Karlsruher Institut für Technologie

Module Handbook
Bachelor Program Mechanical Engineering

SPO 2016, B.Sc.

Valid from Summer Term 2020

Date: 15/02/2020

KIT DEPARTMENT OF MECHANICAL ENGINEERING

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1 About this handbook

1.1 Notes and rules

The program exists of several **subjects** (e.g. Fundamentals of Engineering). Every subject is split into **modules** and every module itself consists of one or more interrelated **module component exams**. The extent of every module is indicated by credit points (CP), which will be credited after the successful completion of the module. Some of the modules are **obligatory**. According to the interdisciplinary character of the program, a great variety of **individual specialization and deepening possibilities** exists for a large number of modules. This enables the student to customize content and time schedule of the program according to personal needs, interest and job perspective. The **module handbook** describes the modules belonging to the program. It describes particularly:

- the structure of the modules
- the extent (in CP),
- the dependencies of the modules,
- the learning outcomes,
- the assessment and examinations.

The module handbook serves as a necessary orientation and as a helpful guide throughout the studies. The module handbook does not replace the **course catalog**, which provides important information concerning each semester and variable course details (e.g. time and location of the course).

1.1.1 Begin and completion of a module

Each module and each examination can only be selected once. The decision on the assignment of an examination to a module (if, for example, an examination in several modules is selectable) is made by the student at the moment when he / she is registered for the appropriate examination. A module is completed or passed when the module examination is passed (grade 4.0 or better). For modules in which the module examination is carried out over several partial examinations, the following applies: The module is completed when all necessary module partial examinations have been passed. In the case of modules which offer alternative partial examinations, the module examination is concluded with the examination with which the required total credit points are reached or exceeded. The module grade, however, is combined with the weight of the predefined credit points for the module in the overall grade calculation.

1.1.2 Module versions

It is not uncommon for modules to be revised due to, for example, new courses or cancelled examinations. As a rule, a new module version is created, which applies to all students who are new to the module. On the other hand, students who have already started the module enjoy confidence and remain in the old module version. These students can complete the module on the same conditions as at the beginning of the module (exceptions are regulated by the examination committee). The date of the student's "`binding declaration"' on the choice of the module in the sense of �5(2) of the Study and Examination Regulation is decisive. This binding declaration is made by registering for the first examination in this module.

In the module handbook, all modules are presented in their current version. The version number is given in the module description. Older module versions can be accessed via the previous module handbooks in the archive.

1.1.3 General and partial examinations

Module examinations can be either taken in a general examination or in partial examinations. If the module examination is offered as a general examination, the entire learning content of the module will be examined in a single examamination. If the module examination is subdivided into partial examinations, the content of each course will be examined in corresponding partial examinations. Registration for examinations can be done online at the campus management portal. The following functions can be accessed on https://campus.studium.kit.edu/:

- Register/unregister for examinations
- Check for examination results
- Create transcript of records

For further and more detailed information, https://studium.kit.edu/Seiten/FAQ.aspx.

1.1.4 Types of exams

Exams are split into written exams, oral exams and alternative exam assessments. Exams are always graded. Non exam assessments can be repeated several times and are not graded.

1.1.5 Repeating exams

Principally, a failed written exam, oral exam or alternative exam assessment can repeated only once. If the repeat examination (including an eventually provided verbal repeat examination) will be failed as well, the examination claim is lost. A request for a second repetition has to be made in written form to the examination committee two months after loosing the examination claim.

1.1.6 Additional accomplishments

Additional accomplishments are voluntarily taken exams, which have no impact on the overall grade of the student and can take place on the level of single courses or on entire modules. It is also mandatory to declare an additional accomplishment as such at the time of registration for an exam.

1.1.7 Further information

More detailed information about the legal and general conditions of the program can be found in the examination regulation of the program (http://www.sle.kit.edu/amtlicheBekanntmachungen.php).

Karlsruher Institut für Technologie

Universität des Landes Baden-Württemberg und
nationales Forschungszentrum in der Helmholtz-Gemeinschaft

Amtliche Bekanntmachung

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Studien- und Prüfungsordnung des Karlsruher Instituts für Technologie (KIT) für den Bachelorstudiengang Maschinenbau

vom 04. August 2015

Aufgrund von § 10 Absatz 2 Ziff. 5 und § 20 des Gesetzes über das Karlsruher Institut für Technologie (KIT-Gesetz - KITG) in der Fassung vom 14. Juli 2009 (GBl. S. 317 f), zuletzt geändert durch Artikel 5 des Dritten Gesetzes zur Änderung hochschulrechtlicher Vorschriften (3. Hochschulrechtsänderungsgesetz – 3. HRÄG) vom 01. April 2014 (GBl. S. 99, 167) und § 8 Absatz 5 des Gesetzes über die Hochschulen in Baden-Württemberg (Landeshochschulgesetz - LHG) in der Fassung vom 1. Januar 2005 (GBl. S. 1 f), zuletzt geändert durch Artikel 1 des 3. HRÄG vom 01. April 2014 (GBl. S. 99 ff.), hat der Senat des KIT am 20. Juli 2015 die folgende Studien- und Prüfungsordnung für den Bachelorstudiengang Maschinenbau beschlossen.

Der Präsident hat seine Zustimmung gemäß § 20 Absatz 2 KITG iVm. § 32 Absatz 3 Satz 1 LHG am 04. August 2015 erteilt.

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Präambel

Das KIT hat sich im Rahmen der Umsetzung des Bolognaprozesses zum Aufbau eines Europäischen Hochschulraumes zum Ziel gesetzt, dass am Abschluss des Studiums am KIT der Mastergrad stehen soll. Das KIT sieht daher die am KIT angebotenen konsekutiven Bachelor- und Masterstudiengänge als Gesamtkonzept mit konsekutivem Curriculum.

I. Allgemeine Bestimmungen

§ 1 Geltungsbereich

Diese Bachelorprüfungsordnung regelt Studienablauf, Prüfungen und den Abschluss des Studiums im Bachelorstudiengang Maschinenbau am KIT.

§ 2 Ziel des Studiums, Akademischer Grad

(1) 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) Aufgrund der bestandenen Bachelorprüfung wird der akademische Grad „Bachelor of Science (B.Sc.)" für den Bachelorstudiengang Maschinenbau verliehen.

§ 3 Regelstudienzeit, Studienaufbau, Leistungspunkte

(1) Der Studiengang nimmt teil am Programm „Studienmodelle individueller Geschwindigkeit". Die Studierenden haben im Rahmen der dortigen Kapazitäten und Regelungen bis einschließlich drittem Fachsemester Zugang zu den Veranstaltungen des MINT-Kollegs Baden-Württemberg (im folgenden MINT-Kolleg).

(2) Die Regelstudienzeit beträgt sechs Semester. Bei einer qualifizierten Teilnahme am MINT-Kolleg bleiben bei der Anrechnung auf die Regelstudienzeit bis zu zwei Semester unberücksichtigt. Die konkrete Anzahl der Semester richtet sich nach § 8 Absatz 2 Satz 3 bis 5.

Eine qualifizierte Teilnahme liegt vor, wenn die Studierende Veranstaltungen des MINT- Kollegs für die Dauer von mindestens einem Semester im Umfang von mindestens zwei Fachkursen (Gesamtworkload 10 Semesterwochenstunden) belegt hat. Das MINT-Kolleg stellt hierüber eine Bescheinigung aus.

(3) Das Lehrangebot des Studiengangs ist in Fächer, die Fächer sind in Module, die jeweiligen Module in Lehrveranstaltungen gegliedert. Die Fächer und ihr Umfang werden in § 20 festgelegt. Näheres beschreibt das Modulhandbuch.

(4) Der für das Absolvieren von Lehrveranstaltungen und Modulen vorgesehene Arbeitsaufwand wird in Leistungspunkten (LP) ausgewiesen. Die Maßstäbe für die Zuordnung von Leistungspunkten entsprechen dem European Credit Transfer System (ECTS). Ein Leistungspunkt entspricht einem Arbeitsaufwand von etwa 30 Zeitstunden. Die Verteilung der Leistungspunkte auf die Semester hat in der Regel gleichmäßig zu erfolgen.

(5) Der Umfang der für den erfolgreichen Abschluss des Studiums erforderlichen Studien- und Prüfungsleistungen wird in Leistungspunkten gemessen und beträgt insgesamt 180 Leistungspunkte.

(6) Lehrveranstaltungen können nach vorheriger Ankündigung auch in englischer Sprache angeboten werden, sofern es deutschsprachige Wahlmöglichkeiten gibt.

§ 4 Modulprüfungen, Studien- und Prüfungsleistungen

(1) Die Bachelorprüfung besteht aus Modulprüfungen. Modulprüfungen bestehen aus einer oder mehreren Erfolgskontrollen.

Erfolgskontrollen gliedern sich in Studien- oder Prüfungsleistungen.

(2) Prüfungsleistungen sind:

1. schriftliche Prüfungen,
2. mündliche Prüfungen oder
3. Prüfungsleistungen anderer Art.

(3) Studienleistungen sind schriftliche, mündliche oder praktische Leistungen, die von den Studierenden in der Regel lehrveranstaltungsbegleitend erbracht werden. Die Bachelorprüfung darf nicht mit einer Studienleistung abgeschlossen werden.

(4) Von den Modulprüfungen sollen mindestens 70 % benotet sein.

(5) Bei sich ergänzenden Inhalten können die Modulprüfungen mehrerer Module durch eine auch modulübergreifende Prüfungsleistung (Absatz 2 Nr.1 bis 3) ersetzt werden.

§ 5 Anmeldung und Zulassung zu den Modulprüfungen und Lehrveranstaltungen

(1) Um an den Modulprüfungen teilnehmen zu können, müssen sich die Studierenden online im Studierendenportal zu den jeweiligen Erfolgskontrollen anmelden. In Ausnahmefällen kann eine Anmeldung schriftlich im Studierendenservice oder in einer anderen, vom Studierendenservice autorisierten Einrichtung erfolgen. Für die Erfolgskontrollen können durch die Prüfenden Anmeldefristen festgelegt werden. Die Anmeldung der Bachelorarbeit ist im Modulhandbuch geregelt.

(2) Sofern Wahlmöglichkeiten bestehen, müssen Studierende, um zu einer Prüfung in einem bestimmten Modul zugelassen zu werden, vor der ersten Prüfung in diesem Modul mit der Anmeldung zu der Prüfung eine bindende Erklärung über die Wahl des betreffenden Moduls und dessen Zuordnung zu einem Fach abgeben. Auf Antrag des/der Studierenden an den Prüfungsausschuss kann die Wahl oder die Zuordnung nachträglich geändert werden. Sofern bereits ein Prüfungsverfahren in einem Modul begonnen wurde, ist die Änderung der Wahl oder der Zuordnung erst nach Beendigung des Prüfungsverfahrens zulässig; dies gilt nur für Prüfungsleistungen.

(3) Zu einer Erfolgskontrolle ist zuzulassen, wer

1. in den Bachelorstudiengang Maschinenbau am KIT eingeschrieben ist; die Zulassung beurlaubter Studierender ist auf Prüfungsleistungen beschränkt; und

2. nachweist, dass er die im Modulhandbuch für die Zulassung zu einer Erfolgskontrolle festgelegten Voraussetzungen erfüllt und

3. nachweist, dass er in dem Bachelorstudiengang Maschinenbau den Prüfungsanspruch nicht verloren hat.

(4) Nach Maßgabe von § 30 Abs. 5 LHG kann die Zulassung zu einzelnen Pflichtveranstaltungen beschränkt werden. Der/die Prüfende entscheidet über die Auswahl unter den Studierenden, die sich rechtzeitig bis zu dem von dem/der Prüfenden festgesetzten Termin angemeldet haben unter Berücksichtigung des Studienfortschritts dieser Studierenden und unter Beachtung von § 13 Abs. 1 Satz 1 und 2, sofern ein Abbau des Überhangs durch andere oder zusätzliche Veranstaltungen nicht möglich ist. Für den Fall gleichen Studienfortschritts sind durch die KIT-Fakultäten weitere Kriterien festzulegen. Das Ergebnis wird den Studierenden rechtzeitig bekannt gegeben.

(5) Die Zulassung ist abzulehnen, wenn die in Absatz 3 und 4 genannten Voraussetzungen nicht erfüllt sind.

§ 6 Durchführung von 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, Abs. 3) wird von der/dem Prüfenden der betreffenden Lehrveranstaltung in Bezug auf die Lerninhalte der Lehrveranstaltung und die Lernziele des Moduls festgelegt. Die Art der Erfolgskontrolle, ihre Häufigkeit, Reihenfolge und Gewichtung sowie gegebenenfalls die Bildung der Modulnote müssen mindestens sechs Wochen vor Vorlesungsbeginn im Modulhandbuch bekannt gemacht werden. Im Einvernehmen von Prüfendem und Studierender bzw. Studierendem können die Art der Prüfungsleistung sowie die Prüfungssprache auch nachträglich geändert werden; im ersten Fall ist jedoch § 4 Abs. 5 zu berücksichtigen. Bei der Prüfungsorganisation sind die Belange Studierender mit Behinderung oder chronischer Erkrankung gemäß § 13 Abs. 1 zu berücksichtigen. § 13 Abs. 1 Satz 3 und 4 gelten entsprechend.

(3) Bei unvertretbar hohem Prüfungsaufwand kann eine schriftlich durchzuführende Prüfungsleistung auch mündlich, oder eine mündlich durchzuführende Prüfungsleistung auch schriftlich abgenommen werden. Diese Änderung muss mindestens sechs Wochen vor der Prüfungsleistung bekannt gegeben werden.

(4) Bei Lehrveranstaltungen in englischer Sprache (§ 3 Abs. 6) können die entsprechenden Erfolgskontrollen in dieser Sprache abgenommen werden. § 6 Abs. 2 gilt entsprechend.

(5) *Schriftliche Prüfungen* (§ 4 Abs. 2 Nr. 1) sind in der Regel von einer/einem Prüfenden nach § 18 Abs. 2 oder 3 zu bewerten. Sofern eine Bewertung durch mehrere Prüfende erfolgt, ergibt sich die Note 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 auf- oder abzurunden. Bei gleichem Abstand ist auf die nächstbessere Notenstufe zu runden. Das Bewertungsverfahren soll sechs Wochen nicht überschreiten. Schriftliche Prüfungen dauern mindestens 60 und höchstens 300 Minuten.

(6) *Mündliche Prüfungen* (§ 4 Abs. 2 Nr. 2) sind von mehreren Prüfenden (Kollegialprüfung) oder von einer/m Prüfenden in Gegenwart einer oder eines Beisitzenden als Gruppen- oder Einzelprüfungen abzunehmen und zu bewerten. Vor der Festsetzung der Note hört die/der Prüfende die anderen an der Kollegialprüfung mitwirkenden Prüfenden an. Mündliche Prüfungen dauern in der Regel mindestens 15 Minuten und maximal 60 Minuten pro Studierenden.

Die wesentlichen Gegenstände und Ergebnisse der *mündlichen Prüfung* sind in einem Protokoll festzuhalten. Das Ergebnis der Prüfung ist den Studierenden im Anschluss an die mündliche Prüfung bekannt zu geben.

Studierende, die sich in einem späteren Semester der gleichen Prüfung unterziehen wollen, werden entsprechend den räumlichen Verhältnissen und nach Zustimmung des Prüflings als Zuhörerinnen und Zuhörer bei mündlichen Prüfungen zugelassen. Die Zulassung erstreckt sich nicht auf die Beratung und Bekanntgabe der Prüfungsergebnisse.

(7) Für *Prüfungsleistungen anderer Art* (§ 4 Abs. 2 Nr. 3) sind angemessene Bearbeitungsfristen einzuräumen und Abgabetermine festzulegen. Dabei ist durch die Art der Aufgabenstellung und durch entsprechende Dokumentation sicherzustellen, dass die erbrachte Prüfungsleistung dem/der Studierenden zurechenbar ist. Die wesentlichen Gegenstände und Ergebnisse einer solchen Erfolgskontrolle sind in einem Protokoll festzuhalten.

Bei *mündlich* durchgeführten *Prüfungsleistungen anderer Art* muss neben der/dem Prüfenden ein/e Beisitzende/r anwesend sein, die/der zusätzlich zum/zur Prüfenden das Protokoll zeichnet.

Schriftliche Arbeiten im Rahmen einer *Prüfungsleistung 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 sie nicht angenommen. Die wesentlichen Gegenstände und Ergebnisse der Erfolgskontrolle sind in einem Protokoll festzuhalten.

§ 6 a Erfolgskontrollen im Antwort-Wahl-Verfahren

Das Modulhandbuch regelt, ob und in welchem Umfang Erfolgskontrollen im Wege des *Antwort-Wahl-Verfahrens* abgelegt werden können

§ 6 b Computergestützte Erfolgskontrollen

(1) Erfolgskontrollen können computergestützt durchgeführt werden. Dabei wird die Antwort bzw. Lösung der/des Studierenden elektronisch übermittelt und, sofern möglich, automatisiert ausgewertet. Die Prüfungsinhalte sind von einer/einem Prüfenden zu erstellen.

(2) Vor der computergestützten Erfolgskontrolle hat die/der Prüfende sicherzustellen, dass die elektronischen Daten eindeutig identifiziert und unverwechselbar und dauerhaft den Studierenden zugeordnet werden können. Der störungsfreie Verlauf einer computergestützten Erfolgskontrolle ist durch entsprechende technische und fachliche Betreuung zu gewährleisten. Alle Prüfungsaufgaben müssen während der gesamten Bearbeitungszeit zur Bearbeitung zur Verfügung stehen.

(3) Im Übrigen gelten für die Durchführung von computergestützten Erfolgskontrollen die §§ 6 bzw. 6 a.

