasticity and infinitesimal plasticity, of linear and non-linear thermoelasticity.

Content

- overview quasistatic nonlinear phenomena
- numerics of nonlinear systems
- foundations of nonlinear continuum mechanics
- balance equations of geometrically nonlinear solid mechanics
- finite elasticity
- infinitesimal plasicity
- linear and gemetrically nonlinear thermoelasticity

Literature
Simó, J.C.; Hughes, T.J.R.: Computational Inelasticity. Springer 1998.Haupt, P.: Continuum Mechanics and Theory of Materials. Springer 2002.Belytschko, T.; Liu,W.K.; Moran, B.: Nonlinear FE for Continua and Structures. JWS 2000.

Course: Robotic I [24152]

Coordinators: Rüdiger Dillmann, Kai Welke, Dillmann, Welker, Do
Part of the modules: SP 31: Mechatronics (p. 177)[SP_31_mach], SP 09: Dynamic Machine Models (p. 165)[SP_09_mach]

ECTS Credits	Hours per week	Term	Instruction language
3	2	Winter term	

Learning Control / Examinations

Conditions
None.

Learning Outcomes

Content

Course: Failure Analysis [2173562]

Coordinators: Katja Poser
Part of the modules: SP 07: Dimensioning and Validation of Mechanical Constructions (p. 164)[SP_07_mach], SP 02: Powertrain Systems (p. 161)[SP_02_mach], SP 26: Materials Science and Engineering (p. 175)[SP_26_mach]

ECTS Credits	Hours per week	Term	Instruction language
4	2	Winter term	de

Learning Control / Examinations
oral

Duration: 20 - 30 minutes

no notes

Conditions
basic knowledge in materials science (e.g. lecture materials science I and II)

Learning Outcomes
The students are able to discuss damage evaluation and to perform damage investigations. They know the common necessary investigation
methods and can regard failures considering load and material resistance. Furthermore they can describe and discuss the most important types of failure and damage appearance.

Content
Aim, procedure and content of examining failure

Examination methods

Types of failure:
Failure due to mechanical loads
Failure due to corrosion in electrolytes
Failure due to thermal loads
Failure due to tribological loads

Damage systematics

Literature
A literature list, specific documents and partial lecture notes shall be handed out during the lecture.

Course: Rail Vehicle Technology [2115996]

Coordinators: Peter Gratzfeld
Part of the modules: SP 50: Rail System Technology (p. 181)[SP_50_mach]

ECTS Credits	Hours per week	Term	Instruction language
4	2	Winter / Summer Term	de

Learning Control / Examinations

- Oral examination
- Duration: 20 minutes
- No tools or reference materials may be used during the exam.

Conditions
none

Recommendations
none

Learning Outcomes

- The students learn about advantages and disadvantages of different types of traction drives and judge which one fits best for each application.
- They understand brakes from a vehicular and an operational point of view. They assess the fitness of different brake systems.
- They know about the basics of running dynamics and bogies.
- They define suitable vehicle concepts based on requirements for modern rail vehicles.

Content

- Main systems of rail vehicles
- Electric and non-electric traction drives
- Brakes
- Bogies
- Vehicle concepts for mass transit and main line

Media
All slides are available for download (Ilias-platform).

Literature
A bibliography is available for download (Ilias-platform).

Remarks
None.

Course: Welding Technology I [2173565]

Coordinators: Bernhard Spies
Part of the modules: SP 26: Materials Science and Engineering (p. 175)[SP_26_mach]

ECTS Credits	Hours per week	Term	Instruction language
2	1	Winter term	de

Learning Control / Examinations
oral

Duration: 30 minutes
(Welding Technology I+II)

no auxiliary material

Conditions
basics of material science (iron- and non-iron alloys), of electrical engineering, of production processes.

Learning Outcomes
knowledge and understanding of the most important welding processes and its industrial application.

recognition, understanding and handling of problems occuring during the application of different welding processes relating to design, material and production.

classification and importance of welding technonolgy within the scope of connecting processes (advantages/disadvantages, alternatives).

Content
definition, application and differentiation: welding,
welding processes,
alternative connecting technologies.
history of welding technology
sources of energy for welding processes

Survey: fusion welding,
pressure welding.
seam preparation/design
welding positions
weldability
gas welding, thermal cutting

manual metal-arc welding
submerged arc welding
IV characteristics: arc/sources of energy
gas-shielded metal-arc welding

Literature
Ruge: Handbuch der Schweißtechnik, Springer-Verlag, 1985

Dilthey: Schweißtechnische Fertigungsverfahren I, Augustinus, Aachen, 1991

Fachbände des Deutschen Verlags für Schweißtechnik

Course: Welding Technology II [2174570]

Coordinators: Bernhard Spies
Part of the modules: SP 26: Materials Science and Engineering (p. 175)[SP_26_mach]

ECTS Credits	Hours per week	Term	Instruction language
2	1	Summer term	de

Learning Control / Examinations
oral

Duration: 30 minutes (Welding Technology I + II)

no auxiliary material

Conditions
lecture on Welding Technology I.
basics of material science (iron- and non-iron alloys), of electrical engineering, of production processes.

Learning Outcomes
recognition, understanding and handling of problems occuring during the application of different welding processes relating to design, material and production.

consolidation of and amplification to the knowledge of Welding Technology I

consolidation of knowledge of material behaviour during welding
design and properties of welded constructions
quality assurance for welding processes

Content
narrow gap welding
TIG-welding
plasma arc welding
electron beam welding
laser welding

spot welding / projection welding
heat flow at welding

welding of low-alloy steel / time-temperature-transformation curve.
welding of high-alloy steel / austenite / Schaefflerdiagramm
low temperature steels
welding of cast iron

heat treatment for welding
welding of aluminium alloys
residual welding stress
methods of testing
design of welded constructions

Literature
Ruge: Handbuch der Schweißtechnik, Springer-Verlag, 1985

Dilthey: Schweißtechnische Fertigungsverfahren II, Augustinus, Aachen, 1991

Course: Fatigue of Metallic Materials [2173585]

Coordinators: Karl-Heinz Lang
Part of the modules: SP 26: Materials Science and Engineering (p. 175)[SP_26_mach], SP 07: Dimensioning and Validation of Mechanical Constructions (p. 164)[SP_07_mach]

ECTS Credits	Hours per week	Term	Instruction language
4	2	Winter term	de

Learning Control / Examinations
oral
Duration: 30 minutes
none

Conditions
none, basic knowledge in Material Science will be helpful

Learning Outcomes
The lecture gives an overview of the deformation and damage behaviour of metallic materials under cyclic loading.
Both the fundamental microstructural processes as well as the development of macroscopic damages are mentioned. The fundamental procedures for the evaluation of uniform and stochastic cyclical loadings are also explained. The students will be able to recognize possible damage due to cyclical loadings and evaluate the fatigue behaviour of components both qualitatively as well as quantitatively.

Content
Introduction: some interesting cases of damage
Testing Facilities
Cyclic Stress Strain Behaviour
Crack Initiation
Crack Propagation
Lifetime Behaviour under Cyclic Loading
Fatigue of Notched Components
Structural Durability

Literature
Lecture notes that include a list of current literature will be distributed.

Course: Schwingungstechnisches Praktikum [2161241]

Coordinators: Hartmut Hetzler, Alexander Fidlin
Part of the modules: SP 05: Calculation Methods in Mechanical Engineering (p. 162)[SP_05_mach], SP 09: Dynamic Machine Models (p. 165)[SP_09_mach]

ECTS Credits	Hours per week	Term	Instruction language
3	3	Summer term	de

Learning Control / Examinations
Colloquium to each session.

Conditions
None.

Recommendations
Vibration theory, mathematical methods of vibration theory, dynamic stability, nonlinear vibrations

Learning Outcomes
* Introduction to common measurement principles for mechanical vibrations
* selected vibrational problems are demonstrated from a theoretical and experimental aspect
* Measurement, evaluation and
comparison with analytical calculations.

Content
* Frequency response of a force-excited oscillator (1DoF)
* stochastically excited oscillator (1DoF)
* digital processing of measurement data
* Determination of Lehr's damping measure from resonance
* forces vibrations of a Duffing oscillator
* isolation of acoustical waves by means of additional masses
* critical speeds of a rotor in elastic bearings
* stability of a parametrically excited oscillator
* resonance of clamped beams with variable cross section
* experimental modal analysis

Literature
comprehensive instructions will be handed out

Course: Selected Topics in Manufacturing Technologies [2118092]

Coordinators: Volker Schulze
Part of the modules: SP 52: Production Management (p. 182)[SP_52_mach]

ECTS Credits	Hours per week	Term	Instruction language
4	2	Summer term	en

Learning Control / Examinations

Conditions
None.

Learning Outcomes

Content

Course: Failure Analysis Seminar [2173577]

Coordinators: Katja Poser
Part of the modules: SP 26: Materials Science and Engineering (p. 175)[SP_26_mach]

ECTS Credits	Hours per week	Term	Instruction language
2	2	Winter term	de

Learning Control / Examinations
participation, report

Conditions
knowledge in ’failure analysis’

Learning Outcomes
The seminar deals with real failed parts. The students will carry out complete failure analyses incl. appropiate reporting. It starts with the basic failure mechanisms of machanically, chemically, and thermally induced failures and it failure appearances. After the failure mechanisms are known possible counters to measure are presented and discussed.

Content
analyse of real failed parts

failure appearances

mechanisms of failure

prevention of failure

writing a report

Course: Safety engineering [2117061]

Coordinators: Hans-Peter Kany
Part of the modules: SP 10: Engineering Design (p. 166)[SP_10_mach], SP 44: Technical Logistics (p. 179)[SP_44_mach]

ECTS Credits	Hours per week	Term	Instruction language
4	2	Winter term	de

Learning Control / Examinations
oral / written (if necessary) => (see “Studienplan Maschinenbau”, version of 7.7.2010)
examination aids: none

Conditions
none

Recommendations
none

Learning Outcomes
The student:

- has basic knowledfe of safety engineering,
- knows the basics of industrial health and labour protection in Germany,
- is familiar with the national and european safety regulations and the basics for the safe methods of design of machinery.
- is able to realize these objectives by using examples in the field of storage- and conveyor-systems.

Content
The course provides basic knowledge of safety engineering. In particular the basics of health at the working place, job safety in Germany, national and European safety rules and the basics of safe machine design are covered. The implementation of these aspects will be illustrated by examples of material handling and storage technology. This course focuses on: basics of safety at work, safety regulations, basic safety principles of machine design, protection devices, system security with risk analysis, electronics in safety engineering, safety engineering for storage and material handling technique, electrical dangers and ergonomics. So, mainly, the technical measures of risk reduction in specific technical circumstances are covered.

Media
presentations

Literature
Defren/Wickert: Sicherheit für den Maschinen- und Anlagenbau, Druckerei und
Verlag: H. von Ameln, Ratingen, ISBN: 3-926069-06-6

Remarks
none

Course: Signals and Systems [23109]

Coordinators: Fernando Puente
Part of the modules: SP 31: Mechatronics (p. 177)[SP_31_mach]

ECTS Credits	Hours per week	Term	Instruction language
3	2	Winter term	de

Learning Control / Examinations

Conditions

None.

Learning Outcomes

Content

Course: Simulation of Coupled Systems [2114095]

Coordinators: Marcus Geimer
Part of the modules: SP 05: Calculation Methods in Mechanical Engineering (p. 162)[SP_05_mach], SP 09: Dynamic Machine Models (p. 165)[SP_09_mach]

ECTS Credits	Hours per week	Term	Instruction language
4	2/2	Summer term	de

Learning Control / Examinations
The assessment consists of an oral exam (20 min) taking place in the recess period. The exam takes place in every semester. Re-examinations are offered at every ordinary examination date.

Conditions
It is recommended to have:

- Knowledge of ProE (ideally in current version)
- Basic knowledge of Matlab/Simulink
- Basic knowledge of dynamics of machines
- Basic knowledge of hydraulics

Learning Outcomes
The limitation of the simulation programs and the related problems will be introduced by using the example of the working movement of a wheel loader. As a solution the coupled simulation of multiple programs by using the mentioned example will be shown.

Content

- Knowledge of the basics of multi-body and hydraulic simulation programs
- Possibilities of coupled simulations
- Development of a simulation model by using the example of a wheel loader
- Documentation of the result in a short report

Literature
Elective literature:

- miscellaneous guides according the software-tools pdf-shaped
- information to the wheel-type loader

Course: Simulation in product development process [2185264]

Coordinators: Albert Albers, Thomas Böhlke, Jivka Ovtcharova

Part of the modules: SP 12: Automotive Technology (p. 168)[SP_12_mach], SP 05: Calculation Methods in Mechanical Engineering (p. 162)[SP_05_mach], SP 09: Dynamic Machine Models (p. 165)[SP_09_mach], SP 07: Dimensioning and Validation of Mechanical Constructions (p. 164)[SP_07_mach], SP 10: Engineering Design (p. 166)[SP_10_mach], SP 13: Strength of Materials/ Continuum Mechanics (p. 170)[SP_13_mach], SP 31: Mechatronics (p. 177)[SP_31_mach]

ECTS Credits	Hours per week	Term	Instruction language
4	2	Winter term	de

Learning Control / Examinations
Not graded:
term paper in group work

- written part: 10 pages per person
- presentation: 15 minutes per group

Conditions
None.

Recommendations
None.

Learning Outcomes
The students learn the connections between simulation methods, the necessary IT technique and the integration of such methods within the product development process. They know the basic approximation methods in mechanics and methods of modelling material behaviour using the finite-element-method. The students learn the integration within the product development process as well as the necessity of coupling different methods and systems. They master the modelling of heterogeneous technical systems and know the foundations of virtual reality.

Content

- approximation methods of mechanics: FDM, BEM, FEM, MBS
- material modelling using the finite-element-methode
- product life cycle
- coupling of methods and system integration
- modelling heterogeneous technical systems
- functional Digital Mock-Up (DMU), virtual prototypes

Literature
sildes of lectures will be available

Course: Simulation of production systems and processes [2149605]

Coordinators: Kai Furmans, Volker Schulze, Gert Zülch
Part of the modules: SP 38: Production Systems (p. 178)[SP_38_mach]

ECTS Credits	Hours per week	Term	Instruction language
5	3	Winter term	de

Learning Control / Examinations
oral examination

Conditions
none

Recommendations
none

Learning Outcomes
The student knows different possibilities of simulation technology within the production technology and is able to use those methods. They range from the modeling of production and work systems down to simulation of single manufacturing processes.

Content
The lecture is focused on the various aspects and possibilities of the usage of simulation technologies within the production technology. First the definition of the terminology and the basic knowledge is pointed out. In the chapter “Design of experiments and validation” the procedure of a simulation study with the preparation work, the selection of the simulation tools, the validation and the analysis of the simulation runs will be discussed. The chapter “Statistical basics” deals with probability distribution and random numbers as well as the use of Monte-Carlo-simulations in practical exercises. The chapter “Simulation of plant, machinery and processes” addresses the simulative analysis of single manufacturing processes via the examination of machine tools down to the modeling of a digital plant with the focus on the production facility. The chapter “Simulation of work systems” in addition consideres the personnel integrated and orientated simulation. Here the assembly systems and the enterprise orientated simulation is considered. Finally the specifications of the material flow simulation for production systems are examined.

Literature
none

Remarks
The lecture starts in winter term 2011/12

Course: Simulation of spray and mixture formation processes in combustion engines [2133114]

Coordinators: Carsten Baumgarten
Part of the modules: SP 48: Internal Combustion Engines (p. 180)[SP_48_mach], SP 05: Calculation Methods in Mechanical Engineering (p. 162)[SP_05_mach]

ECTS Credits	Hours per week	Term	Instruction language
4	2	Winter term	de

Learning Control / Examinations
oral examination, Duration: ca. 45 min., no auxiliary means

Conditions
None.

Recommendations
basic knowledge in combustion engines and fluid dynamics helpful

Learning Outcomes
Students get to know the more and more important field of mathematical modelling and simulation of three dimensional spray and mixture formation processes. After describing the fundamental mechanisms and categories of the in-cylinder spray and mixture formation the basic equations needed for sub-processes such as spray breakup, droplet decelleration, droplet collision, ignition etc. are discussed. Last but not least trend-setting mixture formation strategies and their potential for engines with direct injection are discusses.

Content
Fundamentals of mixture formation in combustin engines

Injection systems and nozzle types

basic equations of fluid dynamics

modelling of spray and mixture formation

DI Diesel engines

DI Gasoline engines

HCCI combustion process

Literature
Slides available in the lectures

Course: Mechatronic Softwaretools [2161217]

Coordinators: Carsten Proppe
Part of the modules: SP 31: Mechatronics (p. 177)[SP_31_mach], SP 05: Calculation Methods in Mechanical Engineering (p. 162)[SP_05_mach], SP 50: Rail System Technology (p. 181)[SP_50_mach]

ECTS Credits	Hours per week	Term	Instruction language
4	2	Winter term	de

Learning Control / Examinations
written exam, duration: 1 h

Conditions
none

Recommendations
none

Learning Outcomes
Mechatronic Softwaretools is a practical training course on using the software packages Maple, Matlab, Simulink and Adams. Mechatronic problems are solved using these packages on PCs.

Content
1. Introduction to Maple: Generating of the nonlinear equations of motion for a double pendulum. Stability and resonance investigation of a Laval-rotor.
2. Introduction to Matlab: Dynamic simulation of a basic vehicle model using the Runge-Kutta-method. Solution of the partial differential equation for a rod by a Galerkin approximation.
3. Introduction to Simulink: Block diagrams of one-mass- and two-mass-oscillators. PID-distance control of two vehicles.
4. Introduction to Adams: Modelling and dynamic simulation of a simple robotic manipulator.

Literature
Hörhager, M.: Maple in Technik und Wissenschaft, Addison-Wesley-Longman, Bonn, 1996

Hoffmann, J.: Matlab und Simulink, Addison-Wesley-Longman, Bonn, 1998

Programmbeschreibungen des Rechenzentrums Karlsruhe zu Maple, Matlab und Simulink

Course: [2163113]

Coordinators: Alexander Fidlin
Part of the modules: SP 05: Calculation Methods in Mechanical Engineering (p. 162)[SP_05_mach], SP 09: Dynamic Machine Models (p. 165)[SP_09_mach]

ECTS Credits	Hours per week	Term	Instruction language
8	4	Winter term	de

Learning Control / Examinations
Oral examination

Duration: 30 min (optional subject)
20 min (major subject)

Means are not allowed

Conditions
None.

Recommendations
Vibration theory, mathematical methods of vibration theory

Learning Outcomes

- to learn the most important methods of the stability analysis
- to apply the stabiliy analysis for equilibria
- to apply the stabiliy analysis for periodic solution
- to apply the stabiliy analysis for systems with feedback control

Content

- Basic concepts of stability
- Lyapunov's functions
- Direct lyapunov's methods
- Stability of equilibria positions
- Attraction area of a stable solution
- Stability according to the first order approximation
- Systems with parametric excitation
- Stability criteria in the control theory

Literature

- Pannovko Y.G., Gubanova I.I. Stability and Oscillations of Elastic Systems, Paradoxes, Fallacies and New Concepts. Consultants Bureau, 1965.
- Hagedorn P. Nichtlineare Schwingungen. Akademische Verlagsgesellschaft, 1978.
- Thomsen J.J. Vibration and Stability, Order and Chaos. McGraw-Hill, 1997.

Course: Control engineering [2150683]

Coordinators: Christoph Gönnheimer
Part of the modules: SP 38: Production Systems (p. 178)[SP_38_mach], SP 02: Powertrain Systems (p. 161)[SP_02_mach], SP 18: Information Technology (p. 173)[SP_18_mach]

ECTS Credits	Hours per week	Term	Instruction language
4	2	Summer term	de

Learning Control / Examinations
oral examination

Conditions
None.

Learning Outcomes
The lecture deals with technical bases of process-oriented information- and control technologies, signal theory and electrical drive technology, programmable logic control, numerical control and robot control technologies as long as computer communication and process control. Furthermore modern field bus technologies are illustrated and current trends in automation technologies are presented. Demonstration of the production science laboratory and an excursion to an industry partner shows the implementation in real applications of the lecture themes.

Content
1. Basics of control engineering
2. Control periphery
3. Programmable logic control (PLC)
4. Numerical control (NC)
5. Robot Control
6. Communication technology
7. Trends in automation technology

Course: Strategic Product Planing [2146193]

Coordinators: Andreas Siebe
Part of the modules: SP 10: Engineering Design (p. 166)[SP_10_mach], SP 02: Powertrain Systems (p. 161)[SP_02_mach], SP 12: Automotive Technology (p. 168)[SP_12_mach]

ECTS Credits	Hours per week	Term	Instruction language
4	2	Summer term	de

Learning Control / Examinations
oral exam

Conditions
registration

Learning Outcomes
Succesful enterprises at an early stage know how their offers do look like on the markets of tomorrow. Thus, beneath the market potentials, also the possible market ratings i.e. the products as well as the underlieing technologies must be thought ahead.The lecture introduces systematically into future management. Different approaches are explained and evaluated. Based on this foundation, the scenariobased strategic productplanning is explained theoretically and exemplified through concretely.

Content
Introduction into future management, Development of scenarios, scenariobased strategy development, trendmanagement, strategic early detection, innovation- and technologymanagement, scenarios in product development, from profiles of requirements to new products, examples out of industrial praxis.

Course: Structural and Functional Ceramics [2126775]

Coordinators: Michael Hoffmann
Part of the modules: SP 26: Materials Science and Engineering (p. 175)[SP_26_mach]

ECTS Credits	Hours per week	Term	Instruction language
4	2	Summer term	de

Learning Control / Examinations
oral
20 min
Auxiliary means:none

Conditions
None.

Learning Outcomes
Based on concrete examples the importance of microstructural constitution on mechanical, thermal, chemical and electrical properties is shown.

Content
The lecture gives an overview on structure and properties of technical relevant structural and functional ceramic materials and parts. The following groups of materials are presented:
Silicon Nitride, Silicon Carbide, Alumina, Zirconia, Ferrolectric ceramics.

Literature
W.D. Kingery, H.K. Bowen, D.R. Uhlmann, Introduction to Ceramics, John Wiley & Sons, New York, (1976)

E. Dörre, H. Hübner, Aluminia, Springer Verlag Berlin, (1984)

J. Kriegesmann, Technische Keramische Werkstoffe, Deutscher Wirtschaftsdienst Köln, (1989)

A. J. Moulson, J. M. Herbert, Electroceramics, Materials, Properties, Applications, Chapman and Hall, London, (1990)

Course: Supply chain management [2117062]

Coordinators: Knut Alicke
Part of the modules: SP 17: Information Management (p. 172)[SP_17_mach]

ECTS Credits	Hours per week	Term	Instruction language
6	4	Winter term	de

Learning Control / Examinations
oral examination

No tools or reference materials may be used during the exam.

Conditions
limited number: application necessary

Learning Outcomes
The student knows theoretical and practical basics to use approaches of Supply Chain Management within the operational practice.

Content

- Bullwhip-Effect, Demand Planning & Forecasting
- Conventional planning processes (MRP + MRPII)
- Stock keeping strategy
- Data acquisition and analysis
- Design for logistics (Postponement, Mass Customization, etc.)
- Logistic partnerships (VMI, etc.)
- Distribution structures (central vs. distributed, Hub&Spoke)
- SCM-metrics (performance measurement) e-business
- Special sectors as well as guest lectures

Media
presentations

Literature
Alicke, K.: Planung und Betrieb von Logistiknetzwerken

Simchi-Levi, D., Kaminsky, P.: Designing and Managing the Supply Chain

Goldratt, E., Cox, J.: The Goal

Remarks
this course is a block course

Course: Sustainable Product Engineering [2146192]

Coordinators: Karl-Friedrich Ziegahn

Part of the modules: SP 12: Automotive Technology (p. 168)[SP_12_mach], SP 31: Mechatronics (p. 177)[SP_31_mach], SP 48: Internal Combustion Engines (p. 180)[SP_48_mach], SP 17: Information Management (p. 172)[SP_17_mach], SP 15: Fundamentals of Energy Technology (p. 171)[SP_15_mach], SP 10: Engineering Design (p. 166)[SP_10_mach], SP 02: Powertrain Systems (p. 161)[SP_02_mach]

ECTS Credits	Hours per week	Term	Instruction language
4	2	Summer term	

Learning Control / Examinations
oral exam

Conditions
None.

Learning Outcomes
The goal of the lecture is to convey the main elements of sustainable product development in the economic, social and ökologichen context.

Content

- understanding of sustainability objectives and their role in product development, the interaction between technical products and their environment, the holistic approach and the equality of economic, social and environmental aspects and environmental aspects
- skills for life-cycle product design using the example of complex automotive components such as airbag systems and other current products
- understanding of product environmental stresses with relevancy to praxis at the example of technology-intensive components, robustness and durability of products as the basis for a sustainable product development, development of skills for the application of environmental simulationduring the process of developement of technical products
- delivery of key skills such as team skills / project / self / presentation based on realistic projects

Course: Technical Acoustics [2158107]

Coordinators: Martin Gabi
Part of the modules: SP 48: Internal Combustion Engines (p. 180)[SP_48_mach], SP 10: Engineering Design (p. 166)[SP_10_mach], SP 24: Energy Converting Engines (p. 174)[SP_24_mach], SP 15: Fundamentals of Energy Technology (p. 171)[SP_15_mach]

ECTS Credits	Hours per week	Term	Instruction language
4	2	Summer term	de

Learning Control / Examinations
Oral examination
Duration: 30 minutes
No tools or reference materials may be used during the exam.

Conditions
none

Recommendations
none

Learning Outcomes
First, the students get to know the fundmental physical-mathematical laws of acoustics in general and the human hearing characteristics. Second, the difference of sound and noise will be outlined. Physical-empirical laws for determination of sound and noise levels of various emission and immission situations will be worked out or derived. Furtheron general sound measurement methods of machinery will be taught. A special focus here are fluid machinery.

Content
Human ear, wave propagation, wave equation, concept of acoustice poles, acoustic level notation, levels of various physical magnitudes, and levels which are corrected by means of hearing sensation, physical-empirical laws of wave propagation in various media, measurement techniques for machinery, fluid driven noise

Literature
1. Lecture notes (downloadable from institute's homepage).
2. Heckl, M.; Müller, H. A.: Taschenbuch der Technischen Akustik, Springer-Verlag.
3. Veit, Ivar: Technische Akustik. Vogel-Verlag (Kamprath-Reihe), Würzburg.
4. Henn, H. et al.: Ingenieurakustik. Vieweg-Verlag.

Course: Computer Engineering [2106002]

Coordinators: Georg Bretthauer
Part of the modules: SP 18: Information Technology (p. 173)[SP_18_mach]

ECTS Credits	Hours per week	Term	Instruction language
4	3	Summer term	de

Learning Control / Examinations
Written examination

Duration: 2 hours (compulsory subject)

Auxiliary means: none

Conditions
None.

Recommendations
None.

Learning Outcomes
The students possess essential knowledge about information processing in digital computers. Based on information representation and calculations of complexity, students are capable to design algorithms efficiently. The students are able to apply the knowledge about efficient algorithm design to important numerical computation methods in mechanical engineering. Students understand the importance of software quality in mechanical engineering and know basic concepts and important measures of quality assurance.

Content
Introduction: definitions, basic concepts, introductory examples

Information coding on finite automata: numbers, characters, commands, examples

Algorithm design: definitions, complexity of algorithms, complexity classes P and NP, examples

Sorting algorithms: relevance, algorithms, simplifications, examples

Software quality assurance: terms and measures, errors, phases of quality assurance, constructive measures, analytical measures, certification

Lectures are complemented by an exercice course.

Literature
Vorlesungsskript (Internet)

Becker, B., Molitor, P.: Technische Informatik : eine einführende Darstellung. München, Wien : Oldenbourg, 2008.

Hoffmann, D. W.: Grundlagen der Technischen Informatik. München: Hanser, 2007.

Balzert, H.: Lehrbuch Grundlagen der Informatik : Konzepte und Notationen in UML, Java und C++, Algorithmik und Software-Technik, Anwendungen. Heidelberg, Berlin : Spektrum, Akad. Verl., 1999.

Trauboth, H.: Software-Qualitätssicherung : konstruktive und analytische Maßnahmen. München, Wien : Oldenbourg, 1993.

Course: Integrated Information Systems for engineers [2121001]

Coordinators: Sven Rogalski, Jivka Ovtcharova
Part of the modules: SP 38: Production Systems (p. 178)[SP_38_mach], SP 17: Information Management (p. 172)[SP_17_mach]

ECTS Credits	Hours per week	Term	Instruction language
5	3	Winter term	de

Learning Control / Examinations
Oral examination, Duration: 25 min., Auxiliary Means: none

Conditions
None

Recommendations
None

Learning Outcomes
Students should gain deeper knowledge about structures and functions of IT-systems applied in product development (engineering and manufacturing). They achieve general knowledge about the relevance of IT-support in engineering tasks.
Students know general approaches for introducing IT systems in existing Enterprise structures and have detail knowledge about “evolutionary process models of PLM” for a successful of IT-Systems installation.

Content

- Information, information systems, information management
- CAP- and CAM-systems
- PPS- and ERP- systems
- PDM-Systems
- Virtual product configuration
- Installation of technical information systems in existing enterprise structures

Literature
Lecture slides

Course: Vibration Theory [2161212]

Coordinators: Wolfgang Seemann
Part of the modules: SP 09: Dynamic Machine Models (p. 165)[SP_09_mach], SP 05: Calculation Methods in Mechanical Engineering (p. 162)[SP_05_mach]

ECTS Credits	Hours per week	Term	Instruction language
5	3	Winter term	de

Learning Control / Examinations
Written exam
If course is chosen as optional subject or part of major subject:
Oral exam, 30 minutes (optional subject), 20 minutes (major subject), no means

Conditions
EM III, EM IV

Learning Outcomes
The course gives an introduction into the vibration theory of linear systems. First, general vibration in form of harmonic signals is considered. One degree of freedom systems are treated in detail for free and forced vibration, especially for harmonic, periodic and arbitrary excitation. This is the foundation for systems with many degrees of freedom as these may be transformed with the help of modal coordinates. For multiple dof systems the eigenvalue problem is solved. Then forced vibration is treated. Finally, wave propagation problems and eigenvalue problems for systems with distributed parameters are discussed. As an application an introduction into rotor dynamics is given.

Goal of the course is to see the similarities for systems with one dof and with multiple dof. Besides typical phenomena like resonance a systematic mathematical approach to vibration problems and an interpretation of the mathematical results should be obtained.

Content
Concept of vibration, superposition of vibration with equal and with different frequencies, complex frequency response.

Vibration of systems with one dof: Free undamped and damped vibration, forced vibration for harmonic, periodic and arbitrary excitation. Excitation of undamped vibration in resonance.

Systems with many degrees of freedom: Eigenvalue problem for undamped vibration, orthogonality of eigenvectors, modal decoupling, approximation methods, eigenvalue problem for damped vibration. Forced vibration for harmonic excitation, modal decomposition for arbitrary forced vibration, vibration absorber.

Vibration of systems with distributed parameters: Partial differential equations as equations of motion, wave propagation, d'Alembert's solution, Ansatz for separation of time and space, eigenvalue problem, infinite number of eigenvalues and eigenfunctions.

Introduction to rotor dynamics: Laval rotor in rigid and elastic bearings, inner damping, Laval rotor in anisotropic bearings, synchronous and asynchronous whirl, rotors with asymmetric shaft.