§ 7 Bewertung von Studien- und Prüfungsleistungen

(1) Das Ergebnis einer Prüfungsleistung wird von den jeweiligen Prüfenden in Form einer Note festgesetzt.

(2) Folgende Noten sollen verwendet werden:

sehr gut (very good)	:	hervorragende Leistung,
gut (good)	:	eine Leistung, die erheblich über den durchschnittlichen Anforderungen liegt,
befriedigend (satisfactory)	:	eine Leistung, die durchschnittlichen Anforderungen entspricht,
ausreichend (sufficient)	:	eine Leistung, die trotz ihrer Mängel noch den Anforderungen genügt,
nicht ausreichend (failed)	:	eine Leistung, die wegen erheblicher Mängel nicht den Anforderungen genügt.

Zur differenzierten Bewertung einzelner Prüfungsleistungen sind nur folgende Noten zugelassen:

1,0; 1,3	:	sehr gut
1,7; 2,0; 2,3	:	gut
2,7; 3,0; 3.3	:	befriedigend
3,7; 4,0	:	ausreichend
5,0	:	nicht ausreichend

(3) Studienleistungen werden mit „bestanden" oder mit „nicht bestanden" gewertet.

(4) Bei der Bildung der gewichteten Durchschnitte der Modulnoten, der Fachnoten und der Gesamtnote wird nur die erste Dezimalstelle hinter dem Komma berücksichtigt; alle weiteren Stellen werden ohne Rundung gestrichen.

(5) Jedes Modul und jede Erfolgskontrolle darf in demselben Studiengang nur einmal gewertet werden.

(6) Eine Prüfungsleistung ist bestanden, wenn die Note mindestens „ausreichend" (4,0) ist.

(7) Die Modulprüfung ist bestanden, wenn alle erforderlichen Erfolgskontrollen bestanden sind. Die Modulprüfung und die Bildung der Modulnote sollen im Modulhandbuch geregelt werden. Sofern das Modulhandbuch keine Regelung über die Bildung der Modulnote enthält, errechnet sich die Modulnote aus einem nach den Leistungspunkten der einzelnen Teilmodule gewichteter Notendurchschnitt. Die differenzierten Noten (Absatz 2) sind bei der Berechnung der Modulnoten als Ausgangsdaten zu verwenden.

(8) Die Ergebnisse der Erfolgskontrollen sowie die erworbenen Leistungspunkte werden durch den Studierendenservice des KIT verwaltet.

(9) Die Noten der Module eines Faches gehen in die Fachnote mit einem Gewicht proportional zu den ausgewiesenen Leistungspunkten der Module ein.

(10) Die Gesamtnote der Bachelorprüfung, die Fachnoten und die Modulnoten 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

§ 8 Orientierungsprüfungen, Verlust des Prüfungsanspruchs

(1) Die Teilmodulprüfungen Höhere Mathematik I, Technische Mechanik I, Technische Mechanik II in den Modulen Höhere Mathematik und Technische Mechanik sind bis zum Ende des Prüfungszeitraums des zweiten Fachsemesters abzulegen (Orientierungsprüfungen).

(2) Wer die Orientierungsprüfungen einschließlich etwaiger Wiederholungen bis zum Ende des Prüfungszeitraums des dritten Fachsemesters nicht erfolgreich abgelegt hat, verliert den Prüfungsanspruch im Studiengang, es sei denn, dass die Fristüberschreitung nicht selbst zu vertreten ist; hierüber entscheidet der Prüfungsausschuss auf Antrag der oder des Studierenden. Eine zweite Wiederholung der Orientierungsprüfungen ist ausgeschlossen.

Die Fristüberschreitung hat die/der Studierende insbesondere dann nicht zu vertreten, wenn eine qualifizierte Teilnahme am MINT-Kolleg im Sinne von § 3 Abs. 2 vorliegt. Ohne ausdrückliche Genehmigung des Vorsitzenden des Prüfungsausschusses gilt eine Fristüberschreitung von

1. einem Semester als genehmigt, wenn die/der Studierende eine qualifizierte Teilnahme am MINT-Kolleg gemäß § 3 Abs. 2 im Umfang von einem Semester nachweist oder
2. zwei Semestern als genehmigt, wenn die/der Studierende eine qualifizierte Teilnahme am MINT-Kolleg gemäß § 3 Abs. 2 im Umfang von zwei Semestern nachweist.

Als Nachweis gilt die vom MINT-Kolleg gemäß § 3 Abs. 2 auszustellende Bescheinigung, die beim Studierendenservice des KIT einzureichen ist. Im Falle von Nr. 1 kann der Vorsitzende des Prüfungsausschusses auf Antrag der Studierenden die Frist um ein weiteres Semester verlängern, wenn dies aus studienorganisatorischen Gründen für das fristgerechte Ablegen der Orientierungsprüfung erforderlich ist, insbesondere weil die Module, die Bestandteil der Orientierungsprüfung sind, nur einmal jährlich angeboten werden.

(3) Ist die Bachelorprüfung bis zum Ende des Prüfungszeitraums des neunten Fachsemesters einschließlich etwaiger Wiederholungen nicht vollständig abgelegt, so erlischt der Prüfungsanspruch im Studiengang Maschinenbau, es sei denn, dass die Fristüberschreitung nicht selbst zu vertreten ist. Die Entscheidung über eine Fristverlängerung und über Ausnahmen von der Fristregelung trifft der Prüfungsausschuss unter Beachtung der in § 32 Abs. 6 LHG genannten Tätigkeiten auf Antrag des/der Studierenden. Der Antrag ist schriftlich in der Regel bis sechs Wochen vor Ablauf der in Satz 1 genannten Studienhöchstdauer zu stellen. *Absatz 2 Satz 3 bis 5 gelten entsprechend.*

(4) Der Prüfungsanspruch geht auch verloren, wenn eine nach dieser Studien- und Prüfungsordnung erforderliche Studien- oder Prüfungsleistung endgültig nicht bestanden ist oder eine Wiederholungsprüfung nach § 9 Abs. 6 nicht rechtzeitig erbracht wurde, es sei denn die Fristüberschreitung ist nicht selbst zu vertreten.

§ 9 Wiederholung von Erfolgskontrollen, endgültiges Nichtbestehen

(1) Studierende können eine nicht bestandene schriftliche Prüfung (§ 4 Absatz 2 Nr. 1) einmal wiederholen. Wird eine schriftliche Wiederholungsprüfung mit „nicht ausreichend“ (5,0) 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.

(2) Studierende können eine nicht bestandene mündliche Prüfung (§ 4 Absatz 2 Nr. 2) einmal wiederholen.

(3) Wiederholungsprüfungen nach Absatz 1 und 2 müssen in Inhalt, Umfang und Form (mündlich oder schriftlich) der ersten entsprechen. Ausnahmen kann der zuständige Prüfungsausschuss auf Antrag zulassen.

(4) Prüfungsleistungen anderer Art (§ 4 Absatz 2 Nr. 3) können einmal wiederholt werden.

(5) Studienleistungen können mehrfach wiederholt werden.

(6) Die Wiederholung von Prüfungsleistungen hat spätestens bis zum Ende des Prüfungszeitraumes des übernächsten Semesters zu erfolgen.

(7) Die Prüfungsleistung ist endgültig nicht bestanden, wenn die mündliche Nachprüfung im Sinne des Absatzes 1 mit „nicht ausreichend“ (5,0) bewertet wurde. Die Prüfungsleistung ist ferner endgültig nicht bestanden, wenn die mündliche Prüfung im Sinne des Absatzes 2 oder die Prüfungsleistung anderer Art gemäß Absatz 4 zweimal mit „nicht bestanden“ bewertet wurde.

(8) Das Modul ist endgültig nicht bestanden, wenn eine für sein Bestehen erforderliche Prüfungsleistung endgültig nicht bestanden ist.

(9) Eine zweite Wiederholung derselben Prüfungsleistung gemäß § 4 Abs. 2 ist nur in Ausnahmefällen auf Antrag des/der Studierenden zulässig („Antrag auf Zweitwiederholung“). Der Antrag ist schriftlich beim Prüfungsausschuss in der Regel bis zwei Monate nach Bekanntgabe der Note zu stellen.

Über den ersten Antrag eines/einer Studierenden auf Zweitwiederholung entscheidet der Prüfungsausschuss, wenn er den Antrag genehmigt. Wenn der Prüfungsausschuss diesen Antrag ablehnt, entscheidet ein Mitglied des Präsidiums. Über weitere Anträge auf Zweitwiederholung entscheidet nach Stellungnahme des Prüfungsausschusses ein Mitglied des Präsidiums. Wird der Antrag genehmigt, hat die Zweitwiederholung spätestens zum übernächsten Prüfungstermin zu erfolgen. Absatz 1 Satz 2 und 3 gelten entsprechend.

(10) Die Wiederholung einer bestandenen Prüfungsleistung ist nicht zulässig.

(11) Die Bachelorarbeit kann bei einer Bewertung mit „nicht ausreichend“ (5,0) einmal wiederholt werden. Eine zweite Wiederholung der Bachelorarbeit ist ausgeschlossen.

§ 10 Abmeldung; Versäumnis, Rücktritt

(1) Studierende können ihre Anmeldung zu *schriftlichen Prüfungen* ohne Angabe von Gründen bis zur Ausgabe der Prüfungsaufgaben widerrufen (Abmeldung). Eine Abmeldung kann online im Studierendenportal bis 24:00 Uhr des Vortages der Prüfung oder in begründeten Ausnahmefällen beim Studierendenservice innerhalb der Geschäftszeiten erfolgen. Erfolgt die Abmeldung gegenüber dem/der Prüfenden hat diese/r Sorge zu tragen, dass die Abmeldung im Campus Management System verbucht wird.

(2) Bei *mündlichen Prüfungen* muss die Abmeldung spätestens drei Werktage vor dem betreffenden Prüfungstermin gegenüber dem/der Prüfenden erklärt werden. Der Rücktritt von einer mündlichen Prüfung weniger als drei Werktage vor dem betreffenden Prüfungstermin ist nur unter den Voraussetzungen des Absatzes 5 möglich. Der Rücktritt von mündlichen Nachprüfungen im Sinne von § 9 Abs. 1 ist grundsätzlich nur unter den Voraussetzungen von Absatz 5 möglich.

(3) Die Abmeldung von *Prüfungsleistungen anderer Art* sowie von *Studienleistungen* ist im Modulhandbuch geregelt.

(4) Eine Erfolgskontrolle gilt als mit „nicht ausreichend“ (5,0) bewertet, wenn die Studierenden einen Prüfungstermin ohne triftigen Grund versäumen oder wenn sie nach Beginn der Erfolgskontrolle ohne triftigen Grund von dieser zurücktreten. Dasselbe gilt, wenn die Bachelorarbeit nicht innerhalb der vorgesehenen Bearbeitungszeit erbracht wird, es sei denn, der/die Studierende hat die Fristüberschreitung nicht zu vertreten.

(5) Der für den Rücktritt nach Beginn der Erfolgskontrolle oder das Versäumnis geltend gemachte Grund muss dem Prüfungsausschuss unverzüglich schriftlich angezeigt und glaubhaft gemacht werden. Bei Krankheit des/der Studierenden oder eines allein zu versorgenden Kindes oder pflegebedürftigen Angehörigen kann die Vorlage eines ärztlichen Attestes verlangt werden.

§ 11 Täuschung, Ordnungsverstoß

(1) Versuchen Studierende das Ergebnis ihrer Erfolgskontrolle durch Täuschung oder Benutzung nicht zugelassener Hilfsmittel zu beeinflussen, gilt die betreffende Erfolgskontrolle als mit „nicht ausreichend“ (5,0) bewertet.

(2) Studierende, die den ordnungsgemäßen Ablauf einer Erfolgskontrolle stören, können von der/dem Prüfenden oder der Aufsicht führenden Person von der Fortsetzung der Erfolgskontrolle ausgeschlossen werden. In diesem Fall gilt die betreffende Erfolgskontrolle als mit „nicht ausreichend“ (5,0) bewertet. In schwerwiegenden Fällen kann der Prüfungsausschuss diese Studierenden von der Erbringung weiterer Erfolgskontrollen ausschließen.

(3) Näheres regelt die Allgemeine Satzung des KIT zur Redlichkeit bei Prüfungen und Praktika in der jeweils gültigen Fassung.

§ 12 Mutterschutz, Elternzeit, Wahrnehmung von Familienpflichten

(1) Auf Antrag sind die Mutterschutzfristen, wie sie im jeweils gültigen Gesetz zum Schutz der erwerbstätigen Mutter (Mutterschutzgesetz - 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 jeweils gültigen Gesetzes (Bundeselterngeld- und Elternzeitgesetz - BEEG) auf Antrag zu berücksichtigen. Der/die Studierende muss bis spätestens vier Wochen vor dem Zeitpunkt, von dem an die Elternzeit angetreten werden soll, dem Prüfungsausschuss, unter Beifügung der erforderlichen Nachweise schriftlich mitteilen, in welchem Zeitraum die Elternzeit in Anspruch genommen werden soll. Der Prüfungsausschuss hat zu prüfen, ob die gesetzlichen Voraussetzungen vorliegen, die bei einer Arbeitnehmerin bzw. einem Arbeitnehmer den Anspruch auf Elternzeit auslösen würden, und teilt dem/der Studierenden das Ergebnis sowie die neu festgesetzten Prüfungszeiten unverzüglich mit. Die Bearbeitungszeit der Bachelorarbeit kann nicht durch Elternzeit unterbrochen werden. Die gestellte Arbeit gilt als nicht vergeben. Nach Ablauf der Elternzeit erhält der/die Studierende ein neues Thema, das innerhalb der in § 14 festgelegten Bearbeitungszeit zu bearbeiten ist.

(3) Der Prüfungsausschuss entscheidet auf Antrag über die flexible Handhabung von Prüfungsfristen entsprechend den Bestimmungen des Landeshochschulgesetzes, wenn Studierende Familienpflichten wahrzunehmen haben. Absatz 2 Satz 4 bis 6 gelten entsprechend.

§ 13 Studierende mit Behinderung oder chronischer Erkrankung

(1) Bei der Gestaltung und Organisation des Studiums sowie der Prüfungen sind die Belange Studierender mit Behinderung oder chronischer Erkrankung zu berücksichtigen. Insbesondere ist Studierenden mit Behinderung oder chronischer Erkrankung bevorzugter Zugang zu teilnahmebegrenzten Lehrveranstaltungen zu gewähren und die Reihenfolge für das Absolvieren bestimmter Lehrveranstaltungen entsprechend ihrer Bedürfnisse anzupassen. Studierende sind gemäß Bundesgleichstellungsgesetz (BGG) und Sozialgesetzbuch Neuntes Buch (SGB IX) behindert, wenn ihre körperliche Funktion, geistige Fähigkeit oder seelische Gesundheit mit hoher Wahrscheinlichkeit länger als sechs Monate von dem für das Lebensalter typischen Zustand abweichen und daher ihre Teilhabe am Leben in der Gesellschaft beeinträchtigt ist. Der Prüfungsausschuss entscheidet auf Antrag der/des Studierenden über das Vorliegen der Voraussetzungen nach Satz 2 und 3. Die/der Studierende hat die entsprechenden Nachweise vorzulegen.

(2) Weisen Studierende eine Behinderung oder chronische Erkrankung nach und folgt daraus, dass sie nicht in der Lage sind, Erfolgskontrollen ganz oder teilweise in der vorgeschriebenen Zeit oder Form abzulegen, kann der Prüfungsausschuss gestatten, die Erfolgskontrollen in einem anderen Zeitraum oder einer anderen Form zu erbringen. Insbesondere ist behinderten Studierenden zu gestatten, notwendige Hilfsmittel zu benutzen.

(3) Weisen Studierende eine Behinderung oder chronische Erkrankung nach und folgt daraus, dass sie nicht in der Lage sind, die Lehrveranstaltungen regelmäßig zu besuchen oder die gemäß § 20 erforderlichen Studien- und Prüfungsleistungen zu erbringen, kann der Prüfungsausschuss auf Antrag gestatten, dass einzelne Studien- und Prüfungsleistungen nach Ablauf der in dieser Studien- und Prüfungsordnung vorgesehenen Fristen absolviert werden können.

§ 14 Modul Bachelorarbeit

(1) Voraussetzung für die Zulassung zum Modul Bachelorarbeit ist, dass die/der Studierende Modulprüfungen im Umfang von 120 LP erfolgreich abgelegt hat. Über Ausnahmen entscheidet der Prüfungsausschuss auf Antrag der/des Studierenden.

(1 a) Dem Modul Bachelorarbeit sind 15 LP zugeordnet. Es besteht aus der Bachelorarbeit und einer Präsentation. Die Präsentation hat spätestens sechs Wochen nach Abgabe der Bachelorarbeit zu erfolgen.

(2) Die Bachelorarbeit kann von Hochschullehrer/innen und leitenden Wissenschaftler/innen gemäß § 14 Abs. 3 Ziff. 1 KITG vergeben werden. Darüber hinaus kann der Prüfungsausschuss weitere Prüfende gemäß § 18 Abs. 2 und 3 zur Vergabe des Themas berechtigen. Den Studierenden ist Gelegenheit zu geben, für das Thema Vorschläge zu machen. Soll die Bachelorarbeit außerhalb der KIT-Fakultät für Maschinenbau angefertigt werden, so bedarf dies der Genehmigung durch den Prüfungsausschuss. Die Bachelorarbeit kann auch in Form einer Gruppenarbeit zugelassen werden, wenn der als Prüfungsleistung zu bewertende Beitrag der einzelnen Studierenden aufgrund objektiver Kriterien, die eine eindeutige Abgrenzung ermöglichen, deutlich unterscheidbar ist und die Anforderung nach Absatz 4 erfüllt. In Ausnahmefällen sorgt die/der Vorsitzende des Prüfungsausschusses auf Antrag der oder des Studierenden dafür, dass die/der Studierende innerhalb von vier Wochen ein Thema für die Bachelorarbeit erhält. Die Ausgabe des Themas erfolgt in diesem Fall über die/den Vorsitzende/n des Prüfungsausschusses.