Literature
Klotter: Technische Schwingungslehre, Bd. 1 Teil A, Heidelberg, 1978

Hagedorn, Otterbein: Technische Schwingungslehre, Bd 1 and Bd 2, Berlin, 1987

Wittenburg: Schwingungslehre, Springer-Verlag, Berlin, 1995

Course: Technical Design in Product Development [2146179]

Coordinators: Markus Schmid, Dr. -Ing. Markus Schmid
Part of the modules: SP 10: Engineering Design (p. 166)[SP_10_mach]

ECTS Credits	Hours per week	Term	Instruction language
4	2	Summer term	de

Learning Control / Examinations
For the reason of high sutdent number the exam is a written exam.
Only dictionnary is allowed.

Conditions
Authorisation by the Examination Office.

Recommendations
None

Learning Outcomes
Status of Technical Design in current Product Development; the lecture supports current examples of the fields of Precision Mechanics, Mechanical and Automotive Engineering

Content
Introduction
Relevant parameters on product value in Technical Design
Design in Methodical Development and Engineering and for a differentiated validation of products
Design in the concept stage of Product Development
Design in the draft and elaboration stage of Product Development

Media
-

Literature
Hexact (R) Lehr- und Lernportal

Remarks
-

Course: Technology of steel components [2174579]

Coordinators: Volker Schulze
Part of the modules: SP 07: Dimensioning and Validation of Mechanical Constructions (p. 164)[SP_07_mach], SP 26: Materials Science and Engineering (p. 175)[SP_26_mach]

ECTS Credits	Hours per week	Term	Instruction language
4	2	Summer term	de

Learning Control / Examinations
oral
duration 20 minutes
No tools or reference materials may be used during the exam

Conditions
Materials Science and Engineering I & II

Learning Outcomes
At the begin of this lecture the basics for the evaluation of the influence of manufacturing processes on the behaviour of metallic components are imparted. After this, the different aspects of changing the behaviour of steel components by forming, heat treating, mechanical surface treatments and joining are discussed.

Content
Meaning, development and characterization of component states

Description of the influence of component states on

mechanical properties at quasistatic loading

mechanical properties at cyclic loading

tribological properties

Stability of component states

Component states due to forming

Component states due to quenching and tempering

Component states due to case hardening

Component states due to surface hardening

Component states due to nitriding

Component states due to machining

Component states due to mechanical surface treatments

Component states due to joining

Literature
Script will be distributed within the lecture
VDEh: Werkstoffkunde Stahl, Bd. 1: Grundlagen, Springer-Verlag, 1984
H.-J. Eckstein: Technologie der Wärmebehandlung von Stahl, Deutscher Verlag Grundstoffindustrie, 1977
H.K.D.H. Badeshia, R.W.K. Honeycombe, Steels - Microstructure and Properties, CIMA Publishing, 3. Auflage, 2006
V. Schulze: Modern Mechanical Surface Treatments, Wiley, Weinheim, 2005

Course: Technologies for energy efficient buildings [2158106]

Coordinators: Ferdinand Schmidt
Part of the modules: SP 15: Fundamentals of Energy Technology (p. 171)[SP_15_mach]

ECTS Credits	Hours per week	Term	Instruction language
4	2	Summer term	de

Learning Control / Examinations
Oral examination
Duration: 30 minutes
No tools or reference materials may be used during the exam.

Conditions
Basic knowledge of thermodynamics and heat transfer

Learning Outcomes
Students know the main factors influencing the final energy consumption of buildings; they know the criteria for indoor comfort as well as principles of energy efficient and solar building design.
Students acquire knowledge on the current state of technologies for the building envelope (including solar thermal energy utilisation) as well as technologies for heating, cooling and air-conditioning of energy efficient buildings.
Students are able to check building energy concepts for plausibility and can estimate how different technologies can be integrated into highly efficient complete systems.

Content
More than one third of the primary energy consumption in Europe can be directly related to the heating, cooling and climatisation of buildings. As a contribution to climate change mitigation, a reduction of greenhouse gas emissions to about one fifth of today's values is required over the next half century.
This course deals with the potentials for reducing the energy demand of buildings and for integrating utilisation of solar energy and environmental energy into building energy concepts. Available technologies and current development trends for efficient energy use in buildings are presented. The influence of various technology options and system concepts on energy demand is discussed referring to building simulation results for selected reference buildings.

1. Terms and definitions: energy economics, climate change mitigation, energy use in buildings
2. Factors influencing energy consumption in buildings and occupants' comfort
3. Heat transfer through the building envelope, insulation technologies
4. Windows and glazings
5. Daylight use, glare protection, shadings
6. Ventilation and air-conditioning, „passive house“ concept
7. Heating and cooling with low-exergy systems (LowEx); ground heat sources and sinks
8. Solar thermal energy use in buildings
9. Heat and cold storage
10. Heat pumps (mechanically / thermally driven)
11. Solar Cooling
12. Cogeneration and Trigeneration
13. Examples of realised system concepts
14. Buildings within supply infrastructures; district heating
15. Excursion

Media
Powerpoint, blackboard, clicker (audience response system)

Literature
1. Voss, K.; Löhnert, G.; Herkel, S.; Wagner, A.; Wambsganß, M.: Bürogebäude mit Zukunft - Konzepte, Analysen, Erfahrungen. Solarpraxis Verlag, 2. Aufl. 2007.
2. Wagner, A.: Energieeffiziente Fenster und Verglasungen. Solarpraxis Verlag, 3. Aufl. 2007.
3. Henning, H.-M. (ed.): Solar Assisted Air-Conditioning in Buildings. Springer, 2nd ed. 2007.
4. Marko, A.; Braun, P.: Thermische Solarenergienutzung an Gebäuden. Springer 1997.

Remarks

Participation in the computer lab exercise (2158108) is a prerequisite for the exam.

Course: Thermal Solar Energy [2169472]

Coordinators: Robert Stieglitz
Part of the modules: SP 15: Fundamentals of Energy Technology (p. 171)[SP_15_mach]

ECTS Credits	Hours per week	Term	Instruction language
4	2	Winter term	de

Learning Control / Examinations
oral
Duration: approximately 30 minutes

no tools or reference materials may be used during the exam

Conditions
Basics in heat and mass transfer

Learning Outcomes
The lecture elaborates the basics of the solar technology and the definition of the major wordings and its phyical content such as radiation, thermal use, insulation etc.. Further the design of solar collectors for different purposes is discussed and analyzed. The functional principle of solar plants is elaborated before at the ende the ways for solar climatization is dis-cussed.

Content
Baiscs of thermal solar energy (radiation, heat conduction, storage, efficiency ....) Active and passive use of solar energy. Solar collectors (design types, efficiency, system technology). Solar plants (heliostats etc.). Solar climatization.

Literature
At the end of the lecture the content will be distributed by a CD containing all relevant information of the given lectures.

Course: Thermal Turbomachines I [2169453]

Coordinators: Hans-Jörg Bauer
Part of the modules: SP 24: Energy Converting Engines (p. 174)[SP_24_mach], SP 15: Fundamentals of Energy Technology (p. 171)[SP_15_mach]

ECTS Credits	Hours per week	Term	Instruction language
6	3	Winter term	de

Learning Control / Examinations
oral
Duration: approximately 1 hour

no tools or reference materials may be used during the exam

Conditions
None.

Recommendations
None.

Learning Outcomes
The main topics of the course are the design principles, construction and applications of modern turbo-machinery. These issues are not only addressed on the level of indi-vidual components and assamblies, but are also considered by viewing the role of the complete turbine in the power generation process. In this manner the role of physical, economic and ecological factors in the design of the machines be-comes evident. It is a recommended lecture combination with 'Thermal Turbomachines II'.

Content
Basic concepts of thermal turbomachinery

Steam Turbines - Thermodynamic process analysis

Gas Turbines - Thermodynamic process analysis

Combined cycle and cogeneration processes

Overview of turbomachinery theory and kinematics

Energy transfer process within a turbine stage

Types of turbines (presented through examples)

1-D streamline analysis techniques

3-D flow fields and radial momentum equilibrium in turbines

Compressor stage analysis and future trends in turbomachinery

Literature
Lecture notes (available via Internet)

Bohl, W.: Strömungsmaschinen, Bd. I, II; Vogel Verlag, 1990, 1991

Sigloch, H.: Strömungsmaschinen, Carl Hanser Verlag, 1993

Traupel, W.: Thermische Turbomaschinen Bd. I, II, Springer-Verlag, 1977, 1982

Course: Thermal Turbomachines II [2170476]

Coordinators: Hans-Jörg Bauer
Part of the modules: SP 24: Energy Converting Engines (p. 174)[SP_24_mach]

ECTS Credits	Hours per week	Term	Instruction language
6	3	Summer term	de

Learning Control / Examinations
oral (can only be taken in conjunction with 'Thermal Turbomachines I')
Duration:approximately 60 minutes (including Thermal Turbomachines I)

Auxiliary:no tools or reference materials may be used during the exam

Conditions
None.

Learning Outcomes
This lecture builds on the fundamentals learned in Thermal Turbo Machines I and focusses on the design aspects and operations of the machines. It is a recommended lecture combination with 'Thermal Turbomachines I'.

Content
General overview, trends in design and development

Comparison turbine - compressor

Integrating resume of losses

Principal equations and correlations in turbine and compressor design, stage performance

Off-design performance of multi-stage turbomachines

Control system considerations for steam and gas turbines

Components of turbomachines

Critical components

Materials for turbine blades

Cooling methods for turbine blades (steam and air cooling methods)

Short overview of power plant operation

Combustion chamber and environmental issues

Literature
Course not packet
Bohl, W.: Strömungsmaschinen, Bd. I,II, Vogel Verlag 1990, 1991
Sigloch, H.: Strömungsmaschinen, Carl Hanser Verlag, 1993
Traupel, W.: Thermische Turbomaschinen, Bd. I,II, Springer-Verlag, 1977, 1982

Course: [2193002]

Coordinators: Hans Jürgen Seifert
Part of the modules: SP 26: Materials Science and Engineering (p. 175)[SP_26_mach]

ECTS Credits	Hours per week	Term	Instruction language
4	3	Winter term	de

Learning Control / Examinations

Conditions
None.

Learning Outcomes

Content

Course: Tribology A [2181113]

Coordinators: Matthias Scherge, Martin Dienwiebel
Part of the modules: SP 48: Internal Combustion Engines (p. 180)[SP_48_mach]

ECTS Credits	Hours per week	Term	Instruction language
4	2	Winter term	

Learning Control / Examinations
oral exam 30 minutes

Conditions
None.

Recommendations
preliminary knowlegde in mathematics, mechanics and materials

Learning Outcomes
The lecture Tribology A introduces fundamental mechanisms present in tribological systems. In the course of the lecture the principal aspects of Tribology at the interface of Mechanical Engineering, Physics, Chemistry and Materials Science are treated. At the end of the lecture participants are able to evaluate Friction and Wear in tribological Systems and can name possible solutions for tribological optimization.

Content
* Chapter 1: Friction Adhesion, geometrical and real area of contact, Friction experiments, friction powder, tribological stressing, evironmental influences, tribological age, contact models, Simulation of contacts, roughness.

* Chapter 2: Wear, plastic deformation at the asperity level, dissipation modes, mechanical mixing, Dynamics of the third body, running-in, running- in dynamics, shear stress.

* Chapter 3: Lubrication, base oils, Stribeck plot, lubrication regimes (HD, EHD, mixed lubrication), additives, oil characterization, solid lubrication.

Literature
[1] Fleischer, G. ; Gröger, H. ; Thum: Verschleiß und Zuverlässigkeit. 1. Auflage. Berlin : VEB-Verlag Technik, 1980

[2] Persson, B.J.N.: Sliding Friction, Springer Verlag Berlin, 1998

[3] M. Dienwiebel, and M. Scherge, Nanotribology in automotive industry, In:Fundamentals of Friction and Wear on the Nanoscale; Editors: E. Meyer and E. Gnecco, Springer, Berlin, 2007.

[4] Scherge, M., Shakhvorostov, D., Pöhlmann, K.: Fundamental wear mechanism of metals. Wear 255, 395–400 (2003)

[5] Shakhvorostov, D., Pöhlmann, K., Scherge, M.: An energetic approach to friction, wear and temperature. Wear 257, 124–130 (2004)

Course: Tribology B [2182139]

Coordinators: Matthias Scherge, Martin Dienwiebel
Part of the modules: SP 48: Internal Combustion Engines (p. 180)[SP_48_mach]

ECTS Credits	Hours per week	Term	Instruction language
4	2	Summer term	de

Learning Control / Examinations
oral examination in combination with tribology A, Duration: 0,5 hours, also possible as a part of a major subject, no auxiliary means

Conditions
None.

Recommendations
helpful: basic knowledge about engines and materials science

Learning Outcomes
The students get to know the analysis of mechanical interaction, ist consequences as well as the prevention of defects and breakdown

On the basis of a wide physikal introduction the problems of dissipation as well as the reaction of solid bodies are discussed with the help of practical examples of engine components.

Additionally state-of-the-art measuring methods are introduced, which characterize the mechanical processes on the length scale from millimeters to the atomic range.

Content
Friction

Wear

Lubrication, additives

Literature
Lecture notes available in the lectures

Course: Turbine and compressor Design [2169462]

Coordinators: Hans-Jörg Bauer, Achmed Schulz
Part of the modules: SP 24: Energy Converting Engines (p. 174)[SP_24_mach]

ECTS Credits	Hours per week	Term	Instruction language
4	2	Winter term	de

Learning Control / Examinations
oral
Duration: approximately 30 minutes

no tools or reference materials may be used during the exam

Conditions
Thermal Turbomachines I+II

Learning Outcomes
The lecture is intended to expand the knowledge from Thermal Turbomachines I+II. Special types of components such as radial turbines and transonic compressors are discussed with emphasis on the proper design of each individual component.

Content
Thermal Turbomaschines, general overview

Design of a turbomachine: Criteria and development

Radial machines

Transonic compressors

Combustion chambers

Multi-spool installations

Literature
Münzberg, H.G.: Gasturbinen - Betriebsverhalten und Optimierung, Springer Verlag, 1977

Traupel, W.: Thermische Turbomaschinen, Bd. I-II, Springer Verlang, 1977, 1982

Course: Turbo Jet Engines [2170478]

Coordinators: Hans-Jörg Bauer, Achmed Schulz
Part of the modules: SP 24: Energy Converting Engines (p. 174)[SP_24_mach]

ECTS Credits	Hours per week	Term	Instruction language
4	2	Summer term	de

Learning Control / Examinations
oral
Duration: approximately 30 minutes

Auxiliary:no tools or reference materials may be used during the exam

Conditions
None.

Learning Outcomes
The lecture concentrates on design concepts and operation of modern jet engines. Based on thermodynamics and fluidmechanics the main components of a jet engine are introduced such as intake, compressor, combustor, turbine and thrust nozzle. Various methods for reducing emissions, noise and fuel consumption are also discussed.

Content
Introduction to jet engines and their components

Demands on engines and propulsive efficiency

Thermodynamic and gas dynamic fundamentals and design calculations

Components of air breathing engines

Jet engine design and development process

Engine and component design

Current developments in the jet engines industry

Literature
Hagen, H.: Fluggasturbinen und ihre Leistungen, G. Braun Verlag, 1982
Hünnecke, K.: Flugtriebwerke, ihre Technik und Funktion, Motorbuch Verlag, 1993
Saravanamuttoo, H.; Rogers, G.; Cohen, H.: Gas Turbine Theory, 5th Ed., 04/2001
Rolls-Royce: The Jet Engine, ISBN:0902121235, 2005

Course: manufacturing technology exercises [2149658]

Coordinators: Volker Schulze
Part of the modules: SP 10: Engineering Design (p. 166)[SP_10_mach], SP 38: Production Systems (p. 178)[SP_38_mach]

ECTS Credits	Hours per week	Term	Instruction language
1	1	Winter term	de

Learning Control / Examinations
None.

Conditions
None.