(3) Thema, Aufgabenstellung und Umfang der Bachelorarbeit sind von dem Betreuer bzw. der Betreuerin so zu begrenzen, dass sie mit dem in Absatz 4 festgelegten Arbeitsaufwand bearbeitet werden kann.

(4) Die Bachelorarbeit soll zeigen, dass die Studierenden in der Lage sind, ein Problem aus ihrem Studienfach selbstständig und in begrenzter Zeit nach wissenschaftlichen Methoden zu bearbeiten. Der Umfang der Bachelorarbeit entspricht 12 Leistungspunkten. Die maximale Bearbeitungsdauer beträgt drei Monate. Thema und Aufgabenstellung sind an den vorgesehenen Umfang anzupassen. Der Prüfungsausschuss legt fest, in welchen Sprachen die Bachelorarbeit geschrieben werden kann. Auf Antrag des Studierenden kann der/die Prüfende genehmigen, dass die Bachelorarbeit in einer anderen Sprache als Deutsch geschrieben wird.

(5) Bei der Abgabe der Bachelorarbeit haben die Studierenden schriftlich zu versichern, dass sie die Arbeit selbstständig verfasst und keine anderen als die angegebenen Quellen und Hilfsmittel benutzt haben, die wörtlich oder inhaltlich übernommenen Stellen als solche kenntlich gemacht und die Satzung des KIT zur Sicherung guter wissenschaftlicher Praxis in der jeweils gültigen Fassung beachtet haben. Wenn diese Erklärung nicht enthalten ist, wird die Arbeit nicht angenommen. Die Erklärung kann wie folgt lauten: „Ich versichere wahrheitsgemäß, die Arbeit selbstständig verfasst, alle benutzten Hilfsmittel vollständig und genau angegeben und alles kenntlich gemacht zu haben, was aus Arbeiten anderer unverändert oder mit Abänderungen entnommen wurde sowie die Satzung des KIT zur Sicherung guter wissenschaftlicher Praxis in der jeweils gültigen Fassung beachtet zu haben.“ Bei Abgabe einer unwahren Versicherung wird die Bachelorarbeit mit „nicht ausreichend“ (5,0) bewertet.

(6) Der Zeitpunkt der Ausgabe des Themas der Bachelorarbeit ist durch die Betreuerin/den Betreuer und die/den Studierenden festzuhalten und dies beim Prüfungsausschuss aktenkundig zu machen. Der Zeitpunkt der Abgabe der Bachelorarbeit ist durch den/die Prüfende/n beim Prüfungsausschuss aktenkundig zu machen. Das Thema kann nur einmal und nur innerhalb des ersten Monats der Bearbeitungszeit zurückgegeben werden. Macht der oder die Studierende einen triftigen Grund geltend, kann der Prüfungsausschuss die in Absatz 3 festgelegte Bearbeitungszeit auf Antrag der oder des Studierenden um höchstens einen Monat verlängern. Wird die Bachelorarbeit nicht fristgerecht abgeliefert, gilt sie als mit „nicht ausreichend“ (5,0) bewertet, es sei denn, dass die Studierenden dieses Versäumnis nicht zu vertreten haben.

(7) Die Bachelorarbeit wird von mindestens einem/einer Hochschullehrer/in oder einem/einer leitenden Wissenschaftler/in gemäß § 14 abs. 3 Ziff. 1 KITG und einem/einer weiteren Prüfenden bewertet. In der Regel ist eine/r der Prüfenden die Person, die die Arbeit gemäß Absatz 2 vergeben hat. Bei nicht übereinstimmender Beurteilung dieser beiden Personen setzt der Prüfungsausschuss im Rahmen der Bewertung dieser beiden Personen die Note der Bachelorarbeit fest; er kann auch einen weiteren Gutachter bestellen. Die Bewertung hat innerhalb von sechs Wochen nach Abgabe der Bachelorarbeit zu erfolgen.

§ 15 Zusatzleistungen

(1) Es können auch weitere Leistungspunkte (Zusatzleistungen) im Umfang von höchstens 30 LP aus dem Gesamtangebot des KIT erworben werden. § 3 und § 4 der Prüfungsordnung bleiben davon unberührt. Diese Zusatzleistungen gehen nicht in die Festsetzung der Gesamt- und Modulnoten ein. Die bei der Festlegung der Modulnote nicht berücksichtigten LP werden als Zusatzleistungen im Transcript of Records aufgeführt und als Zusatzleistungen gekennzeichnet. Auf Antrag der/des Studierenden werden die Zusatzleistungen in das Bachelorzeugnis aufgenommen und als Zusatzleistungen gekennzeichnet. Zusatzleistungen werden mit den nach § 7 vorgesehenen Noten gelistet.

(2) Die Studierenden haben bereits bei der Anmeldung zu einer Prüfung in einem Modul diese als Zusatzleistung zu deklarieren.

§ 15 a Mastervorzug

Studierende, die im Bachelorstudium bereits mindestens 120 LP erworben haben, können zusätzlich zu den in § 15 Abs. 1 genannten Zusatzleistungen Leistungspunkte aus einem konsekutiven Masterstudiengang am KIT im Umfang von höchstens 30 LP erwerben (Mastervorzugsleistungen). § 3 und § 4 der Prüfungsordnung bleiben davon unberührt. Die Mastervorzugsleistungen gehen nicht in die Festsetzung der Gesamt-, Fach- und Modulnoten ein. Sie werden im Transcript of Records aufgeführt und als solche gekennzeichnet sowie mit den nach § 7 vorgesehenen Noten gelistet. § 15 Absatz 2 gilt entsprechend.

§ 16 Überfachliche Qualifikationen

Neben der Vermittlung von fachlichen Qualifikationen ist der Auf- und Ausbau überfachlicher Qualifikationen im Umfang von mindestens 6 LP Bestandteil eines Bachelorstudiums. Überfachliche Qualifikationen können additiv oder integrativ vermittelt werden.

§ 17 Prüfungsausschüsse

(1) Für den Bachelorstudiengang werden Prüfungsausschüsse gebildet. Sie bestehen jeweils aus vier stimmberechtigten Mitgliedern: zwei Hochschullehrer/innen / leitenden Wissenschaftler/innen gemäß § 14 Abs. 3 Ziff. 1 KITG / Privatdozentinnen bzw. -dozenten, zwei akademischen Mitarbeiterinnen und Mitarbeitern nach § 52 LHG / wissenschaftlichen Mitarbeiter/innen gemäß § 14 Abs. 3 Ziff. 2 KITG und einer bzw. einem Studierenden mit beratender Stimme. Im Falle der Einrichtung eines gemeinsamen Prüfungsausschusses für den Bachelor- und den Masterstudiengang Maschinenbau erhöht sich die Anzahl der Studierenden auf zwei Mitglieder mit beratender Stimme, wobei je eine bzw. einer dieser Beiden aus dem Bachelor- und aus dem Masterstudiengang stammt. Die Amtszeit der nichtstudentischen Mitglieder beträgt zwei Jahre, die des studentischen Mitglieds ein Jahr.

(2) Die/der Vorsitzende, ihre/sein Stellvertreter/in, die weiteren Mitglieder des jeweiligen Prüfungsausschusses sowie deren Stellvertreter/innen werden von dem KIT-Fakultätsrat bestellt, die akademischen Mitarbeiter/innen nach § 52 LHG, die wissenschaftlichen Mitarbeiter gemäß § 14 Abs. 3 Ziff. 2 KITG und die Studierenden auf Vorschlag der Mitglieder der jeweiligen Gruppe; Wiederbestellung ist möglich. Die/der Vorsitzende und deren/dessen Stellvertreter/in müssen Hochschullehrer/innen oder leitende Wissenschaftler/innen § 14 Abs. 3 Ziff. 1 KITG sein. Die/der Vorsitzende des jeweiligen Prüfungsausschusses nimmt die laufenden Geschäfte wahr und wird durch das jeweilige Prüfungssekretariat unterstützt.

(3) Der jeweilige Prüfungsausschuss achtet auf die Einhaltung der Bestimmungen dieser Studien- und Prüfungsordnung und fällt die Entscheidungen in Prüfungsangelegenheiten. Er entscheidet über die Anerkennung von Studienzeiten sowie Studien- und Prüfungsleistungen und trifft die Feststellung gemäß § 19 Absatz 1 Satz 1. Er berichtet der KIT-Fakultät regelmäßig über die Entwicklung der Prüfungs- und Studienzeiten, einschließlich der Bearbeitungszeiten für die Bachelorarbeiten und die Verteilung der Modul- und Gesamtnoten. Er ist zuständig für Anregungen zur Reform der Studien- und Prüfungsordnung und zu Modulbeschreibungen. Der Prüfungsausschuss entscheidet mit der Mehrheit seiner Stimmen. Bei Stimmengleichheit entscheidet der Vorsitzende des Prüfungsausschusses.

(4) Der Prüfungsausschuss kann die Erledigung seiner Aufgaben für alle Regelfälle auf die/den Vorsitzende/n des Prüfungsausschusses übertragen. In dringenden Angelegenheiten, deren Erledigung nicht bis zu der nächsten Sitzung des Prüfungsausschusses warten kann, entscheidet die/der Vorsitzende des Prüfungsausschusses.

(5) Die Mitglieder des Prüfungsausschusses haben das Recht, der Abnahme von Prüfungen beizuwohnen. Die Mitglieder des Prüfungsausschusses, die Prüfenden und die Beisitzenden unterliegen der Verschwiegenheit. Sofern sie nicht im öffentlichen Dienst stehen, sind sie durch die/den Vorsitzende/n zur Verschwiegenheit zu verpflichten.

(6) In Angelegenheiten des Prüfungsausschusses, die eine an einer anderen KIT-Fakultät zu absolvierende Prüfungsleistung betreffen, ist auf Antrag eines Mitgliedes des Prüfungsausschusses eine fachlich zuständige und von der betroffenen KIT-Fakultät zu nennende prüfungsberechtigte Person hinzuzuziehen.

(7) Belastende Entscheidungen des Prüfungsausschusses sind schriftlich mitzuteilen. Sie sind zu begründen und mit einer Rechtsbehelfsbelehrung zu versehen. Vor einer Entscheidung ist Gelegenheit zur Äußerung zu geben. Widersprüche gegen Entscheidungen des Prüfungsausschusses sind innerhalb eines Monats nach Zugang der Entscheidung schriftlich oder zur Niederschrift beim Präsidium des KIT einzulegen.

§ 18 Prüfende und Beisitzende

(1) Der Prüfungsausschuss bestellt die Prüfenden. Er kann die Bestellung der/dem Vorsitzenden übertragen.

(2) Prüfende sind Hochschullehr/innen sowie leitende Wissenschaftler/innen gemäß § 14 Abs. 3 Ziff. 1 KITG, habilitierte Mitglieder und akademische Mitarbeiter/innen gemäß § 52 LHG, welche der KIT-Fakultät angehören und denen die Prüfungsbefugnis übertragen wurde; desgleichen kann wissenschaftlichen Mitarbeitern gemäß § 14 Abs. 3 Ziff. 2 KITG die Prüfungsbefugnis übertragen werden. Bestellt werden darf nur, wer mindestens die dem jeweiligen Prüfungsgegenstand entsprechende fachwissenschaftliche Qualifikation erworben hat.

(3) Soweit Lehrveranstaltungen von anderen als den unter Absatz 2 genannten Personen durchgeführt werden, sollen diese zu Prüfenden bestellt werden, sofern die KIT-Fakultät eine Prüfungsbefugnis erteilt hat und sie die gemäß Absatz 2 Satz 2 vorausgesetzte Qualifikation nachweisen können.

(4) Die Beisitzenden werden durch die Prüfenden benannt. Zu Beisitzenden darf nur bestellt werden, wer einen akademischen Abschluss in einem mathematisch-naturwissenschaftlichen oder ingenieurwissenschaftlichen Studiengang oder einen gleichwertigen akademischen Abschluss erworben hat.

§ 19 Anerkennung von Studien- und Prüfungsleistungen, Studienzeiten

(1) Studien- und Prüfungsleistungen sowie Studienzeiten, die in Studiengängen an staatlichen oder staatlich anerkannten Hochschulen und Berufsakademien der Bundesrepublik Deutschland oder an ausländischen staatlichen oder staatlich anerkannten Hochschulen erbracht wurden, werden auf Antrag der Studierenden anerkannt, sofern hinsichtlich der erworbenen Kompetenzen kein wesentlicher Unterschied zu den Leistungen oder Abschlüssen besteht, die ersetzt werden sollen. Dabei ist kein schematischer Vergleich, sondern eine Gesamtbetrachtung vorzunehmen. Bezüglich des Umfangs einer zur Anerkennung vorgelegten Studienleistung bzw. Prüfungsleistung (Anrechnung) werden die Grundsätze des ECTS herangezogen.

(2) Die Studierenden haben die für die Anerkennung erforderlichen Unterlagen vorzulegen. Studierende, die neu in den Studiengang Maschinenbau immatrikuliert wurden, haben den Antrag mit den für die Anerkennung erforderlichen Unterlagen innerhalb eines Semesters nach Immatrikulation zu stellen. Bei Unterlagen, die nicht in deutscher oder englischer Sprache vorliegen, kann eine amtlich beglaubigte Übersetzung verlangt werden. Die Beweislast dafür, dass der Antrag die Voraussetzungen für die Anerkennung nicht erfüllt, liegt beim Prüfungsausschuss.

(3) Werden Leistungen angerechnet, die nicht am KIT erbracht wurden, werden sie im Zeugnis als „anerkannt“ ausgewiesen. Liegen Noten vor, werden die Noten, soweit die Notensysteme vergleichbar sind, übernommen und in die Berechnung der Modulnoten und der Gesamtnote einbezogen. Sind die Notensysteme nicht vergleichbar, können die Noten umgerechnet werden. Liegen keine Noten vor, wird der Vermerk „bestanden“ aufgenommen.

(4) Bei der Anerkennung von Studien- und Prüfungsleistungen, die außerhalb der Bundesrepublik Deutschland erbracht wurden, sind die von der Kultusministerkonferenz und der Hochschulrektorenkonferenz gebilligten Äquivalenzvereinbarungen sowie Absprachen im Rahmen der Hochschulpartnerschaften zu beachten.

(5) Außerhalb des Hochschulsystems erworbene Kenntnisse und Fähigkeiten werden angerechnet, wenn sie nach Inhalt und Niveau den Studien- und Prüfungsleistungen gleichwertig sind, die ersetzt werden sollen und die Institution, in der die Kenntnisse und Fähigkeiten erworben wurden, ein genormtes Qualitätssicherungssystem hat. Die Anrechnung kann in Teilen versagt werden, wenn mehr als 50 Prozent des Hochschulstudiums ersetzt werden soll.

(6) Zuständig für Anerkennung und Anrechnung ist der jeweilige Prüfungsausschuss. Im Rahmen der Feststellung, ob ein wesentlicher Unterschied im Sinne des Absatz 1 vorliegt, sind die zuständigen Fachvertreter/innen zu hören. Der jeweilige Prüfungsausschuss entscheidet in Abhängigkeit von Art und Umfang der anzurechnenden Studien- und Prüfungsleistungen über die Einstufung in ein höheres Fachsemester.

II. Bachelorprüfung

§ 20 Umfang und Art der Bachelorprüfung

(1) Die Bachelorprüfung besteht aus den Modulprüfungen nach Absatz 2 sowie dem Modul Bachelorarbeit (§ 14).

(2) Es sind Modulprüfungen in folgenden Pflichtfächern abzulegen:

1. Ingenieurwissenschaftliche Grundlagen: Modul(e) im Umfang von 143 LP,
2. Vertiefung im Maschinenbau: Modul(e) im Umfang von 16 LP,
3. Überfachliche Qualifikationen im Umfang von 6 LP gemäß § 16.

Die Festlegung der zur Auswahl stehenden Module und deren Fachzuordnung werden im Modulhandbuch getroffen.

§ 21 Bestehen der Bachelorprüfung, Bildung der Gesamtnote

(1) Die Bachelorprüfung ist bestanden, wenn alle in § 20 genannten Modulprüfungen mindestens mit „ausreichend“ bewertet wurden.

(2) Die Gesamtnote der Bachelorprüfung errechnet sich als ein mit Leistungspunkten gewichteter Notendurchschnitt der Fachnoten sowie des Moduls Bachelorarbeit.

Dabei wird die Note des Moduls Bachelorarbeit mit dem doppelten Gewicht gegenüber den Noten der übrigen Fächer berücksichtigt.

(3) Haben Studierende 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.

§ 22 Bachelorzeugnis, Bachelorurkunde, Diploma Supplement und Transcript of Records

(1) Über die Bachelorprüfung werden nach Bewertung der letzten Prüfungsleistung eine Bachelorurkunde und ein Zeugnis erstellt. Die Ausfertigung von Bachelorurkunde und Zeugnis soll nicht später als drei Monate nach Ablegen 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. Diese Dokumente werden den Studierenden zusammen ausgehändigt. In der Bachelorurkunde wird die Verleihung des akademischen Bachelorgrades beurkundet. Die Bachelorurkunde wird von dem Präsidenten und der KIT-Dekanin/ dem KIT-Dekan der KIT-Fakultät unterzeichnet und mit dem Siegel des KIT versehen.