Learning Outcomes
The student
• is able to name the different manufacturing methods and to explain their functions
• is able to classify the manufacturing methods by their general structure and functionality according to specific main groups
• is able to perform a process selection based on the methods he/she has learned about and their characteristics
• is able to identify the correlation between different methods
• is able to evaluate the different methods against specific applications on the basis of technical and economical aspects

Content
The objective of the lecture is to look at manufacturing engineering within the wider context of production engineering, to provide an overview over the different manufacturing methods and to impart detailed process knowledge of the common methods. The lecture covers the basic principles of manufacturing engineering and deals with the manufacturing methods according to their classification into main groups on the basis of technical and economical aspects. The lecture is completed with topics such as process chains in manufacturing.
The following topics will be covered:
• Introduction
• Quality control
• Primary processing (casting, plastics engineering, sintering, generative manufacturing processes),
• Forming (sheet-metal forming, massive forming, plastics engineering),
• Cutting (machining with geometrically defined and geometrically undefined cutting edges, separating, abrading)
• Joining
• Coating
• Heat treatment and surface treatment
• Process chains in manufacturing
• Work preparation

Media
Practice sheets for the manufacturing technology exercises will be made available through ilias.

Course: Übungen zu Integrierte Produktionsplanung [2150661]

Coordinators: Gisela Lanza
Part of the modules: SP 38: Production Systems (p. 178)[SP_38_mach]

ECTS Credits	Hours per week	Term	Instruction language
2	2	Summer term	de

Learning Control / Examinations

Conditions
None.

Learning Outcomes
The exercises and practical examples demonstrate the contents of the lecture. Concrete exercises and casestudies from the industrial practice are presented and solved.

Content
1. Introduction (external lecturer)
2. Site location, site selection + target definition and value benefit analysis
3. Integrated production systems
4. Lean methods, value stream mapping
5. Manufacturing planning
6. Capacity determination and layout planning for the manufacturing
7. Assembly layout, cycle time calculation
8. Shift model, manual assembly layout
9. Life-Cycle-Performance: Calculation of LCP-key figures
10. Summary and outlook (external lecturer)

Course: Mathematical methods of vibration theory (Tutorial) [2162242]

Coordinators: Wolfgang Seemann, N.N.
Part of the modules: SP 05: Calculation Methods in Mechanical Engineering (p. 162)[SP_05_mach]

ECTS Credits	Hours per week	Term	Instruction language
1	1	Summer term	de

Learning Control / Examinations

Conditions
Technische Mechanik III, IV / Engineering Mechanics III, IV

Learning Outcomes
Deepen understanding of the course by solving corresponding problems

Content
Seven tutorials with examples of the contents of the course

Literature
Riemer, Wedig, Wauer: Mathematische Methoden der Technischen Mechanik

Course: Introduction into the nonlinear vibrations (Tutorial) [2162248]

Coordinators: Alexander Fidlin, N.N.
Part of the modules: SP 09: Dynamic Machine Models (p. 165)[SP_09_mach], SP 05: Calculation Methods in Mechanical Engineering (p. 162)[SP_05_mach]

ECTS Credits	Hours per week	Term	Instruction language
1	1	Summer term	de

Learning Control / Examinations

Conditions
None.

Learning Outcomes

Content

Course: Exercises Product Lifecycle Management [2121351]

Coordinators: Jivka Ovtcharova, Mitarbeiter
Part of the modules: SP 38: Production Systems (p. 178)[SP_38_mach]

ECTS Credits	Hours per week	Term	Instruction language
0	1	Winter term	de

Learning Control / Examinations

Conditions
None.

Recommendations
None.

Learning Outcomes
The theoretical Konzepts and contents of the lecture will be trained within practical relevance by basic functionalities of PLM System solutions.First, an overview of the GUI will be given. Then, techniques for the handling of meta and product data will be introduced, followed by enterprise application integration of CAD systems and the correlating management of data and information. Subsequent to basic methods of numbering, revision and klassification of data and information, manipulating methods with product structure editors will be explained. Based on these product structures, the management of product variants and the derivation of 2D-drafts, bill of materials and where-used lists will be done. After beeing trained in the basic functionalities, the students will work teamoriented in a collaborative environment in terms of workflow management, followed by processing Engineering Change Management.

Content

Course: Exercises Virtual Engineering II [2122379]

Coordinators: Jivka Ovtcharova
Part of the modules: SP 09: Dynamic Machine Models (p. 165)[SP_09_mach]

ECTS Credits	Hours per week	Term	Instruction language
0	1	Summer term	de

Learning Control / Examinations

Conditions
None.

Recommendations
None.

Learning Outcomes
The students learn about the different operating philosophies of further CAx tools from the fields of validation, Virtual Reality and digital factory and are able to apply the basic functions of corresponding software systems.

Content
In this module, the practical use of various software systems in the environment of virtual mock-up and digital factory for solving problems in engineering is demonstrated in small groups.

Literature
Exercise notes

Course: Environmentally compatible energy generation / wind turbines [23381]

Coordinators: Norbert Lewald, Lewald
Part of the modules: SP 15: Fundamentals of Energy Technology (p. 171)[SP_15_mach]

ECTS Credits	Hours per week	Term	Instruction language
4	2	Winter term	

Learning Control / Examinations

Conditions
None.

Learning Outcomes

Content

Course: Combustion Engines A with tutorial [2133101]

Coordinators: Ulrich Spicher
Part of the modules: SP 12: Automotive Technology (p. 168)[SP_12_mach], SP 02: Powertrain Systems (p. 161)[SP_02_mach], SP 15: Fundamentals of Energy Technology (p. 171)[SP_15_mach], SP 24: Energy Converting Engines (p. 174)[SP_24_mach], SP 48: Internal Combustion Engines (p. 180)[SP_48_mach]

ECTS Credits	Hours per week	Term	Instruction language
8	6	Winter term	de

Learning Control / Examinations
oral examination, Duration: 45 min., no auxiliary means

Conditions
None.

Recommendations
None.

Learning Outcomes
The students get basic knowledgement in construction, thermodynamic process, main concepts of gasoline and Diesel engines, driving gear dynamics and design of combustion engines. In particular the thermodyanamical processes and the problems of exhaust gas emissions are discussed.
Also, this lecture provides fundamentals for continuative lectures in the field of combustion engines.

Content
Introduction
Engine and operating parameters

Thermodynamics of combustion engines

Gas exchange

Otto-process

Diesel-process

Literature
Lecturer notes available in the 'Studentenhaus'

Remarks
weekly exercises to consolidate the lecture material

Course: Combustion Engines B with Tutorial [2134135]

Coordinators: Ulrich Spicher
Part of the modules: SP 48: Internal Combustion Engines (p. 180)[SP_48_mach], SP 12: Automotive Technology (p. 168)[SP_12_mach], SP 02: Powertrain Systems (p. 161)[SP_02_mach], SP 24: Energy Converting Engines (p. 174)[SP_24_mach]

ECTS Credits	Hours per week	Term	Instruction language
4	3	Summer term	de

Learning Control / Examinations
oral examination, Duration: 0,5 hours, no auxiliary means

Conditions
None.

Recommendations
Combustion Engines A helpful

Learning Outcomes
The students deepen and complement their knowledgement from the lecture combustion engines A. The get to know construction elements, development tools and latest development trends. They will be able to understand and judge a wide variety of powertrain concepts.

Content
Emissions
Fuels
Drive Train Dynamics
Engine Parts
Boosting
Alternative Powertrain Concepts

Special Engine Concepts

Power Transmission

Literature
Lecture notes available in the 'Studentenhaus'

Remarks
exercises every two weeks to consolidate the lecture material

Course: Behaviour Generation for Vehicles [2138336]

Coordinators: Christoph Stiller, Thao Dang
Part of the modules: SP 12: Automotive Technology (p. 168)[SP_12_mach], SP 18: Information Technology (p. 173)[SP_18_mach], SP 31: Mechatronics (p. 177)[SP_31_mach], SP 44: Technical Logistics (p. 179)[SP_44_mach], SP 09: Dynamic Machine Models (p. 165)[SP_09_mach]

ECTS Credits	Hours per week	Term	Instruction language
4	2	Summer term	de

Learning Control / Examinations
Oral examination

Duration: 30 minutes

no reference materials

Conditions
Fundamentals in measurement, system and control theory, e.g. from the lecture "Measurement and Control Systems"

Learning Outcomes
Modern vehicle control systems like ABS or ESP transform the intention of the driver into a corresponding behaviour of the vehicle. This is achieved by compensating disturbances like a varying traction for example. Within the recent years, vehicles have been increasingly equipped with sensors that gather information about the environment (Radar, Lidar and Video for example). This enables the vehicles to generate an 'intelligent' behaviour and transform this behaviour into control signals for actors. Several so called 'driver assistance systems' have already achieved remarkable improvements as far as comfort, safety and efficiency are concerned. But nevertheless, several decades of research will be required to achieve an automated behaviour with a performance equivalent to a human operator ('the driver'). The lecture addresses students in mechanical engineering and related subjects who intend to get an interdisciplinary knowledge in a state-of-the-art technical domain. Information technology, control theory and kinematic aspects are treated to provide a broad overview over vehicle guidance. Application examples from cutting-edge and future driver assistance systems illustrate the discussed subjects.

Content
1. Driver assistance systems
2. Driving comfort and safety
3. Vehicle dynamics
4. Path and trajectory planning
5. Path control
6. Collision avoidance

Literature
TBA

Course: Failure of Structural Materials: Fatigue and Creep [2181715]

Coordinators: Oliver Kraft, Peter Gumbsch, Patric Gruber
Part of the modules: SP 26: Materials Science and Engineering (p. 175)[SP_26_mach]

ECTS Credits	Hours per week	Term	Instruction language
4	2	Winter term	de

Learning Control / Examinations
oral exam 30 minutes

Conditions
compulsory preconditions: none

Learning Outcomes

- Mechanical Understanding of Load vs Material Strength
- Empirical Material Behavior
- Physical Understanding of Failure Phenomena
- Statistical Description of Failure
- Material Selection and Understanding Alloying Effects

Content
1 Fatigue
1.1 Introduction
1.2 Statistical Aspects
1.3 Lifetime
1.4 Fatigue Mechanisms
1.5 Material Selection
1.6 Thermomechanical Loading
1.7 Notches and Shape Optimization
1.8 Case Study: ICE-Desaster

2 Creep
2.1 Introduction
2.2 High Temperature Plasticity
2.3 Phänomenological DEsciption of Creep
2.4 Creep Mechanisms
2.5 Alloying Effects

Literature
1. Engineering Materials, M. Ashby and D.R. Jones (2nd Edition, Butterworth-Heinemann, Oxford, 1998); sehr lesenswert, relativ einfach aber dennoch umfassend, verständlich
2. Mechanical Behavior of Materials, Thomas H. Courtney (2nd Edition, McGraw Hill, Singapur); Klassiker zu den mechanischen Eigenschaften der Werkstoffe, umfangreich, gut
3. Bruchvorgänge in metallischen Werkstoffen, D. Aurich (Werkstofftechnische Verlagsgesellschaft Karlsruhe), relativ einfach aber dennoch umfassender Überblick für metallische Werkstoffe
4. Fatigue of Materials, Subra Suresh (2nd Edition, Cambridge University Press); Standardwerk über Ermüdung, alle Materialklassen, umfangreich, für Einsteiger und Fortgeschrittene

Course: Failure of structural materials: deformation and fracture [2181711]

Coordinators: Peter Gumbsch, Oliver Kraft, Daniel Weygand
Part of the modules: SP 02: Powertrain Systems (p. 161)[SP_02_mach], SP 26: Materials Science and Engineering (p. 175)[SP_26_mach], SP 13: Strength of Materials/ Continuum Mechanics (p. 170)[SP_13_mach]

ECTS Credits	Hours per week	Term	Instruction language
4	2	Winter term	de

Learning Control / Examinations
oral exam 30 minutes

Conditions
compulsory preconditions: none

Learning Outcomes

- Mechanical Understanding of Load vs Material Strength
- Empirical Material Behavior
- Physical Understanding of Failure Phenomena

Content
1. Introduction
2. linear elasticity
3. classification of stresses
4. Failure due to plasticity
* tensile test
* dislocations
* hardening mechanisms
* guidelines for dimensioning
5. composite materials
6. fracture mechanics
6.1 hypotheses for failure
6.2 linear elasic fracture mechanics
6.3 crack resitance
6.4 experimental measurement of fracture toughness
6.5 defect measurement
6.6 crack propagation
6.7 application of fracture mechanics
6.8 atomistics of fracture

Literature
1. Engineering Materials, M. Ashby and D.R. Jones (2nd Edition, Butterworth-Heinemann, Oxford, 1998); sehr lesenswert, relativ einfach aber dennoch umfassend, verständlich
2. Mechanical Behavior of Materials, Thomas H. Courtney (2nd Edition, McGraw Hill, Singapur); Klassiker zu den mechanischen Eigenschaften der Werkstoffe, umfangreich, gut
3. Bruchvorgänge in metallischen Werkstoffen, D. Aurich (Werkstofftechnische Verlagsgesellschaft Karlsruhe), relativ einfach aber dennoch umfassender Überblick für metallische Werkstoffe

Course: Gear Cutting Technology [2149655]

Coordinators: Klaus Felten
Part of the modules: SP 12: Automotive Technology (p. 168)[SP_12_mach]

ECTS Credits	Hours per week	Term	Instruction language
4	2	Winter term	de

Learning Control / Examinations
oral, duration 30 min., no resources

Conditions
None.

Learning Outcomes
The student
• has the knowledge about the presented content,
• understands the within the lecture taught theory of gears and gear cutting as well as the taught basics and characteristics of the covered gear cutting processes,
• is able to transfer the within the lecture learned knowledge about the basics of the gearing geometry and the manufacturing of gears on new problematic issues and
• is able to analyze and to evaluate the applicability of the taught processes and techniques for various problems.

Content
This lecture is focused on the demands of the modern manufacturing process of gears on the basis of the gearing geometry and the theory of gears and transmission types. For this purpose the processes for manufacturing various gearing types are covered, which are state of the technology in current operational practice. The subdivision of the processes is made in soft and hard machining, in each case in cutting and non-cutting methods. For the comprehensive understanding of the taught processes initially the description of the kinematics, the machine technology, the tools, the fields of application and the speciality as well as the current trends are made. Subsequent for the evaluation and classification in the fields of application and the capability of the processes finally the sequence of manufacturing of gears in mass production and the manufacturing errors are covered in the lecture.
The content of the lecture will be rounded off by demonstrative example parts and the possibility of the visit of real manufacturing environments within two short excursions to gear manufacturing companies.
1. History of gears
2. Basic factors of gear geometry
3. Types of toothed wheeles
4. Types of gearings
5. Overview of methods for soft machining of gears (subdivided in metal-cutting and non-cutting, representation of the different processes regarding kinematics, machine-tool, tool and trend of development)
6. Overview over methods for hard machining of gears (subdivided in geometrical defined and undefined cutting edge, representation of the different processes regarding kinematics, machine-tool, tool and trend of development)
7. Sequence of manufacturing in mass production
8. Manufacturing errors of gears
9. Special applications of gearings

Literature
Lecture notes

Course: Virtual Engineering II [2122378]

Coordinators: Jivka Ovtcharova
Part of the modules: SP 09: Dynamic Machine Models (p. 165)[SP_09_mach]

ECTS Credits	Hours per week	Term	Instruction language
4	3	Summer term	de

Learning Control / Examinations
Oral examination
Duration: 20 min

Auxiliary Means: none

Conditions
None.

Recommendations
None.

Learning Outcomes
The students will get to know the definition of virtual reality how the stereoscopic effect occurs and which technologies can be used to simulate this effect.
They will be able to model a scene in VR and store the VR graph on a computer. The will understand the inner workings of the VR pipeline for visualizing the scene works. They will be familiar with various systems of interacting with the VR scene and will be able to assess the advantages and disadvantages of various manipulation and tracking devices.
Moreover, they will know which validation tests can be carried through in the product development process with the aid of a virtual mock-up (VMU) and what's the difference between a VMU, a physical mock-up (PMU) and a virtual prototype (VP).
They will get to know the vision of an integrated virtual product development and understand which challenges need to be resolved towards that vision.

Content
The lecture presents the informational interrelationship required for understanding the virtual product development process. For this purpose, an emphasis and focus will be placed on IT-systems used in the industrial sector as support for the process chain of virtual engineering:

- The corresponding models can be visualized in Virtual Reality Systems, from single parts up through a complete assembly.
- Virtual Prototypes combine CAD-data as well as information about the remaining characteristics of the components and assembly groups for immersive visualisation, functionality tests and functional validations in the VR/AR/MR environment.
- Integrated Virtual Product Development explains exemplified the product development process from the point of view of Virtual Engineering.

The goal of the lecture is to clarify the relationship between construction and validation operations through the usage of virtual prototypes and VR/AR/MR visualisation techniques in connection with PDM/PLM-systems. This will be achieved through an introduction to each particular IT-system along with praxis-oriented exercises.

Literature
Lecture slides

Course: Virtual Reality Laboratory [2123375]

Coordinators: Jivka Ovtcharova, Jurica Katicic
Part of the modules: SP 31: Mechatronics (p. 177)[SP_31_mach], SP 17: Information Management (p. 172)[SP_17_mach]

ECTS Credits	Hours per week	Term	Instruction language
3	3	Winter / Summer Term	de

Learning Control / Examinations
Presentation of project work (40%)
Individual project participation (30%)
Written test (20%)
Soft skills (10%)

Conditions
None

Recommendations
Participation in the course Virtual Engineering 2 [2122378]

Learning Outcomes
The students are able to operate and use hardware and software for Virtual Reality applications in order to:

- draft solutions for complex tasks in a team.
- solve subtasks within a specific work package in small groups, keeping the interfaces to other work packages in mind and
- merge this solution in the final product.

Content
The Virtual Reality lab course consists of following three parts:

- Basics: Introduction in Virtual Reality (hardware, software, applications)
- Tool Kit: 3DVIA Virtools as application development environment
- Application: autonomous further development of an existing driving simulator in Virtual Reality in small groups

Media
Stereoscopic projection in MR and VR at the Lifecycle Engineering Solutions Center (LESC), 15 computers, beamer

Literature
Presentations, Exercise documents, Tutorials, Books for individual work

Course: Material Analysis [2174586]

Coordinators: Jens Gibmeier
Part of the modules: SP 26: Materials Science and Engineering (p. 175)[SP_26_mach]

ECTS Credits	Hours per week	Term	Instruction language
4	2	Summer term	de

Learning Control / Examinations
oral examination
duration: 20 - 30 minutes
no auxillray resources

Conditions
obligation: Material Science I/II

Learning Outcomes
The students have basic knowledge about methods of material analysis. They have a basic understanding to transfer this nasic knowledge on problems in engineering science. Furthermore, the students have the ability to describe technical material by its microscopic and submicroscopic structure

Content
The following methods will be introduced within this module:

microscopic methods: optical microscopy, electron microscopy (SEM/TEM), atomic force microscopy

material and microstructure analyses by means of X-ray, neutron and electron beams

spectroscopic methods

Literature
lecture notes (will be provided at the beginning of the lecture)

literature will be quoted at the beginning of the lecture

Course: Materials and mechanical loads in the power train: engines, gearboxes and drive sections [2173570]

Coordinators: Jürgen Hoffmeister
Part of the modules: SP 12: Automotive Technology (p. 168)[SP_12_mach], SP 02: Powertrain Systems (p. 161)[SP_02_mach], SP 26: Materials Science and Engineering (p. 175)[SP_26_mach]

ECTS Credits	Hours per week	Term	Instruction language
4	2	Winter term	de

Learning Control / Examinations
oral
duration: 20 - 30 minutes
none

Conditions
None.

Learning Outcomes
Deep understanding of materials and mechanical loads in engines, gearboxes and drive sections, especially cast materials (cast aluminium alloys, cast magnesium alloys, cast iron), case-hardened steel, and other structural materials used in the power train.

Content
Introduction

constructive, production-orientated and material aspects in the power train

engines

stress in the engines
cast aluminium alloys
cast magnesium alloy
cast irons
and other materials

gearboxes

stress in the gearboxes
case-hardened steel
and other materials

drive sections

stress in the drive sections
materials for the clutch
materials for the power train
materials in other elements of the drive sections

Literature
Reference, data and draft in the lecture

Course: Materials for Lightweight Construction [2174574]

Coordinators: Kay Weidenmann
Part of the modules: SP 12: Automotive Technology (p. 168)[SP_12_mach], SP 10: Engineering Design (p. 166)[SP_10_mach], SP 07: Dimensioning and Validation of Mechanical Constructions (p. 164)[SP_07_mach], SP 26: Materials Science and Engineering (p. 175)[SP_26_mach]

ECTS Credits	Hours per week	Term	Instruction language
4	2	Summer term	de

Learning Control / Examinations
Oral examination
Duration: 20 - 30 Min
none

Conditions
Werkstoffkunde I/II (recommended)

Learning Outcomes
The students know different lightweight materials, their composition, properties and fields of application and can apply this knowledge effectively and precisely.
They master the hardening mechanisms of lightweight materials and can transfer this knowledge to applied problems.
The students have a basic understanding of basic mechanical models of composites - mainly polymer matrix composites - and can depict differences in the mechanical properties depending on composition and structure.

Content
Introduction

Constructive, production-orientied and material aspects of lightweight construction

Aluminium-based alloys
Aluminium wrought alloys
Aluminium cast alloys

Magnesium-based alloys
Magnesium wrought alloys
Magnesium cast alloys

Titanium-based alloys
Titanium wrought alloys
Titanium cast alloys

High-strength steels
High-strength structural steels
Heat-treatable and hardenable steels

Composites - mainly PMC
Matrices
Reinforcements

Literature
Presentation slides and additional lecture notes are handed out during the lecture, additional literature recommendations given

Course: Material Science III [2173553]

Coordinators: Alexander Wanner
Part of the modules: SP 26: Materials Science and Engineering (p. 175)[SP_26_mach]

ECTS Credits	Hours per week	Term	Instruction language
8	5	Winter term	de

Learning Control / Examinations
oral; 30-40 minutes

Conditions
Basic knowledge in materials science and engineering (Werkstoffkunde I/II)

Learning Outcomes
The students are familiar with the thermodynamic foundations of phase transformations, the kinetics of phase transformations in the solid states (nucleation and growth phenomena), the mechanisms of microstructure formation and microstructure-property relationships. They can assess the effects of heat treatmens and of alloying on the microstructure and the properties of iron-based materials (steels in particular). The can select steels for structural applications in mechanical engineering and subject them to appropriate heat treatmens.

Content
Properties of pure iron; thermodynamic foundations of single-component and of binary systems; nucleation and growth; diffusion processes in crystalline iron; the phase diagram Fe-Fe3C; effects of alloying on Fe-C-alloys; nonequilibrium microstructures; multicomponent iron-based alloys; heat treatment technology; hardenability and hardenability tests.

Literature
Lecture Notes; Problem Sheets; Bhadeshia, H.K.D.H. & Honeycombe, R.W.K.
Steels – Microstructure and Properties
CIMA Publishing, 3. Auflage, 2006

Course: Materials modelling: dislocation based plasticy [2182740]

Coordinators: Daniel Weygand
Part of the modules: SP 13: Strength of Materials/ Continuum Mechanics (p. 170)[SP_13_mach], SP 26: Materials Science and Engineering (p. 175)[SP_26_mach]

ECTS Credits	Hours per week	Term	Instruction language
4	2	Summer term	de

Learning Control / Examinations
oral exam 30 minutes

Conditions
None.

Learning Outcomes
Understanding of the physical basics of dislocations and their interaction with other point, line and area defects. Knowledge of modelling approaches for dislocation based plasticity. Modelling of microstructure evolution with discrete methods.

Content
1. Introduction
2. elastic fields of dislocations
3. slip, crystallography
4. equations of motion of dislocations
a) fcc
b) bcc
5. interaction between dislocations
6. discrete dislocation dynamics in two dimensions
7. discrete dislocation dynamics in three dimensions
8. continuum description of dislocations
9. microstructure evolution: grain growth
a) physical basis: small/large angle boundaries
b) interaction between dislocations and GBs
10) Monte Carlo methods in micro structure evolution

Literature

- D. Hull and D.J. Bacon, Introduction to Dislocations, Oxford Pergamon 1994
- J.P. Hirth and J. Lothe: Theory of dislocations, New York Wiley 1982. (oder 1968)
- J. Friedel, Dislocations, Pergamon Oxford 1964.
- V. Bulatov, W. Cai, Computer Simulations of Dislocations, Oxford University Press 2006
- A.S. Argon, Strengthening mechanisms in crystal plasticity, Oxford materials.

Course: Machine Tools and Industrial Handling [2149902]

Coordinators: Jürgen Fleischer
Part of the modules: SP 10: Engineering Design (p. 166)[SP_10_mach], SP 38: Production Systems (p. 178)[SP_38_mach]

ECTS Credits	Hours per week	Term	Instruction language
8	4	Winter term	de

Learning Control / Examinations
Performance is assessed in the form of one oral examination (45 min) during the lecture-free period. The examination will take place once every semester and can be retaken at every official examination date.

Conditions
None.

Learning Outcomes
The student
• has knowledge about the application of machine tools.
• comprehends the assembly and the operation purpose of the major components of a machine tool.
• is able to apply methods of selection and assessment of production machines to new tasks.
• is able to assess the dimensioning of a machine tool.

Content
The lecture overviews the assembly, dimensioning and application of machine tools and industrial handling. A consolidated and practice oriented knowledge is imparted about the choice, dimensioning and assessment of production machines. At first, the major components of machine tools are explained systematically. At this, the characteristics of dimensioning of machine tools are described in detail. Finally, the application of machine tools is demonstrated by means of example machines of the manufacturing processes turning, milling, grinding, massive forming, sheet metal forming and toothing.

Media
Lecture notes for the lecture “Machine Tools and Industrial Handling” will be made available through ilias.

Literature
lecture notes

Universität Karlsruhe (TH)
Forschungsuniversität · gegründet 1825

Der Rektor

Amtliche Bekanntmachung

2008 **Ausgegeben Karlsruhe, den 09. September 2008** **Nr. 78**

I n h a l t **Seite**

Studien- und Prüfungsordnung der Universität Karlsruhe (TH) für den Bachelorstudiengang Maschinenbau

Aufgrund von § 34 Abs. 1, Satz 1 des Landeshochschulgesetzes (LHG) vom 1. Januar 2005 hat die beschließende Senatskommission für Prüfungsordnungen der Universität Karlsruhe (TH) am 31. Januar 2008 die folgende Studien- und Prüfungsordnung für den Bachelorstudiengang Maschinenbau beschlossen.

Der Rektor hat seine Zustimmung am 28. Februar 2008 erteilt.

Inhaltsverzeichnis

In dieser Satzung wurde nur die weibliche Sprachform gewählt. Alle personenbezogenen Aussagen gelten jedoch stets für Frauen und Männer gleichermaßen.

Die Universität Karlsruhe (TH) hat sich im Rahmen der Umsetzung des Bolognaprozesses zum Aufbau eines Europäischen Hochschulraumes zum Ziel gesetzt, dass am Abschluss der Studierendenausbildung an der Universität Karlsruhe (TH) in der Regel der Mastergrad steht. Die Universität Karlsruhe (TH) sieht daher die an der Universität Karlsruhe (TH) angebotenen konsekutiven Bachelor- und Masterstudiengänge als Gesamtkonzept mit konsekutivem Curriculum.

I. Allgemeine Bestimmungen

§ 1 Geltungsbereich, Ziele

(1) Diese Bachelorprüfungsordnung regelt Studienablauf, Prüfungen und den Abschluss des Studiums im Bachelorstudiengang Maschinenbau an der Universität Karlsruhe (TH).

(2) Im Bachelorstudium sollen die wissenschaftlichen Grundlagen und die Methodenkompetenz der Fachwissenschaften vermittelt werden. Ziel des Studiums ist die Fähigkeit, einen konsekutiven Masterstudiengang erfolgreich absolvieren zu können sowie das erworbene Wissen berufsfeldbezogen anwenden zu können.

§ 2 Akademischer Grad

Aufgrund der bestandenen Bachelorprüfung wird der akademische Grad „Bachelor of Science“ (abgekürzt: „B.Sc.“) für den Bachelorstudiengang Maschinenbau verliehen.

§ 3 Regelstudienzeit, Studienaufbau, Leistungspunkte

(1) Die Regelstudienzeit beträgt sechs Semester. Sie umfasst ein Berufspraktikum, Prüfungen und die Bachelorarbeit.

(2) Die im Studium zu absolvierenden Lehrinhalte sind in Module gegliedert, die jeweils aus einer Lehrveranstaltung oder mehreren, thematisch und zeitlich aufeinander bezogenen Lehrveranstaltungen bestehen. Art, Umfang und Zuordnung der Lehrveranstaltungen zu einem Modul sowie die Möglichkeiten, Module und Lehrveranstaltungen untereinander zu kombinieren, beschreibt der Studienplan. Die Module und ihr Umfang werden in § 17 definiert.

(3) Der für das Absolvieren von Lehrveranstaltungen und Modulen vorgesehene Arbeitsaufwand wird in Leistungspunkten (Credits) ausgewiesen. Die Maßstäbe für die Zuordnung von Leistungs-punkten entsprechen dem ECTS (European Credit Transfer System). Ein Leistungspunkt entspricht einem Arbeitsaufwand von etwa 30 Stunden.

(4) Der Umfang der für den erfolgreichen Abschluss des Studiums erforderlichen Studienleistungen wird in Leistungspunkten gemessen und beträgt insgesamt 180 Leistungspunkte.

(5) Die Verteilung der Leistungspunkte im Studienplan auf die Semester hat in der Regel gleichmäßig zu erfolgen.

(6) Lehrveranstaltungen können auch in englischer Sprache angeboten werden.

§ 4 Aufbau der Prüfungen

(1) Die Bachelorprüfung besteht aus einer Bachelorarbeit und Modulprüfungen, jede Modulprüfung aus einer oder mehreren Modulteilprüfungen. Eine Modulteilprüfung besteht aus mindestens einer Erfolgskontrolle.

(2) Erfolgskontrollen sind:

1. schriftliche Prüfungen,
2. mündliche Prüfungen oder
3. Erfolgskontrollen anderer Art.

Erfolgskontrollen anderer Art sind z.B. Vorträge, Marktstudien, Projekte, Fallstudien, Experimente, schriftliche Arbeiten, Berichte, Seminararbeiten und Klausuren, sofern sie nicht als schriftliche oder mündliche Prüfung in der Modul- oder Lehrveranstaltungsbeschreibung im Studienplan ausgewiesen sind.

(3) In der Regel sind mindestens 50 % einer Modulprüfung in Form von schriftlichen oder mündlichen Prüfungen (Abs. 2, Nr. 1 und 2) abzulegen, die restlichen Prüfungen erfolgen durch Erfolgskontrollen anderer Art (Abs. 2, Nr. 3).

§ 5 Anmeldung und Zulassung zu den Prüfungen

(1) Um zu schriftlichen und/oder mündlichen Prüfungen (§ 4 Abs. 2, Nr. 1 und 2) in einem bestimmten Modul zugelassen zu werden, muss die Studentin vor der ersten schriftlichen oder mündlichen Prüfung in diesem Modul beim Studienbüro eine bindende Erklärung über die Wahl des betreffenden Moduls bzw. der Teilmodule, wenn diese Wahlmöglichkeit besteht, abgeben. Darüber hinaus muss sich die Studentin für jede einzelne Modulteilprüfung, die in Form einer schriftlichen oder mündlichen Prüfung (§ 4 Abs. 2, Nr. 1 und 2) durchgeführt wird, beim Studienbüro anmelden. Dies gilt auch für die Zulassung zur Bachelorarbeit.

(2) Um an den Modulprüfungen teilnehmen zu können, muss sich die Studentin schriftlich oder per Online-Anmeldung beim Studienbüro anmelden. Hierbei sind die gemäß dem Studienplan für die jeweilige Modulprüfung notwendigen Studienleistungen nachzuweisen.