(2) Das Zeugnis enthält die Fach- und Modulnoten sowie die den Modulen und Fächern zugeordnete Leistungspunkte und die Gesamtnote. Sofern gemäß § 7 Abs. 2 Satz 2 eine differenzierte Bewertung einzelner Prüfungsleitungen vorgenommen wurde, wird auf dem Zeugnis auch die entsprechende Dezimalnote ausgewiesen; § 7 Abs. 4 bleibt unberührt. Das Zeugnis ist von der KIT-Dekanin/ dem KIT-Dekan der KIT-Fakultät und von der/dem Vorsitzenden des jeweiligen Prüfungsausschusses zu unterzeichnen.

(3) Mit dem Zeugnis erhalten die Studierenden ein Diploma Supplement in deutscher und englischer Sprache, das den Vorgaben des jeweils gültigen ECTS Users‘ Guide entspricht, sowie ein Transcript of Records in deutscher und englischer Sprache.

(4) Das Transcript of Records enthält in strukturierter Form alle erbrachten Studien- und Prüfungsleistungen. Dies beinhaltet alle Fächer und Fachnoten samt den zugeordneten Leistungspunkten, die dem jeweiligen Fach zugeordneten Module mit den Modulnoten und zugeordneten Leistungspunkten sowie die den Modulen zugeordneten Erfolgskontrollen samt Noten und zugeordneten Leistungspunkten. Absatz 2 Satz 2 gilt entsprechend. Aus dem Transcript of Records soll die Zugehörigkeit von Lehrveranstaltungen zu den einzelnen Modulen deutlich erkennbar sein. Angerechnete Studien- und Prüfungsleistungen sind im Transcript of Records aufzunehmen. Alle Zusatzleistungen werden im Transcript of Records aufgeführt.

(5) Die Bachelorurkunde, das Bachelorzeugnis und das Diploma Supplement einschließlich des Transcript of Records werden vom Studierendenservice des KIT ausgestellt.

III. Schlussbestimmungen

§ 23 Bescheinigung von Prüfungsleistungen

Haben Studierende die Bachelorprüfung endgültig nicht bestanden, wird ihnen auf Antrag und gegen Vorlage der Exmatrikulationsbescheinigung eine schriftliche Bescheinigung ausgestellt, die die erbrachten Studien- und Prüfungsleistungen und deren Noten enthält und erkennen lässt, dass die Prüfung insgesamt nicht bestanden ist. Dasselbe gilt, wenn der Prüfungsanspruch erloschen ist.

§ 24 Aberkennung des Bachelorgrades

(1) Haben Studierende 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 Studierende darüber täuschen wollte, und wird diese Tatsache erst nach Aushändigung des Zeugnisses bekannt, wird dieser Mangel durch das Bestehen der Prüfung geheilt. Hat die/der Studierende 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 des Prüfungsausschusses 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 § 36 Abs. 7 LHG.

§ 25 Einsicht in die Prüfungsakten

(1) Nach Abschluss der Bachelorprüfung wird den Studierenden auf Antrag innerhalb eines Jahres Einsicht in das Prüfungsexemplar ihrer Bachelorarbeit, die darauf bezogenen Gutachten und in die Prüfungsprotokolle gewährt.

(2) Für die Einsichtnahme in die schriftlichen Modulprüfungen, schriftlichen Modulteilprüfungen bzw. Prüfungsprotokolle gilt eine Frist von einem Monat nach Bekanntgabe des Prüfungsergebnisses.

(3) Der/die Prüfende bestimmt Ort und Zeit der Einsichtnahme.

(4) Prüfungsunterlagen sind mindestens fünf Jahre aufzubewahren.

§ 26 Inkrafttreten, Übergangsvorschriften

(1) Diese Studien- und Prüfungsordnung tritt am 01. Oktober 2016 in Kraft.

(2) Gleichzeitig tritt die Studien- und Prüfungsordnung des KIT für den Bachelorstudiengang Maschinenbau vom 28. Februar 2008 (Amtliche Bekanntmachung des KIT Nr. 78 vom 09. September 2008), zuletzt geändert durch Satzung vom 24. September 2014 (Amtliche Bekanntmachung des KIT Nr. 53 vom 01. Oktober 2014), außer Kraft.

(3) Studierende, die auf Grundlage der Studien- und Prüfungsordnung für den Bachelorstudiengang Maschinenbau vom 28. Februar 2008 (Amtliche Bekanntmachung des KIT Nr. 78 vom 09. September 2008), zuletzt geändert durch Satzung vom 24. September 2014 (Amtliche Bekanntmachung des KIT Nr. 53 vom 01. Oktober 2014), ihr Studium am KIT aufgenommen haben, können Prüfungen auf Grundlage dieser Studien- und Prüfungsordnung letztmalig am 30. September 2021 ablegen.

(4) Studierende, die auf Grundlage der Studien- und Prüfungsordnung für den Bachelorstudiengang Maschinenbau vom 28. Februar 2008 (Amtliche Bekanntmachung des KIT Nr. 78 vom 09. September 2008), zuletzt geändert durch Satzung vom 24. September 2014 (Amtliche Bekanntmachung des KIT Nr. 53 vom 01. Oktober 2014), ihr Studium am KIT aufgenommen haben, können auf Antrag ihr Studium nach der vorliegenden Studien- und Prüfungsordnung fortsetzen.

(5) Die Prüfungsordnung für den Diplomstudiengang Maschinenbau vom 27. Juli 2000 (Amtliche Bekanntmachung der Universität Karlsruhe (TH) Nr. 18 vom 15. August 2000, S. 107 ff.) bleibt außer Kraft. Studierende, 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 die Diplomprüfung einschließlich etwaiger Wiederholungen letztmalig bis zum 30. September 2017 ablegen.

Karlsruhe, den 04. August 2015

Professor Dr.-Ing. Holger Hanselka
(Präsident)

Karlsruher Institut für Technologie

Die Forschungsuniversität in der Helmholtz-Gemeinschaft

Amtliche Bekanntmachung

2019 **Ausgegeben Karlsruhe, den 26. Februar 2019** **Nr. 03**

I n h a l t **Seite**

Satzung zur Änderung der Studien- und Prüfungsordnung des Karlsruher Instituts für Technologie (KIT) für den Bachelorstudiengang Maschinenbau

vom 21. Februar 2019

Aufgrund von § 10 Absatz 2 Ziff. 5 und § 20 Absatz 2 Satz 1 des Gesetzes über das Karlsruher Institut für Technologie (KIT-Gesetz - KITG) in der Fassung vom 14. Juli 2009 (GBl. S. 317 f), zuletzt geändert durch Artikel 2 des Gesetzes zur Weiterentwicklung des Hochschulrechts (HRWeitEG) vom 13. März 2018 (GBl S. 85, 94), und § 32 Absatz 3 Satz 1 des Gesetzes über die Hochschulen in Baden-Württemberg (Landeshochschulgesetz - LHG) in der Fassung vom 1. Januar 2005 (GBl. S. 1 f), zuletzt geändert durch Artikel 1 des Gesetzes zur Weiterentwicklung des Hochschulrechts (HRWeitEG) vom 13. März 2018 (GBl. S. 85) hat der KIT-Senat am 18. Februar 2019 die folgende Satzung zur Änderung der Studien- und Prüfungsordnung für den Bachelorstudiengang Maschinenbau vom 04. August 2015 (Amtliche Bekanntmachung des Karlsruher Instituts für Technologie (KIT) Nr. 62 vom 06. August 2015) beschlossen.

Der Präsident hat seine Zustimmung gemäß § 20 Absatz 2 Satz 1 KITG i.V.m. § 32 Absatz 3 Satz 1 LHG am 21. Februar 2019 erteilt.

Artikel 1 – Änderung der Studien- und Prüfungsordnung

1. § 9 Absatz 11 werden folgende Sätze 3 und 4 angefügt:

„Die Präsentation nach § 14 Absatz 1 a ist eine Studienleistung und kann bei einer Bewertung mit „nicht bestanden (not passed)“ (im Gegensatz zu anderen Studienleistungen) nur einmal wiederholt werden. Die Präsentation ist endgültig nicht bestanden, wenn sie zweimal mit „nicht bestanden“ (not passed) bewertet wurde.“

2. § 12 Absatz 1 wird wie folgt geändert:

a) Satz 1 wird wie folgt gefasst:

„Es gelten die Vorschriften des Gesetzes zum Schutz von Müttern bei der Arbeit, in der Ausbildung und im Studium (Mutterschutzgesetz – MuSchG) in seiner jeweils geltenden Fassung.“

b) Satz 2 wird aufgehoben.

c) Die bisherigen Sätze 3 und 4 werden die Sätze 2 und 3

3. § 14 wird wie folgt geändert:

a) In Absatz 1 a Satz 2 wird nach dem Wort „Bachelorarbeit“ die Angabe „mit 12 LP“ und nach dem Wort „Präsentation“ die Angabe „mit 3 LP“ eingefügt.

b) In Absatz 2 Satz 1 werden nach den Wörtern „Hochschullehrer/innen“ das Wort “und“ durch ein Komma ersetzt und nach der Angabe „§ 14 Abs. 3 Ziff. 1 KITG“ die Wörter „und habilitierten Mitgliedern der KIT-Fakultät für Maschinenbau“ eingefügt.

c) In Absatz 7 Satz 1 werden nach den Wörtern „Hochschullehrer/innen“ das Wort “oder“ durch ein Komma ersetzt und nach der Angabe „§ 14 Abs. 3 Ziff. 1 KITG“ die Wörter „oder einem habilitierten Mitglied der KIT-Fakultät für Maschinenbau“ eingefügt.

4. § 17 wird wie folgt geändert:

a) In Absatz 1 Satz 3 wird das Wort „stammt“ durch die Wörter „stammen soll“ ersetzt.

b) In Absatz 7 Satz 4 werden nach dem Wort „Entscheidung“ die Wörter „schriftlich oder zur Niederschrift“ gestrichen.

5. § 18 Absatz 3 wird wie folgt geändert:

Nach dem Wort „sofern“ werden die Wörter „die KIT-Fakultät eine Prüfungsbefugnis erteilt hat und“ gestrichen.

6. § 26 Absatz 5 wird aufgehoben und folgender neuer Absatz 5 eingefügt:

„(5) Für Studierende, die

1. ihr Studium im Bachelorstudiengang Maschinenbau vor dem Wintersemester 2018/2019 aufgenommen haben oder
2. ihr Studium im Bachelorstudiengang Maschinenbau ab dem Wintersemester 2018/2019 in einem höheren Fachsemester aufgenommen haben bzw. aufnehmen sofern das Fachsemester über dem Jahrgang der Studienanfänger zum Wintersemester 2018/2019 liegt,

finden § 9 Abs. 11 und § 14 Abs. 1 a in der Fassung der Studien- und Prüfungsordnung des Karlsruher Instituts für Technologie (KIT) für den Bachelorstudiengang Maschinenbau vom 04. August 2015 (Amtliche Bekanntmachung des KIT Nr. 62 vom 06. August 2015) weiterhin Anwendung.

Studierende nach Satz 1 Ziffer 1 und Ziffer 2, können das Modul Bachelorarbeit auf Grundlage der Studien- und Prüfungsordnung des Karlsruher Instituts für Technologie (KIT) für den Bachelorstudiengang Maschinenbau in der Fassung vom 04. August 2015 (Amtliche Bekanntmachung des KIT Nr. 62 vom 06. August 2015) letztmalig bis zum 31. März 2023 ablegen“

Artikel 2 – Inkrafttreten

Diese Änderungssatzung tritt zum 01. April 2019 in Kraft.

Karlsruhe, den 21. Februar 2019

gez. Prof. Dr.-Ing. Holger Hanselka
(Präsident)

Studienplan der KIT-Fakultät für Maschinenbau für den Bachelorstudiengang Maschinenbau gemäß SPO 2015

Fassung vom 30. August 2019

Inhaltsverzeichnis

0 Abkürzungsverzeichnis

Semester:	WS	Wintersemester
	SS	Sommersemester
Schwerpunkte:	K, KP	Teilleistung im Kernbereich, ggf. Pflicht des Schwerpunkts
	E	Teilleistung im Ergänzungsbereich des Schwerpunkts
	EM	Teilleistung im Ergänzungsbereich ist nur im Masterstudiengang wählbar
	E(P), E/P	Teilleistung Praktikum im Ergänzungsbereich des Schwerpunkts, unbenotet
Lehrveranstaltung:	V	Vorlesung
	Ü	Übung
	P	Praktikum
	SWS	Semesterwochenstunden
Teilleistung:	LP	Leistungspunkte
	Pr	Prüfung
	Pr (h)	Prüfungsdauer in Stunden
	mPr	mündliche Prüfung
	sPr	schriftliche Prüfung
	PraA	Prüfungsleistung anderer Art
	Üschein	Übungsschein, Studienleistung
	Pschein	Praktikumsschein, Studienleistung
	Schein	unbenotete Modulleistung, Studienleistung
	TL	Teilleistung
	Gew	Gewichtung einer Prüfungsleistung im Modul bzw. in der Gesamtnote
Sonstiges:	SPO	Studien- und Prüfungsordnung
	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 wird für Prüfungen mindestens ein Prüfungstermin angeboten. Prüfungstermine sowie Termine, zu denen die Anmeldung zu den Prüfungen spätestens erfolgen muss, werden von der Prüfungskommission festgelegt. Die Anmeldung für die Prüfungen erfolgt in der Regel mindestens eine Woche vor der Prüfung. Anmelde- und Prüfungstermine werden rechtzeitig bekanntgegeben, bei schriftlichen Prüfungen mindestens sechs Wochen vor der Prüfung.

Über Hilfsmittel, die bei einer Prüfung benutzt werden dürfen, entscheidet der Prüfer. Eine Liste der zugelassenen Hilfsmittel wird gleichzeitig mit der Ankündigung des Prüfungstermins bekanntgegeben. Studienleistungen können solange beliebig oft wiederholt werden, bis diese erfolgreich bestanden wurden.

1.2 Module des Bachelorstudiums

Voraussetzung für die Zulassung zu den Modulprüfungen ist der Nachweis über die unten aufgeführten Studienleistungen. Schriftliche Prüfungen werden als Klausuren mit der angegebenen Prüfungsdauer in Stunden abgenommen. Prüfungsleistungen gehen mit dem angegebenen Gewicht (Gew) in die Modulnote bzw. die Gesamtnote ein. Zur Berechnung der Modul- und Fachnoten wird auf §7 Abs. 4 und 9 in der SPO verwiesen. Die Teilmodulprüfungen Höhere Mathematik 1, Technische Mechanik 1 und Technische Mechanik 2 sind Orientierungsprüfungen. Zu den Regelungen wird auf §8 der SPO verwiesen.

Das in § 16 SPO beschriebene Fach „Überfachliche Qualifikationen“ bildet das Modul „Schlüsselqualifikationen“ mit einem Umfang von 6 Leistungspunkten.

Fach	Modul	LP/ Modul	Teilleistung	LP	Koordinator	Art der Erfolgs-kontrolle		Pr (h)	Gew
						Studien-leistungen	Prüfungs-leistungen		
Ingenieurwissenschaftliche Grundlagen	Höhere Mathematik	21	Höhere Mathematik I	7	Kirsch	Üschein	sPr	2	7
			Höhere Mathematik II	7		ÜSchein	sPr	2	7
			Höhere Mathematik III	7		ÜSchein	sPr	2	7
	Technische Mechanik	23	Technische Mechanik I	7	Böhlke	Üschein	sPr	1,5	7
			Technische Mechanik II	6		Üschein	sPr	1,5	6
			Technische Mechanik III & IV	10	Seemann	Üschein Üschein	sPr	3	10
	Werkstoffkunde	14	Werkstoffkunde I & II	11	Heilmaier		mPr	ca. 0,5	14
			Werkstoffkunde-Praktikum	3		Pschein			
	Technische Thermodynamik	15	Technische Thermo-dynamik und Wärmeüber-tragung I	8	Maas	Üschein	sPr	3	8
			Technische Thermody-namik und Wärmeüber-tragung II	7		Üschein	sPr	3	7
	Strömungslehre	8	Strömungslehre I & II	8	Frohnapfel		sPr	3	8
	Physik	5	Wellen- und Quanten-physik	5	Pilawa		sPr	2	5
	Elektrotechnik	8	Elektrotechnik und Elektronik	8	Becker		sPr	3	8
	Mess- und Re-gelungstechnik	7	Grundlagen der Mess- und Regelungstechnik	7	Stiller		sPr	2,5	7

Fach	Modul	LP/ Modul	Teilleistung	LP	Koordinator	Art der Erfolgskontrolle: Studienleistungen	Art der Erfolgskontrolle: Prüfungsleistungen	Pr (h)	Gew
	Informatik	6	Informatik im Maschinenbau	6	Ovtcharova	Pschein	sPr	3	6
	Maschinenkonstruktionslehre	20	Maschinenkonstruktionslehre I & II	7	Albers	Üschein, Üschein	sPr	1	7
			Maschinenkonstruktionslehre III & IV	13		Üschein, Üschein	sPr	4	13
	Maschinen und Prozesse	7	Maschinen und Prozesse	7	Kubach	Pschein	sPr	3	7
	Fertigungsprozesse	4	Grundlagen der Fertigungstechnik	4	Schulze		sPr	1	4
	Betriebliche Produktionswirtschaft	5	Betriebliche Produktionswirtschaft	3	Furmans		sPr	1,5	5
			Betriebliche Produktionswirtschaft Projekt	2			PraA		
Vertiefung im Maschinenbau	Schwerpunkt	12	Kern- und Ergänzungsbereich, wählbare TL siehe Modulhandbuch	12	SP-Verantwortlicher		mPr	ca. 0,7	12
							mPr	ca. 0,7	
	Wahlpflichtmodul	4	wählbare TL siehe Modulhandbuch	4	Heilmaier		mPr	ca. 0,4	4
Überfachliche Qualifikationen	Schlüsselqualifikationen	6	Arbeitstechniken im Maschinenbau	4	Deml	Schein			
			wählbare TL von HoC, ZAK bzw. siehe Modulhandbuch	2	N.N.	Schein			
Bachelorarbeit	Bachelorarbeit	15	Bachelorarbeit	12			PraA		30
			Präsentation	3					

1.3 Studienplan

Lehrveranstaltungen 1. bis 4. Semester Angaben in Semesterwochenstunden (SWS)	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 Fertigungstechnik	2											
Wellen- und Quantenphysik										2	1	
Technische Mechanik I-IV	3	2		3	2		2	2		2	2	
Werkstoffkunde I, II	4	1		2	1							
Werkstoffkunde-Praktikum[1]						2						
Technische Thermodynamik und Wärmeübertragung I, II							4	2		3	2	
Maschinenkonstruktionslehre I-IV	2	1		2	2		2	2	1	2	2	1
Informatik im Maschinenbau				2	2	2						
Elektrotechnik und Elektronik							4	2				
Strömungslehre I										2	1	
Arbeitstechniken Maschinenbau										1		1

Lehrveranstaltungen 5. bis 6. Semester Angaben in Semesterwochenstunden (SWS)	WS 5. Sem.			SS 6. Sem.		
	V	Ü	P	V	Ü	P
Grundlagen der Mess- und Regelungstechnik	3	1				
Strömungslehre II	2	1				
Maschinen und Prozesse	4		1			
Betriebliche Produktionswirtschaft	3	1				
Schlüsselqualifikationen				2		
Wahlpflichtmodul	(2)			2		
Schwerpunkt (6 SWS, variabel)	3	( )	( )	3	( )	( )

1.4 Bachelorarbeit

Das Modul Bachelorarbeit besteht aus einer schriftlichen Ausarbeitung (Bachelorarbeit, 12 LP) sowie einer mündlichen Präsentation (3 LP). Die Präsentation soll spätestens sechs Wochen nach Abgabe der Bachelorarbeit erfolgen. Die Präsentation soll ca. 20 Minuten dauern und wird anschließend mit dem anwesenden Fachpublikum diskutiert.
Die Durchführung und Benotung der Bachelorarbeit ist in § 14 der SPO für den Bachelorstudiengang Maschinenbau sowie im Modulhandbuch unter „Modul Bachelorarbeit“ geregelt.

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

2 Schwerpunkte

Folgende Schwerpunkte sind derzeit vom Fakultätsrat genehmigt (siehe Angaben im Modulhandbuch):

Schwerpunkt	Verantwortlicher	SP-Nr.
Antriebssysteme	Albers	2
Bahnsystemtechnik	Gratzfeld	50
Entwicklung und Konstruktion	Albers	10
Festigkeitslehre/Kontinuumsmechanik	Böhlke	13
Grundlagen der Energietechnik	Bauer	15
Informationsmanagement	Ovtcharova	17
Informationstechnik	Stiller	18
Kraftfahrzeugtechnik	Gauterin	12
Kraft- und Arbeitsmaschinen	Th. Koch	24
Materialwissenschaft und Werkstofftechnik	Heilmaier	26
Mechatronik	Hagenmeyer	31
Modellbildung und Simulation in der Dynamik	Seemann	61
Production Engineering	Lanza	52
Produktionssysteme	Schulze	38
Schwingungslehre	Fidlin	60
Technische Logistik	Furmans	44
Technik des Verbrennungsmotors	Th. Koch	57

Für den Schwerpunkt werden Teilleistungen im Umfang von 12 LP gewählt, davon werden mindestens 8 LP im Kernbereich (K) erworben. „KP“ bedeutet, dass die Teilleistung im Kernbereich Pflicht ist, sofern sie nicht bereits belegt wurde. Die übrigen 4 LP können aus dem Ergänzungsbereich kommen. Dabei dürfen im Rahmen von Praktika höchstens 4 LP erworben werden, die auch als unbenotete Modulleistung erbracht werden können.

Die im Ergänzungsbereich (E) angegebenen Teilleistungen verstehen sich als Empfehlung, andere Teilleistungen (auch aus anderen KIT-Fakultäten) können mit Genehmigung des jeweiligen Schwerpunkt-verantwortlichen gewählt werden. Dabei ist eine Kombination mit Teilleistungen aus den Bereichen Informatik, Elektrotechnik und Mathematik in einigen Schwerpunkten besonders willkommen. Mit „EM“ gekennzeichnete Teilleistungen stehen im Bachelorstudiengang nicht zur Wahl. Für manche Schwerpunkte wird die Belegung einer bestimmten Teilleistung im Rahmen des Wahlpflichtmoduls empfohlen (s. Empfehlungen im Modulhandbuch).

Ein Absolvieren des Schwerpunktmoduls mit mehr als 12 LP ist nur im Fall, dass die Addition innerhalb des Schwerpunktmoduls nicht auf 12 LP aufgeht, erlaubt. Nicht zulässig ist es jedoch, noch weitere Teilleistungen anzumelden, wenn bereits 12 LP erreicht oder überschritten wurden.

Für die Prüfungsleistungen in den Schwerpunkten gelten folgende Regeln:
Die Prüfungen werden grundsätzlich mündlich abgenommen, bei unvertretbar hohem Prüfungsaufwand kann eine mündlich durchzuführende Prüfung auch schriftlich abgenommen werden. Es wird empfohlen, die Kernbereichsprüfung im Block abzulegen. Bei mündlichen Prüfungen im Schwerpunkt soll die Prüfungsdauer fünf Minuten pro Leistungspunkt betragen. Erstreckt sich eine mündliche Prüfung über mehr als 12 LP, soll die Prüfungsdauer 60 Minuten betragen.

Die Bildung der Schwerpunktnote erfolgt anhand der mit Prüfungsleistungen abgeschlossenen Teilleistungen. Dabei werden alle Teilleistungen gemäß ihrer LP gewichtet. Bei der Bildung der Gesamtnote wird der Schwerpunkt mit 12 LP gewertet.

Die Beschreibung der Schwerpunkte hinsichtlich der jeweils darin enthaltenen Teilleistungen und den damit verbundenen Lehrveranstaltungen ist im aktuellen Modulhandbuch des Bachelorstudiengangs festgelegt.

3 Änderungshistorie (ab 20.07.2016)

20.07.2016	Sprachliche Anpassung an das Eckpunktepapier des KIT, Überarbeitung der Prüfungsmodalitäten
17.08.2016	Redaktionelle Änderungen, u.a. im Modul Physik
28.06.2017	Redaktionelle Änderungen, u.a. in den Modulen Technische Thermodynamik und Strömungslehre
13.07.2018	Anpassung der Schwerpunkte sowie redaktionelle Änderungen
30.08.2019	Redaktionelle Änderungen, u.a. in Punkt 1
15.02.2020	Redaktionelle Änderungen, u.a. in Punkt 1.2

WS 2019-2020	B.Sc. Maschinenbau: 1. Fachsemester, Ingenieurwissenschaftliche Grundlagen				
Zeit	**Montag**	**Dienstag**	**Mittwoch**	**Donnerstag**	**Freitag**
08:00 - 09:30					
09:45 - 11:15	**2161245** Technische Mechanik I Audimax		**2149658** Grundlagen der Fertigungstechnik Gerthsen		
11:30 - 13:00	**0131100** Höhere Mathematik I (Üb) Audimax	**0131000** Höhere Mathematik I Audimax	**2145185** Maschinenkonstruktionslehre I (Üb) HS. a.F.		
13:00 - 14:00					
14:00 - 15.30	**2173552** Werkstoffkunde I (Üb) HS a.F.	**2145178** Maschinenkonstruktionslehre I Daimler / Benz		**2161245** Technische Mechanik I Audimax	**2173550** Werkstoffkunde I Audimax
15:45 - 17:15		**2173550** Werkstoffkunde I Gerthsen		**0131000** Höhere Mathematik I Audimax	**2161246** Technische Mechanik I (Üb) Audimax / Daimler
17:30 - 19:00					

Stand: 04.09.2019

Vorlesung	Übung

WS 2019-2020	B.Sc. Maschinenbau: 3. Fachsemester, Ingenieurwissenschaftliche Grundlagen				
Zeit	**Montag**	**Dienstag**	**Mittwoch**	**Donnerstag**	**Freitag**
08:00 - 09:30			**0131400** Höhere Mathematik III Audimax		**2165502** Technische Thermodynamik und Wärmeübertragung I (Üb) Gerthsen
09:45 - 11:15	**2306339** Elektrotechnik und Elektronik (+Üb) Daimler			**2165501** Technische Thermodynamik und Wärmeübertragung I HS a.F.	**0131400** Höhere Mathematik III Gerthsen
11:30 - 13:00	**2161203** Technische Mechanik III HS a.F.	**2306339** Elektrotechnik und Elektronik (+Üb) Benz		**2145153** MKL III (Üb) Audimax	
13:00 - 14:00					
14:00 - 15.30	**2145154** Workshop zu MKL III Räume siehe Homepage	**2165501** Technische Thermodynamik und Wärmeübertragung I Gerthsen		**2161204** Technische Mechanik III (Üb) Daimler / Benz	**2145154** Workshop zu MKL III Räume siehe Homepage
15:45 - 17:15		**2145151** MKL III Daimler / Benz		**0131500** Höhere Mathematik III (Üb) Gerthsen	
17:30 - 19:00					

Stand: 04.09.2019

Vorlesung	Übung	Workshop

WS 2019-2020	**B.Sc. Maschinenbau: 5. Fachsemester; Pflichtmodule, Wahlpflichtmodul**				
Zeit	**Montag**	**Dienstag**	**Mittwoch**	**Donnerstag**	**Freitag**
08:00 - 09:30	2181612 Phys. GL der Lasertechnik (+Üb) Grashof 2114093 Fluidtechnik Gaede	2165515 GL der techn. Verbrennung I 30.41 HS 3 2105011 Einf. in die Mechatronik (+Üb) (14-tägl.) Hertz	2137301 GL der Mess- und Regelungstechnik (14-tägl.) Gerthsen	2185000 Maschinen und Prozesse (+Üb) HS a.F.	2105011 Einführung in die Mechatronik Hertz
09:45 - 11:15	2137303 GL der Mess- und Regelungstechnik (Tu) 50.31 R 106	2137303 GL der Mess- und Regelungstechnik (Tu) 50.31 R 106 2161254 MM der Kontinuums-mechanik 10.50 Großer HS	2153512 Strömungslehre II HS a.F.		2183702 Mikrostruktursimulation (+ Üb) Oberer HS 2137303 GL der MRT (Tu) 50.41 R -133
11:30 - 13:00	2137303 GL der MRT (Tu) 10.50 R 701.3; 50.41 R -108, -109, -134 2133123 Techn. GL des Verbr.-motors 10.50 Kl. HS	2183703 Modellierung und Simulation HsKA, AM001, Amalienstr. 81-87 2137303 GL der MRT (Tu) 10.50 R 602, 702; 10.91 R 228; 50.41 R -108, -109, -134	2183702 Mikrostruktursimulation (+ Üb, 14-tägl.) 30.48 R 017		2153512 Strömungslehre II HS a.F.
13:00 -14:00					
14:00 - 15.30	2121350 PLM HS I Chemie 2110085 Betriebliche Produktionswirt-schaft (+Üb) Daimler/Benz	2117095 GL der technischen Logistik (+Üb) Gaede	2181738 Wiss. Programmieren für Ingenieure Grashof 2137303 GL der MRT (Tu) 50.41 R -134	2137303 GL der Mess- und Regelungstechnik (Tu) 10.81 HS 62; 40.32 SR 032	2161206 MM der Dynamik Grashof 2110085 Betriebliche Produktions-wirtschaft (+Üb) HS a.F.
15:45 - 17:15	2137301 GL der Mess- und Regelungstechnik Audimax	2185000 Maschinen und Prozesse (+Üb) HS a.F.	2117095 GL d. techn. Logistik (+Üb) Tulla HS 2181612 Phys. GL der Lasertechnik (+Üb) Redt.	2137303 GL der MRT (Tu) 40.32 SR 032; 30.41 HS 2 2161212 Technische Schw. Lehre 30.33 MTI 2165512 Wärme- u. Stoff-übertragung Nusselt	2137303 GL der MRT (Tu) 10.50 R 701.3 2161255 MM der Kontinuums-mechanik (Üb) 10.50 Kl. HS
17:30 - 19:00	2183703 Modellierung und Simulation (bis 20:00 Uhr) 20.29 Pool C				

Stand: 05.09.2019

Pflichtfach	Übung / Tutorium	Wahlpflichtfach

WS 2019-2020	**B.Sc. Maschinenbau: 5. Fachsemester; Wahlpflichtmodul**				
Zeit	**Montag**	**Dienstag**	**Mittwoch**	**Donnerstag**	**Freitag**
08:00 - 09:30	2181612 Phys. GL der Lasertechnik (+Üb) Grashof 2114093 Fluidtechnik Gaede	2161207 MM der Dynamik (Üb) Grashof 2165515 GL der techn. Verbrenn. I 30.41HS 3 2105011 Einf. in die Mechatronik (14-tägl.) Hertz			2105011 Einführung in die Mechatronik Hertz
09:45 - 11:15		2161254 MM der Kontinuumsmechanik 10.50 Großer HS		2181739 Wiss. Programmieren für Ingenieure (Üb) 20.21 SCC-PC-Pool H	2183702 Mikrostruktur-simulation (+Üb) Oberer HS 2165513 Wärme- und Stoffüber. (Üb) Grashof
11:30 - 13:00	2114088 Fluidtechnik (Üb) 30.41 HS 3 2133123 Techn. GL des Verbr.-motors 10.50 Kleiner HS	2183703 Modellierung und Simulation HsKA, AM001, Amalienstr. 81-87	2183702 Mikrostruktursimulation (+ Üb, 14-tägl.) 30.48 R 017		
13:00 - 14:00					
14:00 - 15.30	2121350 PLM HS I Chemie	2117095 GL der techn. Logistik (+Üb) Gaede	2161213 Techn. Schwingungs-lehre (Üb) Tulla 2181738 Wiss. Programmieren für Ingenieure Grashof		2161206 MM der Dynamik Grashof 2181739 Wiss. Programmieren für Ingenieure (Üb) 20.21 SCC-PC-Pool A
15:45 - 17:15			2117095 GL der technischen Logistik (+Üb) Tulla HS 2181612 Physik. GL Lasertechnik (+Üb) 10.91 Redt.	2181739 Wiss. Program-mieren für Ingenieure (Üb) 20.21 SCC-PC-Pool A 2161212 Techn. Schwing.-lehre 30.33 MTI 2165512 Wärme- und Stoff-übertragung Nusselt	2161255 MM der Kontinuumsmechanik (Üb) 10.50 Kl. HS
17:30 - 19:00	2183703 Modellierung und Simulation (bis 20:00 Uhr) 20.29 Pool C				

Stand: 11.09.2019

Vorlesung	Übung

SS 2020 — B.Sc. Maschinenbau: 2. Fachsemester, Ingenieurwissenschaftliche Grundlagen

Zeit	Montag	Dienstag	Mittwoch	Donnerstag	Freitag
08:00 - 09:30		**0180900** Höhere Mathematik II (Üb) Audimax	**2146185** MKL II (Üb) Daimler, Benz	**0180800** Höhere Mathematik II Audimax	
09:45 - 11:15	**0180800** Höhere Mathematik II Audimax	**2162250** Technische Mechanik II Audimax	**2121390** Informatik im Maschinenbau Gerthsen	**2162250** Technische Mechanik II Audimax	**2162251** Technische Mechanik II (Üb) Audimax
11:30 - 13:00	**2174563** Werkstoffkunde II (Üb) HS a.F.		**2174560** Werkstoffkunde II Audimax		**2146178** MKL II Benz
13:00 - 14:00					
14:00 - 15.30					**2121390** Informatik im Maschinenbau Gerthsen
15:45 - 17:15					
17:30 - 19:00					

Stand: 10.03.2020

Vorlesung	Übung	Praktikum

2121392 Rechnerpraktikum zu Informatik im Maschinenbau Termine s. Instituts-Homepage	**2162252** Rechnerübungen zu Technische Mechanik II Termine siehe Instituts-Homepage	**2174597** Experimentelles Praktikum in Werkstoffkunde Blockveranstaltung

SS 2020 — B.Sc. Maschinenbau: 4. Fachsemester, Ingenieurwissenschaftliche Grundlagen

Zeit	Montag	Dienstag	Mittwoch	Donnerstag	Freitag
08:00 - 09:30	**2166555** Technische Thermodynamik u. Wärmeübertragung II (Üb) Gerthsen	**4040411** Wellen und Quantenphysik Gerthsen	**2166526** Techn. Thermodynamik und Wärmeübertragung II Gerthsen	**2166556** Tech. Thermodynamik und Wärmeübertragung II (Tu) Redtenbacher	**2166556** Technische Thermodynamik und Wärmeübertragung II (Tu) Hertz
09:45 - 11:15				**2166526** Technische Thermodynamik und Wärmeübertragung II HS a.F.	**2146184** MKL IV (Üb) Daimler, Benz **2166556** Tech.Thermo-dynamik und Wärmeü. II (Tu) Hertz
11:30 - 13:00		**2166556** Technische Thermodynamik und Wärmeübertragung II (Tu) Hertz		**2154512** Strömungslehre I Audimax	**2154512** Strömungslehre I Audimax
13:00 - 14:00					
14:00 - 15.30	**2146187** MKL IV Workshop Ort und Termine s. Aushang und Institutshomepage	**2162231** Technische Mechanik IV Daimler, Benz		**2146177** MKL IV Daimler, Benz	**2146187** MKL IV Workshop Ort und Termine s. Aushang und Instituts-homepage
15:45 - 17:15		**2162232** Technische Mechanik IV (Üb) Daimler, Benz		**4040412** Wellen und Quantenphysik (Üb) Gerthsen	**2174970** Arbeitstechniken im Maschinenbau (Einzeltermin, danach Online-VL) Audimax
17:30 - 19:00					