(3) Die Zulassung darf nur abgelehnt werden, wenn

a. die Studentin in einem mit dem Maschinenbau vergleichbaren oder einem verwandten Studiengang bereits eine Diplomvorprüfung, Diplomprüfung, Bachelor- oder Masterprüfung nicht bestanden hat, sich in einem Prüfungsverfahren befindet oder den Prüfungsanspruch in einem solchen Studiengang verloren hat oder
b. die gemäß dem Studienplan für die jeweilige Modulprüfung notwendigen Studienleistungen nicht nachgewiesen werden können oder
c. die in § 18 genannte Voraussetzung nicht erfüllt ist.

In Zweifelsfällen entscheidet die jeweilige Prüfungskommission.

(4) Die Anmeldung zu einer ersten schriftlichen Modulprüfung gilt zugleich als bedingte Anmeldung für die Wiederholung der Modulprüfung bei nicht bestandener Prüfung.

§ 6 Durchführung von Prüfungen und Erfolgskontrollen

(1) Erfolgskontrollen werden studienbegleitend, in der Regel im Verlauf der Vermittlung der Lehrinhalte der einzelnen Module oder zeitnah danach, durchgeführt.

(2) Die Art der Erfolgskontrolle (§ 4 Abs. 2, Nr. 1 bis 3) der einzelnen Lehrveranstaltungen wird von der Prüferin der betreffenden Lehrveranstaltung in Bezug auf die Lehrinhalte der Lehrveranstaltung und die Lehrziele des Moduls festgelegt. Die Prüferin sowie die Art der Erfolgskontrollen, ihre Häufigkeit, Reihenfolge und Gewichtung, die Bildung der Lehrveranstaltungsnote und der Modulnote müssen mindestens sechs Wochen vor Semesterbeginn bekannt gegeben werden. Im Einvernehmen von Prüferin und Studentin kann die Art der Erfolgskontrolle auch nachträglich geändert werden. Dabei ist jedoch § 4 Abs. 3 zu berücksichtigen. Für die jeweilige Modulprüfung notwendige Studien- und Prüfungsleistungen sind im Studienplan festgelegt.

(3) Bei unvertretbar hohem Prüfungsaufwand kann eine schriftlich durchzuführende Prüfung auch mündlich oder eine mündlich durchzuführende Prüfung auch schriftlich abgenommen werden. Diese Änderung muss mindestens sechs Wochen vor der Prüfung bekannt gegeben werden.

(4) Macht eine Studentin glaubhaft, dass sie wegen länger andauernder oder ständiger körperlicher Behinderung nicht in der Lage ist, die Erfolgskontrollen ganz oder teilweise in der vorgeschriebenen Form abzulegen, kann die zuständige Prüfungskommission – in dringenden Angelegenheiten, deren Erledigung nicht bis zu einer Sitzung des Ausschusses aufgeschoben werden kann, deren Vorsitzende – gestatten, Erfolgskontrollen in einer anderen Form zu erbringen.

(5) Mit Zustimmung der Studentin kann die Prüferin die entsprechenden Erfolgskontrollen in einer anderen Sprache als Deutsch abnehmen.

(6) Schriftliche Prüfungen (§ 4 Abs. 2, Nr. 1) sind in der Regel von einer Prüferin nach § 15 Abs. 2 oder § 15 Abs. 3 zu bewerten. Die Note ergibt sich aus dem arithmetischen Mittel der Einzelbewertungen. Entspricht das arithmetische Mittel keiner der in § 7 Abs. 2, Satz 2 definierten Notenstufen, so ist auf die nächstliegende Notenstufe zu runden. Bei gleichem Abstand ist auf die nächstbessere Notenstufe zu runden. Das Bewertungsverfahren soll sechs Wochen nicht überschreiten. Schriftliche Einzelprüfungen dauern mindestens 60 und höchstens 300 Minuten.

(7) Mündliche Prüfungen (§ 4 Abs. 2, Nr. 2) sind von mehreren Prüferinnen (Kollegialprüfung) oder von einer Prüferin in Gegenwart einer Beisitzenden als Gruppen- oder Einzelprüfungen abzunehmen und zu bewerten. Vor der Festsetzung der Note hört die Prüferin die anderen an der Kollegialprüfung mitwirkenden Prüferinnen an. Mündliche Prüfungen dauern in der Regel mindestens 15 Minuten und maximal 60 Minuten pro Studentin.

(8) Die wesentlichen Gegenstände und Ergebnisse der mündlichen Prüfung in den einzelnen Fächern sind in einem Protokoll festzuhalten. Das Ergebnis der Prüfung ist der Studentin im Anschluss an die mündliche Prüfung bekannt zu geben.

(9) Bei Prüfungen nach § 4 Abs. 2 , Nr. 1 und Nr. 2 kann von der Prüferin ein Bonus von bis zu maximal 0.4 Notenpunkten für vorlesungsbegleitende Übungen oder Projektarbeiten des Pflichtbereichs, die mit der Note 1.0 bewertet werden, vergeben werden. Die Note wird in diesem Falle um den gewährten Bonus verbessert. Entspricht das so entstandene Ergebnis keiner der in § 7 Abs. 2, Satz 2 definierten Notenstufen, so ist auf die nächstliegende Notenstufe zu runden.

(10) Studentinnen, die sich in einem späteren Prüfungszeitraum der gleichen Prüfung unterziehen wollen, werden entsprechend den räumlichen Verhältnissen als Zuhörerinnen bei mündlichen Prüfungen zugelassen. Die Zulassung erstreckt sich nicht auf die Beratung und Bekanntgabe der Prüfungsergebnisse. Aus wichtigen Gründen oder auf Antrag der zu prüfenden Studentin ist die Zulassung zu versagen.

(11) Für Erfolgskontrollen anderer Art sind angemessene Bearbeitungsfristen einzuräumen und Abgabetermine festzulegen. Dabei ist durch die Art der Aufgabenstellung und durch entsprechende Dokumentation sicherzustellen, dass die erbrachte Studienleistung der Studentin zurechenbar ist. Die wesentlichen Gegenstände und Ergebnisse einer solchen Erfolgskontrolle sind in einem Protokoll festzuhalten.

(12) Schriftliche Arbeiten im Rahmen einer Erfolgskontrolle anderer Art haben dabei die folgende Erklärung zu tragen: „Ich versichere wahrheitsgemäß, die Arbeit selbstständig angefertigt, alle benutzten Hilfsmittel vollständig und genau angegeben und alles kenntlich gemacht zu haben, was aus Arbeiten anderer unverändert oder mit Abänderungen entnommen wurde.“ Trägt die Arbeit diese Erklärung nicht, wird diese Arbeit nicht angenommen. Die wesentlichen Gegenstände und Ergebnisse einer solchen Erfolgskontrolle sind in einem Protokoll festzuhalten.

(13) Bei mündlich durchgeführten Erfolgskontrollen anderer Art muss neben der Prüferin eine Beisitzerin anwesend sein, die zusätzlich zur Prüferin die Protokolle zeichnet.

§ 7 Bewertung von Prüfungen und Erfolgskontrollen

(1) Das Ergebnis einer Erfolgskontrolle wird von den jeweiligen Prüferinnen in Form einer Note festgesetzt.

364

(2) Im Bachelorzeugnis dürfen nur folgende Noten verwendet werden:

1	=	sehr gut (very good)	=	hervorragende Leistung,
2	=	gut (good)	=	eine Leistung, die erheblich über den durchschnittlichen Anforderungen liegt,
3	=	befriedigend (satisfactory)	=	eine Leistung, die durchschnittlichen Anforderungen entspricht,
4	=	ausreichend (sufficient)	=	eine Leistung, die trotz ihrer Mängel noch den Anforderungen genügt,
5	=	nicht ausreichend (failed)	=	eine Leistung, die wegen erheblicher Mängel nicht den Anforderungen genügt.

Für die Bachelorarbeit und die Modulteilprüfungen sind zur differenzierten Bewertung nur folgende Noten zugelassen:

1	:	1.0, 1.3	=	sehr gut
2	:	1.7, 2.0, 2.3	=	gut
3	:	2.7, 3.0, 3.3	=	befriedigend
4	:	3.7, 4.0	=	ausreichend
5	:	4.7, 5.0	=	nicht ausreichend

Diese Noten müssen in den Protokollen und in den Anlagen (Transcript of Records und Diploma Supplement) verwendet werden.

(3) Für Erfolgskontrollen anderer Art kann im Studienplan die Benotung mit „bestanden" (passed) oder „nicht bestanden" (failed) vorgesehen werden.

(4) Bei der Bildung der gewichteten Durchschnitte der Modulteilnoten, Modulnoten und der Gesamtnote wird nur die erste Dezimalstelle hinter dem Komma berücksichtigt; alle weiteren Stellen werden ohne Rundung gestrichen.

(5) Jedes Modul, jede Lehrveranstaltung und jede Erfolgskontrolle darf in demselben Studiengang bzw. einem darauf aufbauenden konsekutiven Masterstudiengang nur einmal angerechnet werden.

(6) Erfolgskontrollen anderer Art dürfen in Modulteilprüfungen oder Modulprüfungen nur eingerechnet werden, wenn die Benotung nicht nach Absatz 3 erfolgt ist. Die zu dokumentierenden Erfolgskontrollen und die daran geknüpften Bedingungen werden im Studienplan festgelegt.

(7) Eine Modulteilprüfung ist bestanden, wenn die Note mindestens „ausreichend" (4.0) ist.

(8) Eine Modulprüfung ist dann bestanden, wenn die Modulnote mindestens „ausreichend" (4.0) ist. Die Modulprüfung und die Bildung der Modulnote werden im Studienplan geregelt. Die differenzierten Modulteilnoten (Absatz 2) sind bei der Berechnung der Modulnoten als Ausgangsdaten zu verwenden.

(9) Enthält der Studienplan keine Regelung darüber, wann eine Modulprüfung bestanden ist, so ist diese Modulprüfung dann endgültig nicht bestanden, wenn eine dem Modul zugeordnete Modulteilprüfung endgültig nicht bestanden wurde.

(10) Die Ergebnisse der Bachelorarbeit, der Modulprüfungen bzw. der Modulteilprüfungen, der Erfolgskontrollen anderer Art sowie die erworbenen Leistungspunkte werden durch das Studienbüro der Universität erfasst.

(11) Die Noten der Teilmodule eines Moduls gehen in die Modulnote mit einem Gewicht proportional zu den ausgewiesenen Leistungspunkten der Module ein.

(12) Werden in dem Schwerpunkt-Modul mehr als die notwendigen Leistungspunkte erworben, werden bei der Festlegung der Modulnote alle Modulteilnoten gemäß ihrer Leistungspunkte gewichtet. Bei der Bildung der Gesamtnote werden nur die in § 17 vorgesehenen Leistungspunkte gewertet.

(13) Die Gesamtnote der Bachelorprüfung, die Modulnoten und die Modulteilnoten lauten:

		bis	1.5	=	sehr gut
von	1.6	bis	2.5	=	gut
von	2.6	bis	3.5	=	befriedigend
von	3.6	bis	4.0	=	ausreichend

(14) Zusätzlich zu den Noten nach Absatz 2 werden ECTS-Noten für Modulprüfungen und für die Bachelorprüfung nach folgender Skala vergeben:

ECTS-Note	Definition
A	gehört zu den besten 10 % der Studentinnen, die die Erfolgskontrolle bestanden haben,
B	gehört zu den nächsten 25 % der Studentinnen, die die Erfolgskontrolle bestanden haben,
C	gehört zu den nächsten 30 % der Studentinnen, die die Erfolgskontrolle bestanden haben,
D	gehört zu den nächsten 25 % der Studentinnen, die die Erfolgskontrolle bestanden haben,
E	gehört zu den letzten 10 % der Studentinnen, die die Erfolgskontrolle bestanden haben,
FX	*nicht bestanden* (failed) - es sind Verbesserungen erforderlich, bevor die Leistungen anerkannt werden,
F	*nicht bestanden* (failed) - es sind erhebliche Verbesserungen erforderlich.

Die Quote ist als der Prozentsatz der erfolgreichen Studentinnen definiert, die diese Note in der Regel erhalten. Dabei ist von einer mindestens fünfjährigen Datenbasis über mindestens 30 Studentinnen auszugehen. Für die Ermittlung der Notenverteilungen, die für die ECTS-Noten erforderlich sind, ist das Studienbüro der Universität zuständig.

§ 8 Erlöschen des Prüfungsanspruchs, Orientierungsprüfungen, Wiederholung von Prüfungen und Erfolgskontrollen

(1) Die Modulteilprüfungen in Höherer Mathematik I, II sowie in Technischer Mechanik I, II sind bis zum Ende des Prüfungszeitraums des zweiten Fachsemesters abzulegen (Orientierungsprüfungen).

Wer die Orientierungsprüfungen einschließlich etwaiger Wiederholungen bis zum Ende des Prüfungszeitraums des dritten Fachsemesters nicht abgelegt hat, verliert den Prüfungsanspruch im Studiengang, es sei denn, dass sie die Fristüberschreitung nicht zu vertreten hat; hierüber entscheidet die jeweilige Prüfungskommission auf Antrag der Studentin. Eine zweite Wiederholung der Orientierungsprüfungen ist in höchstens einer Modulteilprüfung möglich.

(2) Studentinnen können eine nicht bestandene schriftliche Prüfung (§ 4 Abs. 2, Nr. 1) einmal wiederholen. Wird eine schriftliche Wiederholungsprüfung mit „nicht ausreichend“ bewertet, so findet eine mündliche Nachprüfung im zeitlichen Zusammenhang mit dem Termin der nicht bestandenen Prüfung statt. In diesem Falle kann die Note dieser Prüfung nicht besser als „ausreichend“ (4.0) sein.

(3) Studentinnen können eine nicht bestandene mündliche Prüfung (§ 4 Abs. 2, Nr. 2) einmal wiederholen.

(4) Wiederholungsprüfungen nach Absatz 2 und 3 sind grundsätzlich zum nächstmöglichen Prüfungstermin abzulegen, sie müssen jedoch spätestens binnen eines Jahres erfolgen. Bei Versäumnis dieser Wiederholungsfrist erlischt der Prüfungsanspruch, es sei denn, die Studentin hat das Versäumnis nicht zu vertreten.

Die Anmeldung erfolgt bei schriftlichen Prüfungen gemäß § 5 Abs. 3. Die Prüfungen müssen in Inhalt, Umfang und Form (mündlich oder schriftlich) der ersten entsprechen. Ausnahmen kann die zuständige Prüfungskommission auf Antrag zulassen. Fehlversuche an anderen Hochschulen sind anzurechnen.

(5) Die Wiederholung einer Erfolgskontrolle anderer Art (§ 4 Abs. 2, Nr. 3) wird im Studienplan geregelt.

(6) Eine zweite Wiederholung derselben schriftlichen oder mündlichen Prüfung ist nur in Ausnahmefällen zulässig. Einen Antrag auf Zweitwiederholung hat die Studentin schriftlich bei der jeweiligen Prüfungskommission zu stellen. Über den ersten Antrag einer Studentin auf Zweitwiederholung entscheidet die jeweilige Prüfungskommission, wenn sie den Antrag genehmigt. Wenn die jeweilige Prüfungskommission diesen Antrag ablehnt, entscheidet die Rektorin. Über weitere Anträge auf Zweitwiederholung entscheidet nach Stellungnahme der jeweiligen Prüfungskommission die Rektorin. Absatz 2, Satz 2 und 3 gilt entsprechend.

(7) Die Wiederholung einer bestandenen Erfolgskontrolle ist nicht zulässig.

(8) Eine Modulprüfung ist endgültig nicht bestanden, wenn mindestens ein Teilmodul des Moduls endgültig nicht bestanden ist.

(9) Die Bachelorarbeit kann bei einer Bewertung mit „nicht ausreichend“ einmal wiederholt werden. Eine zweite Wiederholung der Bachelorarbeit ist ausgeschlossen.

(10) Ist gemäß § 34 Abs. 2, Satz 3 LHG die Bachelorprüfung bis zum Beginn der Vorlesungszeit des zehnten Fachsemesters einschließlich etwaiger Wiederholungen nicht vollständig abgelegt, so erlischt der Prüfungsanspruch im Studiengang, es sei denn, dass die Studentin die Fristüberschreitung nicht zu vertreten hat. Die Entscheidung darüber trifft die jeweilige Prüfungskommission.