Stand: 10.03.2020

Vorlesung	Übung	Workshop

SS 2020	B.Sc. Maschinenbau: Wahlpflichtfächer / Wahlpflichtmodul				
Zeit	**Montag**	**Dienstag**	**Mittwoch**	**Donnerstag**	**Freitag**
08:00 - 09:30				**2183703** Modellierung und Simulation (+Üb) 20.29 Pool C	
09:45 - 11:15	**2162242** MM d. Schwingungslehre (Üb) Grashof	**2161225** Maschinendynamik (Üb) HS I Chemie **2174576** Systematische Werkstoffauswahl Redtenbacher		**2174577** Sys. Werk-stoffaus. (Üb) Daimler	**2154433** MM der Strömungslehre (Üb) HS Sport
11:30 - 13:00		**2183703** Modellierung und Simulation (+Üb) HsKA, AM001, Amalienstr. 81-87 **2162235** Einf. in die Mehrkörperdynamik HS a. F.		**2162335** Einführung in die Mehrkörper-dynamik (Üb) 10.50 Gr. HS	**2142891** Physik für Ingenieure (Üb) Grashof
13:00 - 14:00		**2183703** Modellierung und Simulation (+Üb) HsKA, AM001, Amalienstr. 81-87			
14:00 - 15:30	**2121001** Technische Informations-systeme (+Ü) 09.23 IMI-Seminarraum 5. OG	**2154432** MM der Strömungslehre Redt.		**2142890** Physik für Ingenieure Criegee	**2161224** Maschinen-dynamik Grashof **2162235** Einf. in die Mehrkörper-dynamik Benz
15:45 - 17:15	**2162241** MM der Schwingungslehre Hertz				
17:30 - 19:00					

Stand: 10.03.2020

Vorlesung	Übung	Workshop

2147175 CAE-Workshop Block-LV Termin + Ort s. Instituts-Homepage	**2161230** Mathém. appl. aux sciences de l'ingénieur (+Üb) Termin + Ort s. Instituts-Homepage	**3122031** Virtual Engineering (Specific Topics) Block-LV Termin + Ort s. Instituts-Homepage

6 Field of study structure

Mandatory	
Orientation Exam	
Bachelor Thesis	15 CR
Fundamentals of Engineering	143 CR
Specialization in Mechanical Engineering	16 CR
Interdisciplinary Qualifications	6 CR

6.1 Orientation Exam

Mandatory		
M-MACH-104624	Orientation Exam	0 CR

6.2 Bachelor Thesis

Credits
15

Mandatory		
M-MACH-104494	Bachelor Thesis	15 CR

6.3 Fundamentals of Engineering

Credits
143

Mandatory		
M-MATH-102859	Advanced Mathematics	21 CR
M-MACH-102572	Engineering Mechanics	23 CR
M-MACH-102562	Materials Science	14 CR
M-MACH-102574	Technical Thermodynamics	15 CR
M-MACH-102565	Fluid Mechanics	8 CR
M-PHYS-104030	Physics	5 CR
M-ETIT-104801	Electrical Engineering *First usage possible from 3/8/2019.*	8 CR
M-MACH-102564	Measurement and Control Systems	7 CR
M-MACH-102563	Computer Science	6 CR
M-MACH-102573	Mechanical Design	20 CR
M-MACH-102566	Machines and Processes	7 CR
M-MACH-102549	Manufacturing Processes	4 CR
M-MACH-100297	Production Operations Management	5 CR

6.4 Specialization in Mechanical Engineering

Credits
16

Mandatory		
M-MACH-102746	Compulsory Elective Module	4 CR
Election block: Major Field (1 item)		
M-MACH-102812	Major Field: Powertrain Systems	12 CR
M-MACH-102638	Major Field: Rail System Technology	12 CR
M-MACH-102815	Major Field: Engineering Design	12 CR
M-MACH-102582	Major Field: Continuum Mechanics	12 CR
M-MACH-102816	Major Field: Fundamentals of Energy Technology	12 CR
M-MACH-102583	Major Field: Information Management	12 CR
M-MACH-102817	Major Field: Information Technology	12 CR
M-MACH-102818	Major Field: Vehicle Technology	12 CR
M-MACH-102838	Major Field: Energy Converting Engines	12 CR
M-MACH-102819	Major Field: Materials Science and Engineering	12 CR
M-MACH-102820	Major Field: Mechatronics	12 CR
M-MACH-104430	Major Field: Modeling and Simulation in Dynamics	12 CR
M-MACH-102644	Major Field: Production Engineering	12 CR
M-MACH-102589	Major Field: Production Systems	12 CR
M-MACH-104442	Major Field: Vibration Theory	12 CR
M-MACH-102645	Major Field: Combustion Engine Techniques	12 CR
M-MACH-102821	Major Field: Technical Logistics	12 CR

6.5 Interdisciplinary Qualifications

Credits
6

Mandatory		
M-MACH-102576	Key Competences	6 CR

7 Modules

M 7.1 Module: Advanced Mathematics [M-MATH-102859]

Responsible: Prof. Dr. Roland Griesmaier
Organisation: KIT Department of Mathematics
Part of: Fundamentals of Engineering

Credits	Language	Level	Version
21	German	3	1

Mandatory			
T-MATH-100525	Tutorial Advanced Mathematics I	0 CR	Arens, Griesmaier, Hettlich
T-MATH-100526	Tutorial Advanced Mathematics II	0 CR	Arens, Griesmaier, Hettlich
T-MATH-100527	Tutorial Advanced Mathematics III	0 CR	Arens, Griesmaier, Hettlich
T-MATH-100275	Advanced Mathematics I	7 CR	Arens, Griesmaier, Hettlich
T-MATH-100276	Advanced Mathematics II	7 CR	Arens, Griesmaier, Hettlich
T-MATH-100277	Advanced Mathematics III	7 CR	Arens, Griesmaier, Hettlich

Competence Certificate
Learning assessment is carried by three written examinations of length 120 minutes each and by three sets of homework assignments (pre-requesites). A "pass" result on a pre-requesites in Advanced Mathematics I, II and III, respectively, is a requirement for registration for the corresponding written examination.

Competence Goal
The students know the fundamentals of one-dimensional calculus. They can reliably use limits, functions, power series and integrals. They understand central concepts such as continuity, differentiability or integrability and they know important statements about these concepts. The students can follow the arguments leading to these statements as presented in the lectures and are able to independently prove simple assertions based on these statements.

The students know about the fundamentals of linear algebra. The are able to use vectors, linear maps and matrices without problems. They have basic knowledge about Fourier series. The students also can theoretically and practically deal with initial value problems of ordinary differential equations. They can make use of classical solution techniques for linear differential equations.

The students know about differential calculus for vector-valued functions of several variables and about techniques of vector calculus such as the definition and application of differential operators, the computation of domain, line and surface integrals and important integral theorems. They have basic knowledge about partial differential equations and know basic facts from stochastics.

Prerequisites
None.

Content
Fundamentals, sequences and convergence, functions and continuity, series, differential calculus of one real variable, integral calculus, vector spaces, linear maps, eigenvalues, Fourier series, differential equations, Laplace transform, multidimensional calculus, domain integrals, vector calculus, partial differential equations, stochastics

Workload
In class: 270 hours

- lectures, tutorials and examinations

Independent study: 360 hours

- independent review of course material
- work on homework assignments
- preparation for written exams

Learning type
Lecture, problem classes, tutorials

M 7.2 Module: Bachelor Thesis [M-MACH-104494]

Responsible: Prof. Dr.-Ing. Martin Heilmaier
Organisation: KIT Department of Mechanical Engineering
Part of: Bachelor Thesis

Credits	Recurrence	Language	Level	Version
15	Each term	German	3	1

Mandatory			
T-MACH-109188	Bachelor Thesis	12 CR	Heilmaier
T-MACH-109189	Presentation	3 CR	Heilmaier

Competence Certificate
The module Bachelor Thesis consists of a written bachelor thesis and an oral presentation of a scientific subject chosen by the student himself/herself or given by the supervisor. The bachelor thesis is designed to show that the student is able to deal with a problem of his/her subject area in an independent manner and within the given period of time using scientific methods.
The work load of the bachelor thesis corresponds to 12 ECTS. The maximal processing time of the bachelor thesis takes three months.
The date of issue of the subject has to be fixed by the supervisor and the student and to be put on record at the examination board. The subject of the bachelor thesis may be only returned once and only within the first month of processing time.
On a reasoned request of the student, the examination board can extend the processing time by up to one month. If the bachelor thesis is not completed in time, this examination is "failed" (5,0), unless the student is not responsible.
The bachelor thesis is to be evaluated by not less than a professor or a senior scientist according to § 14 Abs. 3 Ziff. 1 KITGor habilitated members of the KIT Faculty of Mechanical Engineering and another examiner. Generally, one of the two examiners is the person who has assigned the thesis. If the examiners do not agree, the bachelor thesis is graded by the examination board within this assessment; another expert can be appointed too. The bachelor thesis has to be graded within a period of six weeks after the submission.
The colloquium presentation must be held within 6 weeks after the submission of the bachelor thesis. The presentation should last around 20 minutes, corresponds to 3 ECTS, and is followed by a scientific discussion with the present expert audience.

Competence Goal
The student is able to work independently on a defined, subject-relevant theme based on scientific criteria within a given period of time. The student is able to do research, to analyze information, to abstract as well as collect and recognize basic principles and regularities on the basis of less structured information. He/she overviews a question, is able to choose scientific methods and techniques, and use them to solve the question or to identify other potentials. In general, this will be carried out in consideration of social and/or ethical aspects.

The student can interpret, evaluate, and if needed plot the results obtained. He/she is able to clearly structure a scientific work and (a) to communicate it in written form using technical terminology as well as (b) to present it in oral form and discuss it with experts.

Prerequisites
The requirement for admission to the bachelor thesis module are 120 ECTS. As to exceptions, the examination board decides on a request of the student (see § 14 (1) SPO).

Modeled Conditions
The following conditions have to be fulfilled:

1. You need to earn at least 120 credits in the following fields:
    - Fundamentals of Engineering
    - Interdisciplinary Qualifications
    - Specialization in Mechanical Engineering

Content
The student shall be allowed to make suggestions for the topic of his/her bachelor thesis. The topic is set by the supervisor of the thesis in accordance with § 14 (3) SPO.

Workload
The workload for the preparation and presentation of the bachelor thesis is about 450 hours.

M 7.3 Module: Compulsory Elective Module (BSc-Modul WPF) [M-MACH-102746]

Responsible: Prof. Dr.-Ing. Martin Heilmaier
Organisation: KIT Department of Mechanical Engineering

Part of: Specialization in Mechanical Engineering (mandatory)

Credits	Recurrence	Language	Level	Version
4	Each term	German	3	3

Election block: Compulsory Elective Module (1 item)			
T-MACH-105381	Virtual Engineering (Specific Topics)	4 CR	Ovtcharova
T-MACH-105212	CAE-Workshop	4 CR	Albers, Matthiesen
T-MACH-100535	Introduction into Mechatronics	6 CR	Böhland, Lorch, Reischl
T-MACH-105209	Introduction into the Multi-Body Dynamics	5 CR	Seemann
T-MACH-102093	Fluid Power Systems	4 CR	Geimer, Pult
T-MACH-109919	Basics of Technical Logistics I	4 CR	Mittwollen, Oellerich
T-MACH-105213	Fundamentals of Combustion I	4 CR	Maas, Sommerer
T-MACH-110377	Advanced Methods in Strength of Materials	4 CR	Böhlke, Frohnapfel
T-MACH-105210	Machine Dynamics	5 CR	Proppe
T-MACH-105452	Mathématiques appliquées aux sciences de l'ingénieur	5 CR	Dantan
T-MACH-105293	Mathematical Methods in Dynamics	6 CR	Proppe
T-MACH-110375	Mathematical Methods in Continuum Mechanics	4 CR	Böhlke
T-MACH-105294	Mathematical Methods of Vibration Theory	6 CR	Seemann
T-MACH-105295	Mathematical Methods in Fluid Mechanics	6 CR	Frohnapfel
T-MACH-105303	Modelling of Microstructures	5 CR	August, Nestler
T-MACH-100300	Modelling and Simulation	5 CR	Gumbsch, Nestler
T-MACH-100530	Physics for Engineers	5 CR	Dienwiebel, Gumbsch, Nesterov-Müller, Weygand
T-MACH-102102	Physical Basics of Laser Technology	5 CR	Schneider
T-MACH-105147	Product Lifecycle Management	4 CR	Ovtcharova
T-MACH-105970	Structural Analysis of Composite Laminates	4 CR	Kärger
T-MACH-100531	Systematic Materials Selection	4 CR	Dietrich, Schulze
T-MACH-105652	Fundamentals of Combustion Engine Technology	5 CR	Bernhardt, Kubach, Pfeil, Toedter, Wagner
T-MACH-102083	Integrated Information Systems for Engineers	4 CR	Ovtcharova
T-MACH-105290	Vibration Theory	5 CR	Fidlin, Seemann
T-MACH-105292	Heat and Mass Transfer	4 CR	Bockhorn, Maas
T-MACH-100532	Scientific Computing for Engineers	4 CR	Gumbsch, Weygand
Election block: Compulsary Elective Module (Tutorial) ()			
T-MACH-110333	Tutorial Continuum Mechanics of Solids and Fluids	1 CR	Böhlke, Frohnapfel
T-MACH-110376	Tutorial Mathematical Methods in Continuum Mechanics	2 CR	Böhlke

Competence Certificate
oral/written exam

Competence Goal
The elective course serves as a comprehensive, in-depth analysis of fundamentals in selected areas of mechanical engineering. The specific learning outcomes are defined by the respective coordinator of the course.

Prerequisites
None

Annotation
Compulsory elective subjects have to be chosen from the corresponding catalogues as displayed in the bachelor´s program with an amount of 4 credit points (see Studienplan or Module Handbook)

Workload
The work load is about 120 hours, corresponding to 4 credit points.The work load varies from lecture to lecture, for example a lecture consisting of 4 credit points includes 28 h of presence during the lecture and 92 h preparation and rework time at home, 120 hours in total.

Learning type
Lectures, Tutorials

M 7.4 Module: Computer Science (BSc-Modul 09, Inf) [M-MACH-102563]

Responsible: Prof. Dr.-Ing. Jivka Ovtcharova
Organisation: KIT Department of Mechanical Engineering

Part of: Fundamentals of Engineering

Credits	Recurrence	Duration	Language	Level	Version
6	Each summer term	2 term	German/English	3	2

Mandatory			
T-MACH-105205	Computer Science for Engineers	6 CR	Ovtcharova
T-MACH-105206	Computer Science for Engineers, Prerequisite	0 CR	Ovtcharova

Competence Certificate
Written examination "Computer Science for Engineers", 100%, 180 minutes; Examination prerequisite: passed lap course.

Competence Goal
Students can identify and explain fundamental terms, problems and concepts of computer science. They can apply the basic methods of the OO modeling with UML and implement the object-oriented programming (OOP) with the programming language JAVA.

Module grade calculation
Examination result "Computer Science for Engineers" 100%

Prerequisites
None

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.

Annotation
For the Bachelor's program Mechanical Engineering the module (including all brick details, exams and courses) is offered in German.

For the Bachelor's program Mechanical Engineering (International) the module (including all brick details, exams and courses) is offered in English.

Workload
Attendance time: 63 hours

Self-study: 117 hours

Learning type
Lecture and Lab Course

M 7.5 Module: Electrical Engineering [M-ETIT-104801]

Responsible: Dr.-Ing. Klaus-Peter Becker
Organisation: KIT Department of Electrical Engineering and Information Technology
Part of: Fundamentals of Engineering (Usage from 3/8/2019)

Credits	Recurrence	Language	Level	Version
8	Each winter term	German	3	1

Mandatory			
T-ETIT-109820	Electrical Engineering and Electronics	8 CR	Becker

M 7.6 Module: Engineering Mechanics (BSc-Modul 03, TM) [M-MACH-102572]

Responsible: Prof. Dr.-Ing. Thomas Böhlke
Prof. Dr.-Ing. Wolfgang Seemann

Organisation: KIT Department of Mechanical Engineering

Part of: Fundamentals of Engineering

Credits	Recurrence	Duration	Language	Level	Version
23	Each winter term	4 term	German/English	3	1

Mandatory			
T-MACH-100282	Engineering Mechanics I	7 CR	Böhlke, Langhoff
T-MACH-100283	Engineering Mechanics II	6 CR	Böhlke, Langhoff
T-MACH-105201	Engineering Mechanics III & IV	10 CR	Seemann
T-MACH-100528	Tutorial Engineering Mechanics I	0 CR	Böhlke, Langhoff
T-MACH-100284	Tutorial Engineering Mechanics II	0 CR	Böhlke, Langhoff
T-MACH-105202	Tutorial Engineering Mechanics III	0 CR	Seemann
T-MACH-105203	Tutorial Engineering Mechanics IV	0 CR	Seemann

Competence Certificate
prerequisites EM I, II (see T-MACH-100528 "Engineering Mechanics I (Tutorial)" as well as T-MACH-100284 "Engineering Mechanics II (Tutorial)"): they consist of solving problems of the work sheets in four categories: written mandatory homework, written homework, computational homework, colloquia.

prerequisites EM III, IV

"Engineering Mechanics I", written exam, 90 minutes; graded:
"Engineering Mechanics II", written exam, 90 minutes; graded;
"Engineering Mechanics III/IV", written exam, 180 Minutes; graded;

The final grade of this module is computed as ECTS-based weighted sum of the included exams.

Competence Goal
After having finished the lectures EM I and EM II the students can

- assess stress and strain distributions for the basic load cases within the framework of elasticity and thermoelasticity
- compute and evaluate 3D stress and strain states
- apply the principle of virtual displacements
- apply energy methods and evaluate approximate solutions
- evaluate the stability of equilibrium positions
- solve worksheet problems to topics of the lecture using the computer algebra system MAPLE

In EM III and EM IV 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.

Prerequisites
None

Content
This Module consists of the courses "Engineering Mechanics I (lecture)" up to "Engineering Mechanics IV (lecture)" as well as "Engineering Mechanics I (Tutorial)" up to "Engineering Mechanics IV (Tutorial)"

Contents of "Engineering Mechanics I": 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

Contents of "Engineering Mechanics II": bending; shear; torsion; stress and strain state in 3D; Hooke's law in 3D; elasticity theors in 3D; energy methods in elastostatics; approximation methods; stability

Contents of "Engineering Mechanics III":

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.

Contents of "Engineering Mechanics IV":

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

Annotation
For the Bachelor’s program Mechanical Engineering the module (including all brick details, exams and courses) is offered in German.

For the Bachelor’s program Mechanical Engineering (International) the module (including all brick details, exams and courses) is offered in English.

Workload
lectures and exercises: 204h

homework and preparation of examination: 486h

Learning type
Lectures, Tutorials, Lab course groups, attestation of solved work sheets, colloquiua, consultation hours (optional)

M 7.7 Module: Fluid Mechanics (BSc-Modul 12, SL) [M-MACH-102565]

Responsible: Prof. Dr.-Ing. Bettina Frohnapfel
Organisation: KIT Department of Mechanical Engineering

Part of: Fundamentals of Engineering

Credits	Recurrence	Duration	Language	Level	Version
8	Each summer term	2 term	German/English	3	1

Mandatory			
T-MACH-105207	Fluid Mechanics 1&2	8 CR	Frohnapfel

Competence Certificate
Common examination of "Fluid Mechanics I" and "Fluid Mechanics II"; written exam, 3 hours (graded)

Competence Goal
After having completed this module the student is capable of deriving the mathematical equations that describe the motion of fluids and can determine flow quantities for generic problems. He/she can name characteristic properties of fluids and distinguish different flow states. The student is capable of determining fluid quantities in fundamental applications. This includes the calculation of

- static and dynamic forces acting from the fluid onto the solid
- two-dimensional viscous flows
- one-dimensional incompressible and compressible flows without losses
- lossy flows through pipes

Module grade calculation
result of exam

Prerequisites
none

Content
properties of fluids, surface tension, hydro- and aerostatics, kinematics, stream tube theory (compressible and incompressible), losses in pipeline systems, dimensional analysis, dimensionless numbers

tensor notation, fluid elements in continuum, Reynolds transport theorem, conservation of mass and momentum, continuity equation, constitutive law for Newtonian fluids, Navier-Stokes equations, angular momentum and energy conservation, integral form of the conservation equations, forces between fluids and solids, analytical solutions of the Navier-Stokes equations

Annotation
For the Bachelor's program Mechanical Engineering the module (including all brick details, exams and courses) is offered in German.

For the Bachelor's program Mechanical Engineering (International) the module (including all brick details, exams and courses) is offered in English.

Workload
regular attendance: 64 hoursself-study: 176 hours

Learning type
Lectures + tutorials

Literature
Zirep J., Bühler, K.: Grundzüge der Strömungslehre, Grundlagen, Statik und Dynamik der Fluide, Springer Vieweg

Kuhlmann, H.: Strömungsmechanik, Pearson Studium

Spurk, J.H.: Strömungslehre, Einführung in die Theorieder Strömungen, Springer-Verlag

Kundu, P.K., Cohen, K.M.: Fluid Mechanics, Elsevier 2008

7.8 Module: Key Competences (BSc-Modul 07, SQL) [M-MACH-102576]

Responsible: Prof. Dr.-Ing. Barbara Deml
Prof. Dr.-Ing. Martin Heilmaier

Organisation: KIT Department of Mechanical Engineering

Part of: Interdisciplinary Qualifications

Credits	Recurrence	Duration	Level	Version
6	Each term	2 term	3	1

Mandatory			
T-MACH-105296	Working Methods in Mechanical Engineering	4 CR	Deml
Election block: Key Competences (at least 2 credits)			
T-MACH-106375	Value Stream within Enterprises – The Value Chain at Bosch	2 CR	Maier

Competence Certificate
Success is monitored within the framework of academic achievements.

Amount, type and scope of the success control can vary according to the individually choice.

Competence Goal
After completing the module Key Competences students can

- determine and coordinate work steps, projects and goals, proceed systematically and purposefully, set priorities as well as assess the feasibility of a task,
- apply methods for the planning of a specific task under given framework conditions in a goal- and resource-oriented way,
- describe methods for scientific research and selection of technical information according to pre-established quality criteria and apply them to given problems,
- discuss empirical methods and apply them to selected examples,
- present technical information in a clear, readable, and convincingly argued manner in various forms of presentation (e.g. poster, exposé, abstract) in writing and appropriately visualize it graphically (e.g. engineering drawings, flowcharts),
- present and stand up for technical content in a convincing and appealing way,
- work as a team in a task-oriented manner, handle any conflicts on their own and take responsibility for themselves and others,
- communicate as a team in an objective, goal-oriented and interpersonal manner, represent their own interests, reflect and take into account the interests of others in their own words, and successfully organize the course of the conversation.

Module grade calculation
non graded

Prerequisites
none

Content
The module Key Competences consists "Working Methods in Mechanical Engineering" and a freely selectable courses offered by the KIT-House of Competence (HoC), the KIT Language Centre (SPZ) and the Centre for Cultural and General Studies (ZAK) with a work load corresponding to a total of 2 ECTS. Upon request, the examination board may approve further courses as freely selectable subjects in the module "Key Competences".

Annotation
Only HoC/SPZ/ZAK courses can be chosen.

Workload
The work load is about 180 hours, corresponding to 6 credit points in the Bachelor of Science program.

Learning type
The teaching and learning methods depend on the respectively chosen courses. The courses can be lectures, seminars, tutorials, or lab courses.

M 7.9 Module: Machines and Processes (mach13BSc-Modul 13, MuP) [M-MACH-102566]

Responsible: Dr.-Ing. Heiko Kubach
Organisation: KIT Department of Mechanical Engineering

Part of: Fundamentals of Engineering

Credits	Recurrence	Duration	Language	Level	Version
7	Each winter term	1 term	German/English	3	2

Mandatory			
T-MACH-105208	Machines and Processes	7 CR	Bauer, Kubach, Maas, Pritz
T-MACH-105232	Machines and Processes, Prerequisite	0 CR	Bauer, Kubach, Maas, Pritz

Competence Certificate
written exam (2 h)

Competence Goal
The students can name and describe basic energy conversion processes and energy converting machines. They can explain the application of these energy conversion processes in various machines. They can analyze and evaluate the processes and machines in terms of functionality and efficiency and they are able to solve basic technical problems in terms of operating the machines.

Module grade calculation
Grade out of written exam (100%)

Prerequisites
None.

Content

- Internal combsution engines
- Hydraulic fluid machinery
- Thermal turbo machines
- Thermodynamics

Annotation
For the Bachelor's program Mechanical Engineering the module (including all brick details, exams and courses) is offered in German.

For the Bachelor's program Mechanical Engineering (International) the module (including all brick details, exams and courses) is offered in English.

Workload
regular attendance: 48 h

self-study: 162 h

Learning type
Lecture+Tutorial

Lab Course

M 7.10 Module: Major Field: Combustion Engine Techniques (SP 57) [M-MACH-102645]

Responsible: Prof. Dr. Thomas Koch
Organisation: KIT Department of Mechanical Engineering

Part of: Specialization in Mechanical Engineering (Major Field)

Credits	Recurrence	Language	Level	Version
12	Each term	German	3	3

Mandatory			
T-MACH-105652	Fundamentals of Combustion Engine Technology	5 CR	Bernhardt, Kubach, Pfeil, Toedter, Wagner
Election block: Combustion Engine Techniques (K) (at least 3 credits)			
T-MACH-105173	Analysis of Exhaust Gas and Lubricating Oil in Combustion Engines	4 CR	Gohl
T-MACH-105184	Fuels and Lubricants for Combustion Engines	4 CR	Kehrwald, Kubach
T-MACH-105169	Engine Measurement Techniques	4 CR	Bernhardt
Election block: Combustion Engine Techniques (E) ()			
T-MACH-110817	Development of hybrid drivetrains	4 CR	Koch
T-MACH-110816	Großdiesel- und -gasmotoren für Schiffsantriebe	4 CR	Kubach
T-MACH-105044	Fundamentals of Catalytic Exhaust Gas Aftertreatment	4 CR	Deutschmann, Grunwaldt, Kubach, Lox
T-MACH-105985	Ignition Systems	4 CR	Toedter
Election block: Combustion Engine Techniques (P) (at most 4 credits)			
T-MACH-105337	Engine Laboratory	4 CR	Wagner

Competence Certificate
oral exam, written exam, lab course reports (see description of bricks)

Competence Goal
After completition of this „Schwerpunkt“ students are able to

- Describe and explain the working principal of different engine types
- Name the challenges in engine development
- Describe the correlations between engine operation, application parameters and emissions

Prerequisites
None

Content
The focus of this “Schwerpunkt” are the basic design and the working principle of internal combustion engines. Different types of engines such as gasoline engine, diesel engine and gas engine are subject. The fundamental thermodynamic aspects as well as the mechanical aspects are discussed. The influence of application parameters and the correlation of engine concepts, fuels and emissions are addressed.

Workload
The work load is 360 hours, corresponding to 12 credit points.

Learning type
Lectures, Exercises, Lab Courses

M 7.11 Module: Major Field: Continuum Mechanics (SP 13) [M-MACH-102582]

Responsible: Prof. Dr.-Ing. Thomas Böhlke
Organisation: KIT Department of Mechanical Engineering

Part of: Specialization in Mechanical Engineering (Major Field)

Credits	Recurrence	Language	Level	Version
12	Each term	German	3	4

Mandatory			
T-MACH-110835	Advanced Methods in Strength of Materials	4 CR	Böhlke, Frohnapfel
T-MACH-110836	Mathematical Methods in Continuum Mechanics	4 CR	Böhlke
Election block: Continuum Mechanics (E) ()			
T-MACH-110362	Introduction to Computational Fluid Dynamics	4 CR	Frohnapfel, Stroh
T-MACH-110837	Introduction to the Finite Element Method	4 CR	Böhlke, Langhoff

Competence Certificate
see different bricks

Competence Goal
After having finished this major field the students can

- list important concepts and models of continuum mechanics both for solids and fluids including field equations and boundary conditions
- apply these models in given problems
- apply methods of tensor algebra and tensor analysis in given problems of continuum mechanics
- classify the basic numerical tools and apply them in given problems of continuum mechanics

Prerequisites
none

Content
The comprehensive topic of the major field are the basics of continuum mechanics that the students acquire within the compulsory parts (8 credit points). Moreover, there is a supplementary area covering the corresponding numerical methods which the students can choose according to their interests.

Recommendation
Students of Mechanical Engineering (Bachelor) having chosen the Major Field "Continuum Mechanics" are recommended to chose one of the following courses as Compulsory Elective Course: "Scientific Computing for Engineers" (Prof. Gumbsch, Dr. Weygand, winter term)

Annotation
Due to capacity reasons, it can not be guaranteed that all students can take part in the corresponding computer tutorials of these courses.

All students having chosen the Major Field "Continuum Mechanics" (No 13) will be allowed to take part in the computer tutorials.

Workload
The work load is about 360 hours in the Bachelor of Science program, whereof the presence time is 125 h.

Learning type
lectures, tutorials, computer tutorial, consultation hours

Literature
see different bricks

M 7.12 Module: Major Field: Energy Converting Engines [M-MACH-102838]

Responsible: Prof. Dr. Thomas Koch
Organisation: KIT Department of Mechanical Engineering

Part of: Specialization in Mechanical Engineering (Major Field)

Credits	Recurrence	Language	Level	Version
12	Each term	German	3	2

Election block: Energy Converting Engines (K) (at least 8 credits)			
T-MACH-105326	Hydraulic Fluid Machinery	8 CR	Pritz
T-MACH-105363	Thermal Turbomachines I	6 CR	Bauer
T-MACH-102194	Combustion Engines I	4 CR	Koch, Kubach
Election block: Energy Converting Engines (E) ()			
T-CIWVT-105780	Design of a Jet Engine Combustion Chamber	6 CR	Zarzalis
T-MACH-105184	Fuels and Lubricants for Combustion Engines	4 CR	Kehrwald, Kubach
T-MACH-102093	Fluid Power Systems	4 CR	Geimer, Pult
T-MACH-105533	Gasdynamics	4 CR	Magagnato
T-MACH-105044	Fundamentals of Catalytic Exhaust Gas Aftertreatment	4 CR	Deutschmann, Grunwaldt, Kubach, Lox
T-MACH-105213	Fundamentals of Combustion I	4 CR	Maas, Sommerer
T-MACH-105325	Fundamentals of Combustion II	4 CR	Maas
T-MACH-105338	Numerical Fluid Mechanics	4 CR	Magagnato
T-MACH-105441	Development of Oil-Hydraulic Powertrain Systems	4 CR	Ays, Geerling
T-MACH-107447	Reliability Engineering 1	3 CR	Konnov
T-MACH-105364	Thermal Turbomachines II	6 CR	Bauer
T-MACH-105366	Turbo Jet Engines	4 CR	Bauer
T-MACH-105234	Windpower	4 CR	Lewald
Election block: Energy Converting Engines (P) (at most 4 credits)			
T-MACH-105515	Introduction to Numerical Fluid Dynamics	4 CR	Pritz

Competence Certificate
refer to different brick descriptions of SP24

Competence Goal
The students acquire broad and well-founded knowledge of the scientific theories, principles and methods of engines and work machines in the mandatory part of this major field. The aim is to design, apply and evaluate these machines.

Building on this, the students deepen selected fields of application in the election block, so that they are then able to independently analyze and evaluate problems from this field of application and to develop solutions based on this. After completing the specialization, students can in particular

- name the function and use of engines and working machines,
- describe the state of the art and the resulting fields of application of the engines and work machines and apply them using the example,
- Name the basic theories, methods and properties for the various fields of application of the engines and work machines and use and evaluate them.

Prerequisites
None

Content
Energy-converting machines are a core topic in mechanical engineering. This major field deals with the design and functioning of various energy-converting machines. Essentially, this involves hydraulic flow machines, thermal turbo machinery and internal combustion engines. In the election block, additional basics, sub-points and detailed questions of the above machines are treated. The spectrum ranges from basic numerical simulation of the processes to application-oriented project planning and system development.

Recommendation
Recommended compulsory optional subject: Heat and mass transfer

Workload
The work load is 360 hours, corresponding to 12 credit points.

Learning type
Lectures and Exercises

M 7.13 Module: Major Field: Engineering Design (SP 10) [M-MACH-102815]

Responsible: Prof. Dr.-Ing. Albert Albers
Prof. Dr.-Ing. Sven Matthiesen

Organisation: KIT Department of Mechanical Engineering

Part of: Specialization in Mechanical Engineering (Major Field)

Credits	Recurrence	Language	Level	Version
12	Each term	German/English	3	4

Election block: Engineering Design (K) (at least 8 credits)			
T-MACH-105233	Powertrain Systems Technology A: Automotive Systems	4 CR	Albers, Matthiesen, Ott
T-MACH-105216	Powertrain Systems Technology B: Stationary Machinery	4 CR	Albers, Matthiesen, Ott
T-MACH-105221	Lightweight Engineering Design	4 CR	Albers, Burkardt
Election block: Engineering Design (E) ()			
T-MACH-105215	Applied Tribology in Industrial Product Development	4 CR	Albers, Lorentz, Matthiesen
T-MACH-105311	Design and Development of Mobile Machines	4 CR	Geimer, Siebert
T-MACH-105212	CAE-Workshop	4 CR	Albers, Matthiesen
T-MACH-108374	Vehicle Ergonomics	4 CR	Heine
T-MACH-102105	Manufacturing Technology	8 CR	Schulze, Zanger
T-MACH-100092	Automotive Engineering I	8 CR	Gauterin, Unrau
T-MACH-102116	Fundamentals for Design of Motor-Vehicle Bodies I	2 CR	Bardehle
T-MACH-102119	Fundamentals for Design of Motor-Vehicle Bodies II	2 CR	Bardehle
T-MACH-105160	Fundamentals in the Development of Commercial Vehicles I	2 CR	Zürn
T-MACH-105161	Fundamentals in the Development of Commercial Vehicles II	2 CR	Zürn
T-MACH-105162	Fundamentals of Automobile Development I	2 CR	Frech
T-MACH-105163	Fundamentals of Automobile Development II	2 CR	Frech
T-MACH-105188	Integrative Strategies in Production and Development of High Performance Cars	4 CR	Schlichtenmayer
T-MACH-105330	Design with Plastics	4 CR	Liedel
T-MACH-105231	Leadership and Management Development	4 CR	Albers, Matthiesen, Ploch
T-MACH-105440	Leadership and Conflict Management	4 CR	Hatzl
T-MACH-105441	Development of Oil-Hydraulic Powertrain Systems	4 CR	Ays, Geerling
T-MACH-105347	Project Management in Global Product Engineering Structures	4 CR	Albers, Gutzmer, Matthiesen
T-MACH-102107	Quality Management	4 CR	Lanza
T-MACH-105171	Safety Engineering	4 CR	Kany
T-MACH-105696	Strategic Product Development - Identification of Potentials of Innovative Products	3 CR	Albers, Matthiesen, Siebe
T-MACH-110396	Strategic Product Development - Identification of Potentials of Innovative Products - Case Study	1 CR	Albers, Matthiesen, Siebe
T-MACH-105358	Sustainable Product Engineering	4 CR	Albers, Matthiesen, Ziegahn
T-MACH-105361	Technical Design in Product Development	4 CR	Albers, Matthiesen, Schmid
T-MACH-109055	Machine Tools and Industrial Handling	8 CR	Fleischer
Election block: Engineering Design (P) (at most 4 credits)			
T-MACH-105370	Laboratory Mechatronics	4 CR	Lorch, Seemann, Stiller
Election block: Engineering Design (Ü) ()			

T-MACH-108887	Design and Development of Mobile Machines - Advance	0 CR	Geimer, Siebert

Competence Goal
The students are able to transfer their knowledge und abilities in product engineering to mechanical systems in research and industrial practice.