§ 9 Versäumnis, Rücktritt, Täuschung, Ordnungsverstoß

(1) Die Studentin kann bei schriftlichen Modulteilprüfungen ohne Angabe von Gründen bis zur Ausgabe der Prüfungsaufgaben zurücktreten. Bei mündlichen Modulteilprüfungen muss der Rücktritt spätestens drei Werktage vor dem betreffenden Prüfungstermin erklärt werden. Die Abmeldung kann schriftlich bei der Prüferin oder per Online-Abmeldung beim Studienbüro erfolgen. Eine durch Widerruf abgemeldete Prüfung gilt als nicht angemeldet.

(2) Eine Modulteilprüfung gilt als mit „nicht ausreichend“ bewertet, wenn die Studentin einen Prüfungstermin ohne triftigen Grund versäumt oder wenn sie nach Beginn der Prüfung ohne triftigen Grund von der Prüfung zurücktritt. Dasselbe gilt, wenn die Bachelorarbeit nicht innerhalb der vorgesehenen Bearbeitungszeit erbracht wird, es sei denn, die Studentin hat die Fristüberschreitung nicht zu vertreten.

(3) Der für den Rücktritt nach Beginn der Prüfung oder das Versäumnis geltend gemachte Grund muss der jeweiligen Prüfungskommission unverzüglich schriftlich angezeigt und glaubhaft gemacht werden. Bei Krankheit der Studentin oder eines von ihr allein zu versorgenden Kindes oder pflegebedürftigen Angehörigen kann die Vorlage eines ärztlichen Attestes und in Zweifelsfällen ein amtsärztliches Attest verlangt werden. Die Anerkennung des Rücktritts ist ausgeschlossen, wenn bis zum Eintritt des Hinderungsgrundes bereits Prüfungsleistungen erbracht worden sind und nach deren Ergebnis die Prüfung nicht bestanden werden kann. Wird der Grund anerkannt, wird ein neuer Termin anberaumt. Die bereits vorliegenden Prüfungsergebnisse sind in diesem Fall anzurechnen.

(4) Versucht die Studentin das Ergebnis ihrer Modulteilprüfung durch Täuschung oder Benutzung nicht zugelassener Hilfsmittel zu beeinflussen, gilt die betreffende Modulteilprüfung als mit „nicht ausreichend“ (5.0) bewertet. Bei Modulprüfungen, die aus mehreren Modulteilprüfungen bestehen, werden die Prüfungsleistungen dieses Moduls, die bis zu einem anerkannten Rücktritt bzw. einem anerkannten Versäumnis einer Prüfungsleistung dieses Moduls erbracht worden sind, angerechnet.

(5) Eine Studentin, die den ordnungsgemäßen Ablauf der Prüfung stört, kann von der jeweiligen Prüferin oder der Aufsicht führenden Person von der Fortsetzung der Modulteilprüfung ausgeschlossen werden. In diesem Fall gilt die betreffende Prüfungsleistung als mit „nicht ausreichend“ (5.0) bewertet. In schwerwiegenden Fällen kann die jeweilige Prüfungskommission die Studentin von der Erbringung weiterer Prüfungsleistungen ausschließen.

(6) Die Studentin kann innerhalb einer Frist von einem Monat verlangen, dass Entscheidungen gemäß Absatz 4 und 5 von der jeweiligen Prüfungskommission überprüft werden. Belastende Entscheidungen der jeweiligen Prüfungskommission sind unverzüglich schriftlich mitzuteilen. Sie sind zu begründen und mit einer Rechtsbehelfsbelehrung zu versehen. Vor einer Entscheidung ist Gelegenheit zur Äußerung zu geben.

(7) Näheres regelt die Allgemeine Satzung der Universität Karlsruhe (TH) zur Redlichkeit bei Prüfungen und Praktika.

§ 10 Mutterschutz, Elternzeit

(1) Auf Antrag sind die Mutterschutzfristen, wie sie im jeweils gültigen Gesetz zum Schutz der erwerbstätigen Mutter (MuSchG) festgelegt sind, entsprechend zu berücksichtigen. Dem Antrag sind die erforderlichen Nachweise beizufügen. Die Mutterschutzfristen unterbrechen jede Frist nach dieser Prüfungsordnung. Die Dauer des Mutterschutzes wird nicht in die Frist eingerechnet.

(2) Gleichfalls sind die Fristen der Elternzeit nach Maßgabe des jeweiligen gültigen Gesetzes (BErzGG) auf Antrag zu berücksichtigen. Die Studentin muss bis spätestens vier Wochen vor dem Zeitpunkt, von dem an sie die Elternzeit antreten will, der jeweiligen Prüfungskommission unter Beifügung der erforderlichen Nachweise schriftlich mitteilen, in welchem Zeitraum sie die Elternzeit in Anspruch nehmen will. Die jeweilige Prüfungskommission hat zu prüfen, ob die gesetzlichen Voraussetzungen vorliegen, die bei einer Arbeitnehmerin den Anspruch auf Elternzeit auslösen würden, und teilt der Studentin das Ergebnis sowie die neu festgesetzten Prüfungszeiten unverzüglich mit. Die Bearbeitungszeit einer Bachelorarbeit kann nicht durch eine Elternzeit unterbrochen werden. Die gestellte Arbeit gilt in diesem Fall als nicht vergeben. Nach Ablauf der Elternzeit erhält die Studentin ein neues Thema.

§ 11 Bachelorarbeit

(1) Voraussetzung für die Zulassung zur Bachelorarbeit ist, dass die Studentin sich in der Regel im 3. Studienjahr befindet, höchstens eine der Modulteilprüfungen der ersten beiden Studienjahre laut § 17 Abs. 3 noch nicht bestanden hat und das Berufspraktikum gemäß § 12 anerkannt wurde. Auf Antrag der Studentin sorgt ausnahmsweise die Vorsitzende der jeweiligen Prüfungskommission dafür, dass die Studentin innerhalb von vier Wochen nach Antragstellung von einer Betreuerin ein Thema für die Bachelorarbeit erhält. Die Ausgabe des Themas erfolgt in diesem Fall über die Vorsitzende der jeweiligen Prüfungskommission.

(2) Thema, Aufgabenstellung und Umfang der Bachelorarbeit sind von der Betreuerin so zu begrenzen, dass sie mit dem in Absatz 3 festgelegten Arbeitsaufwand bearbeitet werden kann.

(3) Der Bachelorarbeit werden 12 Leistungspunkte zugeordnet. Die empfohlene Bearbeitungsdauer beträgt drei Monate. Die maximale Bearbeitungsdauer beträgt einschließlich einer Verlängerung vier Monate. Im Anschluss an die Bachelorarbeit, spätestens vier Wochen nach Abgabe, findet am Institut der Prüferin ein Kolloquium von etwa 30 Minuten Dauer über das Thema der Bachelorarbeit und deren Ergebnisse statt. Die Bachelorarbeit kann im Einvernehmen mit der Prüferin auch auf Englisch oder Französisch geschrieben werden. Die Bachelorarbeit soll zeigen, dass die Studentin in der Lage ist, ein Problem aus dem Maschinenbau selbstständig und in begrenzter Zeit nach wissenschaftlichen Methoden zu bearbeiten.

(4) Die Bachelorarbeit kann von jeder Prüferin nach § 15 Abs. 2 vergeben und betreut werden. Soll die Bachelorarbeit außerhalb der Fakultät für Maschinenbau angefertigt werden, so bedarf dies der Genehmigung der jeweiligen Prüfungskommission. Der Studentin ist Gelegenheit zu geben, für das Thema Vorschläge zu machen. Die Bachelorarbeit kann auch in Form einer Gruppenarbeit zugelassen werden, wenn der als Prüfungsleistung zu bewertende Beitrag der einzelnen Studentin aufgrund objektiver Kriterien, die eine eindeutige Abgrenzung ermöglichen, deutlich unterscheidbar ist und die Anforderung nach Absatz 3 erfüllt.

(5) Bei der Abgabe der Bachelorarbeit hat die Studentin schriftlich zu versichern, dass sie die Arbeit selbstständig verfasst hat und keine anderen als die angegebenen Quellen und Hilfsmittel benutzt hat, die wörtlich oder inhaltlich übernommenen Stellen als solche kenntlich gemacht und die Satzung der Universität Karlsruhe (TH) zur Sicherung guter wissenschaftlicher Praxis in der jeweils gültigen Fassung beachtet hat. Wenn diese Erklärung nicht enthalten ist, wird die Arbeit nicht angenommen. Bei Abgabe einer unwahren Versicherung wird die Bachelorarbeit mit „nicht ausreichend" (5.0) bewertet.

(6) Der Zeitpunkt der Ausgabe des Themas der Bachelorarbeit und der Zeitpunkt der Abgabe der Bachelorarbeit sind aktenkundig zu machen. Das Thema kann nur einmal und nur innerhalb des ersten Monats der Bearbeitungszeit zurückgegeben werden. Ein neues Thema ist binnen vier Wochen zu stellen und auszugeben. Auf begründeten Antrag der Studentin kann die jeweilige Prüfungskommission die in Absatz 3 festgelegte Bearbeitungszeit um höchstens einen Monat verlängern. Wird die Bachelorarbeit nicht fristgerecht abgeliefert, gilt sie als mit „nicht ausreichend" bewertet, es sei denn, dass die Studentin dieses Versäumnis nicht zu vertreten hat. § 8 gilt entsprechend.

(7) Die Bachelorarbeit wird von einer Betreuerin sowie in der Regel von einer weiteren Prüferin bewertet. Eine der beiden muss Juniorprofessorin oder Professorin der Fakultät für Maschinenbau sein. Bei nicht übereinstimmender Beurteilung der beiden Prüferinnen setzt die jeweilige Prüfungskommission im Rahmen der Bewertung der beiden Prüferinnen die Note der Bachelorarbeit fest. Der Bewertungszeitraum soll sechs Wochen nicht überschreiten.

§ 12 Berufspraktikum

(1) Während des Bachelorstudiums ist ein mindestens zwölfwöchiges Berufspraktikum abzuleisten. Davon entfallen sechs Wochen auf das Grundpraktikum und die restlichen sechs Wochen auf das Fachpraktikum, welches geeignet ist, der Studentin eine Anschauung von berufspraktischer Tätigkeit im Maschinenbau zu vermitteln. Dem Fachpraktikum sind 8 Leistungspunkte zugeordnet.

(2) Die Studentin setzt sich in eigener Verantwortung mit geeigneten privaten bzw. öffentlichen Einrichtungen in Verbindung, an denen das Praktikum abgeleistet werden kann. Die Studentin wird dabei von einer Prüferin nach § 15 Abs. 2 und einer Firmenbetreuerin betreut.

(3) Das sechswöchige Grundpraktikum soll vor Studienbeginn abgeleistet werden. Es ist möglich, auch Teile des Fachpraktikums schon vor Studienaufnahme abzuleisten.

(4) Bei der Anmeldung zum zweiten Abschnitt der Bachelorprüfung muss das komplette Berufspraktikum anerkannt sein.

(5) Weitere Regelungen zu Inhalt, Durchführung und Anerkennung des Berufspraktikums finden sich im Studienplan. Das Berufspraktikum geht nicht in die Gesamtnote ein.

§ 13 Zusatzmodule, Zusatzleistungen

(1) Die Studentin kann sich weiteren Prüfungen in Modulen im Umfang von höchstens 20 Leistungspunkten unterziehen. § 3 und § 4 der Studien- und Prüfungsordnung bleiben davon unberührt.

(2) Das Ergebnis maximal zweier Module, die jeweils mindestens 3 Leistungspunkte umfassen müssen, wird auf Antrag der Studentin in das Bachelorzeugnis als Zusatzmodul aufgenommen und als Zusatzmodul gekennzeichnet. Zusatzmodule werden bei der Festsetzung der Gesamtnote nicht mit einbezogen. Alle Zusatzleistungen werden im Transcript of Records automatisch aufgenommen und als Zusatzleistungen gekennzeichnet. Zusatzleistungen werden mit den gemäß

§ 7 vorgesehenen Noten gelistet. Diese Zusatzleistungen gehen nicht in die Festsetzung der Gesamt- und Modulnoten ein.

(3) Die Studentin hat bereits bei der Anmeldung zu einer Prüfung in einem Modul dieses als Zusatzleistung zu deklarieren.

§ 14 Prüfungskommission

(1) Für den Bachelorstudiengang Maschinenbau werden Prüfungskommissionen gebildet. Sie bestehen jeweils aus vier stimmberechtigten Mitgliedern: zwei Professorinnen, Juniorprofessorinnen, Hochschul- oder Privatdozentinnen, zwei Vertreterinnen der Gruppe der wissenschaftlichen Mitarbeiterinnen nach §11 Abs. 1, Satz 2, Nr. 2 LHG und einer Vertreterin der Studentinnen mit beratender Stimme. Die Amtszeit der nichtstudentischen Mitglieder beträgt zwei Jahre, die des studentischen Mitglieds ein Jahr.

(2) Die Vorsitzende, ihre Stellvertreterin, die weiteren Mitglieder der jeweiligen Prüfungskommission sowie deren Stellvertreterinnen werden vom Fakultätsrat bestellt, die Mitglieder der Gruppe der wissenschaftlichen Mitarbeiterinnen nach §11 Abs. 1, Satz 2, Nr. 2 LHG und die Vertreterin der Studentinnen auf Vorschlag der Mitglieder der jeweiligen Gruppe; Wiederbestellung ist möglich. Die Vorsitzende und deren Stellvertreterin müssen Professorin oder Juniorprofessorin sein. Die Vorsitzende der Prüfungskommission nimmt die laufenden Geschäfte wahr und wird durch die Prüfungssekretariate unterstützt.

(3) Die jeweilige Prüfungskommission ist zuständig für die Auslegung und Umsetzung der Prüfungsordnung sowie die Durchführung der ihr durch diese Studien- und Prüfungsordnung zugewiesenen Aufgaben. Sie achtet auf die Einhaltung der Bestimmungen dieser Studien- und Prüfungsordnung und fällt die Entscheidung in Prüfungsangelegenheiten. Sie entscheidet über die Anrechnung von Studienzeiten, Studienleistungen und Modulprüfungen und übernimmt die Gleichwertigkeitsfeststellung. Sie berichtet der jeweiligen Fakultät regelmäßig über die Entwicklung der Prüfungs- und Studienzeiten, einschließlich der Bearbeitungszeiten für die Bachelorarbeiten und die Verteilung der Modul- und Gesamtnoten. Sie ist zuständig für Anregungen zur Reform der Studien- und Prüfungsordnung und zu Modulbeschreibungen.

(4) Die Prüfungskommission kann die Erledigung ihrer Aufgaben für alle Regelfälle auf die Vorsitzende der Prüfungskommission übertragen.

(5) Die Mitglieder der Prüfungskommission haben das Recht, der Abnahme von Prüfungen beizuwohnen. Die Mitglieder der Prüfungskommission, die Prüferinnen und die Beisitzenden unterliegen der Amtsverschwiegenheit. Sofern sie nicht im öffentlichen Dienst stehen, sind sie durch die Vorsitzende zur Verschwiegenheit zu verpflichten.

(6) In Angelegenheiten der Prüfungskommission, die eine an einer anderen Fakultät zu absolvierende Prüfungsleistung betreffen, ist auf Antrag eines Mitgliedes der Prüfungskommission eine fachlich zuständige und von der betroffenen Fakultät zu nennende Professorin, Juniorprofessorin, Hochschul- oder Privatdozentin hinzuziehen. Sie hat in diesem Punkt Stimmrecht.

(7) Belastende Entscheidungen der Prüfungskommission sind schriftlich mitzuteilen. Sie sind zu begründen und mit einer Rechtsbehelfsbelehrung zu versehen. Widersprüche gegen Entscheidungen der Prüfungskommission sind innerhalb eines Monats nach Zugang der Entscheidung schriftlich oder zur Niederschrift an die Prüfungskommission zu richten. Hilft die Prüfungskommission dem Widerspruch nicht ab, ist er zur Entscheidung dem für die Lehre zuständigen Mitglied des Rektorats vorzulegen.

§ 15 Prüferinnen und Beisitzende

(1) Die jeweils zuständige Prüfungskommission bestellt die Prüferinnen und die Beisitzenden. Sie kann die Bestellung der Vorsitzenden übertragen.

(2) Prüferinnen sind Hochschullehrerinnen und habilitierte Mitglieder sowie wissenschaftliche Mitarbeiterinnen der jeweiligen Fakultät, denen die Prüfungsbefugnis übertragen wurde. Bestellt werden darf nur, wer mindestens die dem jeweiligen Prüfungsgegenstand entsprechende fachwissenschaftliche Qualifikation erworben hat. Bei der Bewertung der Bachelorarbeit muss eine Prüferin Hochschullehrerin sein.

(3) Soweit Lehrveranstaltungen von anderen als den unter Absatz 2 genannten Personen durchgeführt werden, sollen diese zur Prüferin bestellt werden, wenn die Fakultät ihr eine diesbezügliche Prüfungsbefugnis erteilt hat.

(4) Zur Beisitzenden darf nur bestellt werden, wer einen Diplom- oder Masterabschluss in einem Studiengang der Fakultät für Maschinenbau oder einen gleichwertigen akademischen Abschluss erworben hat.

§ 16 Anrechnung von Studienzeiten, Anerkennung von Studienleistungen und Modulprüfungen

(1) Studienzeiten und gleichwertige Studienleistungen, Modulteilprüfungen und Modulprüfungen, die in gleichen oder anderen Studiengängen auch an anderen Hochschulen erbracht wurden, werden von Amts wegen angerechnet. Gleichwertigkeit ist festzustellen, wenn Leistungen in Inhalt, Umfang und in den Anforderungen denjenigen des Bachelorstudienganges der Universität Karlsruhe (TH) im Wesentlichen entsprechen. Dabei ist kein schematischer Vergleich, sondern eine Gesamtbetrachtung vorzunehmen. Bezüglich des Umfangs einer zur Anerkennung vorgelegten Studienleistung und Modulprüfung werden die Grundsätze des ECTS herangezogen; die inhaltliche Gleichwertigkeitsprüfung orientiert sich an den Qualifikationszielen des Moduls.

(2) Werden Leistungen angerechnet, können die Noten – soweit die Notensysteme vergleichbar sind – übernommen werden und in die Berechnung der Modulnoten und der Gesamtnote einbezogen werden. Die Anerkennung wird im Zeugnis gekennzeichnet. Bei unvergleichbaren Notensystemen wird nur der Vermerk „anerkannt“ aufgenommen. Die Studentin hat die für die Anrechnung erforderlichen Unterlagen vorzulegen.

(3) Bei der Anrechnung von Studienzeiten und der Anerkennung von Studienleistungen, Modulteilprüfungen und Modulprüfungen, die außerhalb der Bundesrepublik erbracht wurden, sind die von der Kultusministerkonferenz und der Hochschulrektorenkonferenz gebilligten Äquivalenzvereinbarungen sowie Absprachen im Rahmen der Hochschulpartnerschaften zu beachten.

(4) Absatz 1 gilt auch für Studienzeiten, Studienleistungen, Modulteilprüfungen und Modulprüfungen, die in staatlich anerkannten Fernstudien- und an anderen Bildungseinrichtungen, insbesondere an staatlichen oder staatlich anerkannten Berufsakademien erworben wurden.

(5) Die Anerkennung von Teilen der Bachelorprüfung kann versagt werden, wenn in einem Studiengang mehr als die Hälfte aller Erfolgskontrollen und/oder in einem Studiengang mehr als die Hälfte der erforderlichen Leistungspunkte und/oder die Bachelorarbeit anerkannt werden soll/en. Dies gilt sowohl bei einem Studiengangwechsel als auch bei einem Studienortwechsel.

(6) Zuständig für die Anrechnungen ist die jeweilige Prüfungskommission. Vor Feststellungen über die Gleichwertigkeit können die zuständigen Fachvertreterinnen gehört werden. Die jeweilige Prüfungskommission entscheidet in Abhängigkeit von Art und Umfang der anzurechnenden Studien- und Prüfungsleistungen über die Einstufung in ein höheres Fachsemester.

II. Bachelorprüfung

§ 17 Umfang und Art der Bachelorprüfung

(1) Die Bachelorprüfung besteht aus den Modulprüfungen nach Absatz 2 und 3 sowie dem zweiten Abschnitt, der Bachelorarbeit (§ 11).

(2) In den ersten beiden Studienjahren sind Modulprüfungen oder Modulteilprüfungen durch den Nachweis von Leistungspunkten in folgenden Modulen abzulegen:

1. Höhere Mathematik: im Umfang von 21 Leistungspunkten,
2. Naturwissenschaftliche Grundlagen: im Umfang von 7 Leistungspunkten,
3. Technische Mechanik: im Umfang von 21 Leistungspunkten,
4. Werkstoffkunde: im Umfang von 15 Leistungspunkten,
5. Maschinenkonstruktionslehre: im Umfang von 18 Leistungspunkten,
6. Technische Thermodynamik: im Umfang von 13 Leistungspunkten,
7. Betriebliche Produktionswirtschaft: im Umfang von 5 Leistungspunkten,
8. Elektrotechnik: im Umfang von 8 Leistungspunkten,
9. Informatik: im Umfang von 8 Leistungspunkten.

Neben den Fachwissenschaftlichen Modulen ist ein Modul zu den Schlüsselqualifikationen im Umfang von 6 Leistungspunkten gemäß Studienplan zu belegen.

(3) Im dritten Studienjahr sind Modulteilprüfungen aus folgenden Modulen abzulegen:

1. Mess- und Regelungstechnik: im Umfang von 7 Leistungspunkten,
2. Strömungslehre: im Umfang von 7 Leistungspunkten,
3. Maschinen und Prozesse: im Umfang von 7 Leistungspunkten,
4. Wahlpflichtfach: im Umfang von 5 Leistungspunkten,
5. Schwerpunkt mit Kern- und Ergänzungsmodul: im Umfang von 12 Leistungspunkten.

(4) Die den Modulen zugeordneten, zum Teil wählbaren Lehrveranstaltungen und Leistungspunkte, die Erfolgskontrollen und Studienleistungen sowie die für den Schwerpunkt zur Auswahl stehenden Module sind im Studienplan festgelegt. Zu den entsprechenden Modulteilprüfungen kann nur zugelassen werden, wer die Anforderungen nach § 5 erfüllt.

(5) Im dritten Studienjahr ist als eine weitere Prüfungsleistung eine Bachelorarbeit gemäß § 11 anzufertigen.

§ 18 Leistungsnachweise für die Bachelorprüfung

Voraussetzung für die Anmeldung zur letzten Modulprüfung der Bachelorprüfung ist die Bescheinigung über das erfolgreich abgeleistete Berufspraktikum nach § 12. In Ausnahmefällen, die die Studentin nicht zu vertreten hat, kann die jeweilige Prüfungskommission die nachträgliche Vorlage dieses Leistungsnachweises genehmigen.

§ 19 Bestehen der Bachelorprüfung, Bildung der Gesamtnote

(1) Die Bachelorprüfung ist bestanden, wenn alle in § 17 genannten Prüfungsleistungen mindestens mit „ausreichend“ bewertet und das Berufspraktikum nach § 12 anerkannt wurde.

(2) Die Gesamtnote der Bachelorprüfung errechnet sich aus den Modulnoten als ein mit Leistungspunkten gewichteter Notendurchschnitt.

(3) Hat die Studentin die Bachelorarbeit mit der Note 1.0 und die Bachelorprüfung mit einem Durchschnitt von 1.2 oder besser abgeschlossen, so wird das Prädikat „mit Auszeichnung“ (with distinction) verliehen.

§ 20 Bachelorzeugnis, Bachelorurkunde, Transcript of Records und Diploma Supplement

(1) Über die Bachelorprüfung wird nach Bewertung der letzten Prüfungsleistung eine Bachelorurkunde und ein Zeugnis erstellt. Die Ausfertigung von Bachelorurkunde und Zeugnis soll nicht später als sechs Wochen nach der Bewertung der letzten Prüfungsleistung erfolgen. Bachelorurkunde und Bachelorzeugnis werden in deutscher und englischer Sprache ausgestellt. Bachelorurkunde und Zeugnis tragen das Datum der erfolgreichen Erbringung der letzten Prüfungsleistung. Sie werden der Studentin gleichzeitig ausgehändigt. In der Bachelorurkunde wird die Verleihung des akademischen Bachelorgrades beurkundet. Die Bachelorurkunde wird von der Rektorin und der Dekanin unterzeichnet und mit dem Siegel der Universität versehen.

(2) Das Zeugnis enthält die in den zugeordneten Modulprüfungen erzielten Noten (bei Wahlpflichtfach und Schwerpunkt mit Bezeichnung der gewählten Fächer), Note und Thema der Bachelorarbeit, die jeweils zugeordneten Leistungspunkte und ECTS-Noten und die Gesamtnote und die ihr entsprechende ECTS-Note. Das Zeugnis ist von den Dekaninnen der beteiligten Fakultäten und von der Vorsitzenden der jeweiligen Prüfungskommission zu unterzeichnen.

(3) Weiterhin erhält die Studentin als Anhang ein Diploma Supplement in deutscher und englischer Sprache, das den Vorgaben des jeweils gültigen ECTS User’s Guide entspricht. Das Diploma Supplement enthält eine Abschrift der Studiendaten der Studentin (Transcript of Records).

(4) Die Abschrift der Studiendaten (Transcript of Records) enthält in strukturierter Form alle erbrachten Prüfungsleistungen. Dies beinhaltet alle Module mit den Modulnoten und ihre entsprechende ECTS-Note samt den zugeordneten Leistungspunkten sowie die den Modulen zugeordneten Lehrveranstaltungen samt Noten und zugeordneten Leistungspunkten. Aus der Abschrift der Studiendaten soll die Zugehörigkeit von Lehrveranstaltungen zu den einzelnen Modulen deutlich erkennbar sein. Angerechnete Studienleistungen sind im Transcript of Records aufzunehmen.

(5) Die Bachelorurkunde, das Bachelorzeugnis und das Diploma Supplement einschließlich des Transcript of Records werden vom Studienbüro der Universität ausgestellt.

III. Schlussbestimmungen

§ 21 Bescheid über Nicht-Bestehen, Bescheinigung von Prüfungsleistungen

(1) Der Bescheid über die endgültig nicht bestandene Bachelorprüfung wird der Studentin in schriftlicher Form erteilt. Der Bescheid ist mit einer Rechtsbehelfsbelehrung zu versehen.

(2) Hat die Studentin die Bachelorprüfung endgültig nicht bestanden, wird ihr auf Antrag und gegen Vorlage der Exmatrikulationsbescheinigung eine schriftliche Bescheinigung ausgestellt, welche die erbrachten Prüfungsleistungen und deren Noten sowie die zur Prüfung noch fehlenden Prüfungsleistungen enthält und erkennen lässt, dass die Prüfung insgesamt nicht bestanden ist. Dasselbe gilt, wenn der Prüfungsanspruch erloschen ist.

§ 22 Aberkennung des Bachelorgrades

(1) Hat die Studentin bei einer Prüfungsleistung getäuscht und wird diese Tatsache nach der Aushändigung des Zeugnisses bekannt, so können die Noten der Modulprüfungen, bei denen getäuscht wurde, berichtigt werden. Gegebenenfalls kann die Modulprüfung für „nicht ausreichend“ (5.0) und die Bachelorprüfung für „nicht bestanden“ erklärt werden.

(2) Waren die Voraussetzungen für die Zulassung zu einer Prüfung nicht erfüllt, ohne dass die Studentin darüber täuschen wollte, und wird diese Tatsache erst nach Aushändigung des Zeugnisses bekannt, wird dieser Mangel durch das Bestehen der Prüfung geheilt. Hat die Studentin die Zulassung vorsätzlich zu Unrecht erwirkt, so kann die Modulprüfung für „nicht ausreichend“ (5.0) und die Bachelorprüfung für „nicht bestanden“ erklärt werden.

(3) Vor einer Entscheidung der jeweiligen Prüfungskommission ist Gelegenheit zur Äußerung zu geben.

(4) Das unrichtige Zeugnis ist zu entziehen und gegebenenfalls ein neues zu erteilen. Mit dem unrichtigen Zeugnis ist auch die Bachelorurkunde einzuziehen, wenn die Bachelorprüfung aufgrund einer Täuschung für „nicht bestanden“ erklärt wurde.

(5) Eine Entscheidung nach Absatz 1 und Absatz 2, Satz 2 ist nach einer Frist von fünf Jahren ab dem Datum des Zeugnisses ausgeschlossen.

(6) Die Aberkennung des akademischen Grades richtet sich nach den gesetzlichen Vorschriften.

§ 23 Einsicht in die Prüfungsakten

(1) Nach Abschluss der Bachelorprüfung wird der Studentin auf Antrag innerhalb eines Jahres Einsicht in ihre Bachelorarbeit, die darauf bezogenen Gutachten und in die Prüfungsprotokolle gewährt.

(2) Für die Einsichtnahme in die schriftlichen Modulprüfungen bzw. Prüfungsprotokolle gilt eine Frist von einem Monat nach Bekanntgabe des Prüfungsergebnisses.

(3) Die Prüferin bestimmt Ort und Zeit der Einsichtnahme.

(4) Prüfungsunterlagen sind mindestens fünf Jahre aufzubewahren.

§ 24 In-Kraft-Treten

(1) Diese Studien- und Prüfungsordnung tritt am 1. Oktober 2008 in Kraft.

(2) Gleichzeitig tritt die Prüfungsordnung der Universität Karlsruhe (TH) für den Diplomstudiengang Maschinenbau vom 27. Juli 2000 und die Prüfungsordnung der Universität Karlsruhe (TH) für den Bachelorstudiengang Maschinenbau vom 08. Februar 2000 außer Kraft.

(3) Auf Antrag können Studentinnen, die auf Grundlage der Prüfungsordnung der Universität Karlsruhe (TH) für den Diplomstudiengang Maschinenbau vom 27. Juli 2000 (Amtliche Bekanntmachung der Universität Karlsruhe (TH) Nr.18 vom 15. August 2000, S. 107 ff.) ihr Studium an der Universität Karlsruhe (TH) aufgenommen haben, ihr Studium auf Grundlage der vorliegenden Prüfungsordnung fortsetzen.

(4) Auf Antrag können Studentinnen, die auf Grundlage der Prüfungsordnung der Universität Karlsruhe (TH) für den Bachelorstudiengang Maschinenbau vom 08. Februar 2000 (Amtliche Bekanntmachung der Universität Karlsruhe (TH) Nr.18 vom 15. August 2000, S. 94 ff.) ihr Studium an der Universität Karlsruhe (TH) aufgenommen haben, ihr Studium auf Grundlage der vorliegenden Prüfungsordnung fortsetzen.

(5) Studentinnen die auf Grundlage der Prüfungsordnung für den Diplomstudiengang Maschinenbau vom 27. Juli 2000 (Amtliche Bekanntmachung der Universität Karlsruhe (TH) Nr. 18 vom 15. August 2000, S. 107 ff.) ihr Studium an der Universität Karlsruhe (TH) aufgenommen haben, können einen Antrag auf Zulassung zur Prüfung letztmalig am 30. September 2015 stellen.

(6) Studentinnen, die auf Grundlage der Prüfungsordnung für den Bachelorstudiengang Maschinenbau vom 08. Februar 2000 (Amtliche Bekanntmachung der Universität Karlsruhe (TH) Nr. 18 vom 15. August 2000, S. 94 ff.) ihr Studium an der Universität Karlsruhe (TH) aufgenommen haben, können einen Antrag auf Zulassung zur Prüfung letztmalig am 30. September 2015 stellen.

Karlsruhe, den 28. Februar 2008

Professor Dr. sc. tech. Horst Hippler
(Rektor)

Index

A

B

C

D

E

T

U

V

W