Prerequisites
None

Content
see courses of the SP10

Workload
The work load is about 360 hours, corresponding to 12 credit points.

Learning type
lectures
auditorium exercises
workshops

M 7.14 Module: Major Field: Fundamentals of Energy Technology [M-MACH-102816]

Responsible: Prof. Dr.-Ing. Hans-Jörg Bauer
Organisation: KIT Department of Mechanical Engineering

Part of: Specialization in Mechanical Engineering (Major Field)

Credits	Recurrence	Language	Level	Version
12	Each term	German/English	3	2

Mandatory			
T-MACH-105220	Fundamentals of Energy Technology	8 CR	Badea, Cheng
Election block: Fundamentals of Energy Technology (K) ()			
T-MACH-105525	Introduction to Nuclear Energy	4 CR	Cheng
T-MACH-105325	Fundamentals of Combustion II	4 CR	Maas
T-MACH-105326	Hydraulic Fluid Machinery	8 CR	Pritz
Election block: Fundamentals of Energy Technology (E) ()			
T-MACH-105462	Selected Problems of Applied Reactor Physics and Exercises	4 CR	Dagan
T-MACH-105151	Energy Efficient Intralogistic Systems	4 CR	Braun, Schönung
T-MACH-105952	Energy Storage and Network Integration	4 CR	Jäger, Stieglitz
T-MACH-105408	Energy Systems I: Renewable Energy	4 CR	Dagan
T-MACH-105533	Gasdynamics	4 CR	Magagnato
T-MACH-105557	Microenergy Technologies	4 CR	Kohl
T-ETIT-101939	Photovoltaics	6 CR	Powalla
T-MACH-105537	Physical and Chemical Principles of Nuclear Energy in View of Reactor Accidents and Back-End of Nuclear Fuel Cycle	4 CR	Dagan
T-MACH-106493	Solar Thermal Energy Systems	4 CR	Dagan
T-MACH-105403	Flows and Heat Transfer in Energy Technology	4 CR	Cheng
T-MACH-105225	Thermal Solar Energy	4 CR	Stieglitz
T-MACH-105234	Windpower	4 CR	Lewald
T-MACH-105338	Numerical Fluid Mechanics	4 CR	Magagnato
Election block: Fundamentals of Energy Technology (P) (at most 4 credits)			
T-MACH-105331	Laboratory Exercise in Energy Technology	4 CR	Bauer, Maas, Wirbser
T-MACH-106707	Workshop on Computer-based Flow Measurement Techniques	4 CR	Bauer

Competence Certificate
Oral exam

Competence Goal
After completion of SP 15 students are able:

- to describe the elements of an energy system and their complex interactions,
- to list different conventional energy sources and assess their static range,
- to name the fluctuating supply of renewable energies such as wind, solar radiation, ocean currents and tides etc. and describe its effects on the energy system,
- to assess the effects of external and internal economic, ecological and technical boundary conditions of energy systems and to derive approaches for an optimal mix of different energy technologies,
- to explain the operational principle of well-established power plants as well as of power plants based on renewable energies.

Prerequisites
None

Content

Fundamentals of energy technology offers sound knowledge on the subject of energy conversion, storage and transport as well as the necessary thermodynamic principles. The topics covered include conventional, fossil-fired power plants, combined heat and power generation, nuclear energy, renewable energy sources such as solar energy, wind power and hydropower, as well as energy storage and grid integration. The election block offers opportunities for in-depth study of the listed energy conversion types as well as practical modules in which the fundamentals can be applied in practice. Furthermore, there is the possibility to extend the knowledge of the fundamentals and to get an insight into numerical methods of flow simulation. Progress and challenges of energy system transformation and the latest findings from energy research are also discussed.

Workload

360 hours

Learning type

Lectures, Tutorials

M 7.15 Module: Major Field: Information Management (SP 17) [M-MACH-102583]

Responsible: Prof. Dr.-Ing. Jivka Ovtcharova
Organisation: KIT Department of Mechanical Engineering

Part of: Specialization in Mechanical Engineering (Major Field)

Credits	Recurrence	Language	Level	Version
12	Each term	German	3	2

Election block: Information Management (K) (at least 8 credits)			
T-MACH-106457	I4.0 Systems Platform	4 CR	Maier, Ovtcharova
T-MACH-105147	Product Lifecycle Management	4 CR	Ovtcharova
T-MACH-102083	Integrated Information Systems for Engineers	4 CR	Ovtcharova
Election block: Information Management (E) ()			
T-MACH-106744	Agile Product Innovation Management - Value-driven Planning of New Products	4 CR	Kläger
T-MACH-105212	CAE-Workshop	4 CR	Albers, Matthiesen
T-MACH-102209	Information Engineering	3 CR	Ovtcharova
T-MACH-102128	Information Systems and Supply Chain Management	3 CR	Kilger
T-MACH-105187	IT-Fundamentals of Logistics	3 CR	Thomas
T-MACH-105442	Intellectual Property Rights and Strategies in Industrial Companies	4 CR	Albers, Matthiesen, Zacharias
T-MACH-102181	PLM for Product Development in Mechatronics	4 CR	Eigner
T-MACH-102155	Product, Process and Resource Integration in the Automotive Industry	4 CR	Mbang
T-MACH-105347	Project Management in Global Product Engineering Structures	4 CR	Albers, Gutzmer, Matthiesen
T-MACH-105358	Sustainable Product Engineering	4 CR	Albers, Matthiesen, Ziegahn
Election block: Information Management (P) (at most 4 credits)			
T-MACH-102185	CATIA CAD Training Course	2 CR	Ovtcharova
T-MACH-102187	CAD-NX Training Course	2 CR	Ovtcharova
T-MACH-102153	PLM-CAD Workshop	4 CR	Ovtcharova
T-MACH-102149	Virtual Reality Practical Course	4 CR	Ovtcharova

Competence Certificate
Examination of other kind and oral and/or written examination: duration 2 hours.

Competence Goal
The students should:

Understand the relevance of information management in product development in consideration of increasing product and process complexity.

Gain basic knowledge in handling information, which is generated by product development activities along the lifecycle.

Prerequisites
None

Content
Generation and management of information

Architecture and functionality of information systems

CAX-systems, Industry 4.0

Workload
360 hours

M 7.16 Module: Major Field: Information Technology [M-MACH-102817]

Responsible: Prof. Dr.-Ing. Christoph Stiller
Organisation: KIT Department of Mechanical Engineering

Part of: Specialization in Mechanical Engineering (Major Field)

Credits	Recurrence	Language	Level	Version
12	Each term	German/English	3	2

Election block: Information Technology (K) (at least 8 credits)			
T-MACH-105314	Computational Intelligence	4 CR	Jakob, Mikut, Reischl
T-MACH-105694	Data Analytics for Engineers	5 CR	Ludwig, Mikut, Reischl
T-MACH-105317	Digital Control	4 CR	Knoop
T-MACH-105223	Machine Vision	8 CR	Lauer, Stiller
T-MACH-105335	Measurement II	4 CR	Stiller
T-MACH-105360	Computer Engineering	6 CR	Keller, Lorch
Election block: Information Technology (E) ()			
T-MACH-105218	Automotive Vision	6 CR	Lauer, Stiller
T-MACH-102150	BUS-Controls	4 CR	Becker, Geimer
T-MACH-102128	Information Systems and Supply Chain Management	3 CR	Kilger
T-MACH-105187	IT-Fundamentals of Logistics	3 CR	Thomas
T-MACH-105169	Engine Measurement Techniques	4 CR	Bernhardt
T-MACH-107447	Reliability Engineering 1	3 CR	Konnov
T-MACH-105185	Control Technology	4 CR	Gönnheimer
T-MACH-105367	Behaviour Generation for Vehicles	4 CR	Stiller, Werling
T-INFO-101466	Information Processing in Sensor Networks	6 CR	Hanebeck
Election block: Information Technology (P) (at most 4 credits)			
T-MACH-105370	Laboratory Mechatronics	4 CR	Lorch, Seemann, Stiller
T-MACH-105341	Lab Computer-Aided Methods for Measurement and Control	4 CR	Stiller
T-MACH-108889	BUS-Controls - Advance	0 CR	Daiß, Geimer

Competence Certificate
Oral exams: duration approx 5 min. per credit point.

However, amount, type and scope of the success control can vary according to the individually choice.

Competence Goal
Students are able to

- explain fundamentals of information technology for given problems in mechanical engineering an mechatronics.
- explain major methods for acquisition, processing and exploitation of information in technical systems.
- outline and to explain alternative methods to determine and to represent measurement uncertainties and their propagation in technical systems.
- explain information filters and fusion methods and understand their application to given problems.

Prerequisites
none

Content

- Techniques of information and data processing in mechanical engeneering
- Techniques of sensor data processing
- Concepts of controll theory
- Electronic devices for data processing

Workload
The work load is about 360 hours, corresponding to 12 credit points.

Learning type
lecture, practical training, exercise, prakticat training in laboratory

7.17 Module: Major Field: Materials Science and Engineering (SP 26) [M-MACH-102819]

Responsible: Prof. Dr.-Ing. Martin Heilmaier
Organisation: KIT Department of Mechanical Engineering

Part of: Specialization in Mechanical Engineering (Major Field)

Credits	Recurrence	Language	Level	Version
12	Each term	German/English	3	4

Election notes
In the core area of Major Field at least 8 ECTS have to be chosen.

Mandatory			
T-MACH-105301	Materials Science and Engineering III	8 CR	Heilmaier
Election block: Materials Science and Engineering (E) ()			
T-MACH-105308	Atomistic Simulations and Molecular Dynamics	4 CR	Brandl, Gumbsch, Schneider
T-MACH-102141	Constitution and Properties of Wearresistant Materials	4 CR	Ulrich
T-MACH-105157	Foundry Technology	4 CR	Wilhelm
T-MACH-102111	Principles of Ceramic and Powder Metallurgy Processing	4 CR	Schell
T-MACH-100287	Introduction to Ceramics	6 CR	Hoffmann
T-MACH-105330	Design with Plastics	4 CR	Liedel
T-MACH-105164	Laser in Automotive Engineering	4 CR	Schneider
T-MACH-105333	Mechanics and Strength of Polymers	4 CR	von Bernstorff
T-MACH-105303	Modelling of Microstructures	5 CR	August, Nestler
T-MACH-102137	Polymer Engineering I	4 CR	Elsner, Liebig
T-MACH-105724	Failure Analysis	4 CR	Greiner, Schneider
T-MACH-105170	Welding Technology	4 CR	Farajian
T-MACH-105354	Fatigue of Metallic Materials	4 CR	Guth, Lang
T-MACH-105970	Structural Analysis of Composite Laminates	4 CR	Kärger
T-MACH-105362	Technology of Steel Components	4 CR	Schulze
T-MACH-102139	Failure of Structural Materials: Fatigue and Creep	4 CR	Gruber, Gumbsch
T-MACH-102140	Failure of Structural Materials: Deformation and Fracture	4 CR	Gumbsch, Weygand
T-MACH-107684	Materials Characterization	4 CR	Gibmeier
T-MACH-105211	Materials of Lightweight Construction	4 CR	Elsner, Liebig
Election block: Materials Science and Engineering (P) (at most 4 credits)			
T-MACH-105651	Biomechanics: Design in Nature and Inspired by Nature	4 CR	Mattheck
T-MACH-105447	Metallographic Lab Class	4 CR	Hauf
T-MACH-102154	Laboratory Laser Materials Processing	4 CR	Schneider
Election block: Materials Science and Engineering (Ü) ()			
T-MACH-107685	Exercises for Materials Characterization	2 CR	Gibmeier

Competence Certificate
Oral exams: duration approx. 5 min. per credit point.

However, amount, type and scope of the success control can vary according to the individual choice.

Competence Goal
As part of a major field a specific subdomain of mechanical engineering is made accessible in breadth and depth. Students gain comprehensive knowledge in the core subjects and detailed knowledge in the supplementary subjects of the selected subdomain. They are able to generate new (scientific) solutions within this subdomain.

The specific learning outcomes are defined by the respective coordinator of the major field.

Prerequisites
None

Content
The comprehensive topic of the major field are the thermodynamical and kinetic basics of materials science that the students acquire within the compulsory parts (8 credit points). Moreover, there is a supplementary area of materials science and engineering which offers different subjects according to the students' interests.

Annotation
The module Materials Science and Engineering consists of 12 credit points in the bachelor´s program. Within the compulsory parts, at least 8 credits are to be chosen. Within the supplementary area, the students can select from a broad variation of courses. For the bachelor´s program, a reduced catalogue exists (see Studienplan).

Workload
The work load is about 360 hours in the Bachelor of Science program, whereof the presence time is 66 h.

Learning type
Within the compulsory parts of the major field Materials Science and Engineering the students choose from a small number of lectures and tutorials (obligatory).

Within the supplementary area students can choose not only lectures and tutorials but also lab courses and seminars.

M 7.18 Module: Major Field: Mechatronics (SP 31) [M-MACH-102820]

Responsible: Prof. Dr. Veit Hagenmeyer
Organisation: KIT Department of Mechanical Engineering

Part of: Specialization in Mechanical Engineering (Major Field)

Credits	Recurrence	Language	Level	Version
12	Each term	German/English	3	4

Election block: Mechatronics (K) (at least 8 credits)			
T-MACH-105314	Computational Intelligence	4 CR	Jakob, Mikut, Reischl
T-MACH-105694	Data Analytics for Engineers	5 CR	Ludwig, Mikut, Reischl
T-MACH-100535	Introduction into Mechatronics	6 CR	Böhland, Lorch, Reischl
T-MACH-105209	Introduction into the Multi-Body Dynamics	5 CR	Seemann
T-MACH-105218	Automotive Vision	6 CR	Lauer, Stiller
T-MACH-105539	Modern Control Concepts I	4 CR	Groell, Matthes
T-MACH-105367	Behaviour Generation for Vehicles	4 CR	Stiller, Werling
Election block: Mechatronics (E) ()			
T-MACH-108844	Automated Manufacturing Systems	8 CR	Fleischer
T-MACH-102150	BUS-Controls	4 CR	Becker, Geimer
T-MACH-105212	CAE-Workshop	4 CR	Albers, Matthiesen
T-MACH-105317	Digital Control	4 CR	Knoop
T-MACH-105514	Experimental Dynamics	5 CR	Fidlin
T-ETIT-100784	Hybrid and Electric Vehicles	4 CR	Becker
T-MACH-105187	IT-Fundamentals of Logistics	3 CR	Thomas
T-MACH-105210	Machine Dynamics	5 CR	Proppe
T-MACH-105224	Machine Dynamics II	4 CR	Proppe
T-MACH-105294	Mathematical Methods of Vibration Theory	6 CR	Seemann
T-MACH-105334	Mechanics in Microtechnology	4 CR	Greiner, Gruber
T-INFO-101266	Human-Machine-Interaction	6 CR	Beigl
T-MACH-105335	Measurement II	4 CR	Stiller
T-MACH-105557	Microenergy Technologies	4 CR	Kohl
T-MACH-108809	Micro- and Nanosystem Integration for Medical, Fluidic and Optical Applications	4 CR	Gengenbach, Hagenmeyer, Koker, Sieber
T-MACH-102152	Novel Actuators and Sensors	4 CR	Kohl, Sommer
T-MACH-105442	Intellectual Property Rights and Strategies in Industrial Companies	4 CR	Albers, Matthiesen, Zacharias
T-MACH-105347	Project Management in Global Product Engineering Structures	4 CR	Albers, Gutzmer, Matthiesen
T-INFO-108014	Robotics I - Introduction to Robotics	6 CR	Asfour
T-ETIT-109313	Signals and Systems	6 CR	Puente León
T-MACH-105372	Theory of Stability	6 CR	Fidlin
T-MACH-105358	Sustainable Product Engineering	4 CR	Albers, Matthiesen, Ziegahn
T-MACH-105521	Theoretical Description of Mechatronic Systems	4 CR	Seemann
T-MACH-105555	System Integration in Micro- and Nanotechnology	4 CR	Gengenbach
T-MACH-105290	Vibration Theory	5 CR	Fidlin, Seemann
Election block: Mechatronics (P) (at most 4 credits)			

T-MACH-105370	Laboratory Mechatronics	4 CR	Lorch, Seemann, Stiller
T-MACH-108878	Laboratory Production Metrology	4 CR	Häfner
T-MACH-105373	Practical Training in Measurement of Vibrations	4 CR	Fidlin
T-MACH-102149	Virtual Reality Practical Course	4 CR	Ovtcharova
Election block: Mechatronics (Ü) ()			
T-MACH-108889	BUS-Controls - Advance	0 CR	Daiß, Geimer
T-INFO-106257	Human-Machine-Interaction Pass	0 CR	Beigl

Competence Certificate
Written exam and oral exam.

Competence Goal
Students of the topic mechatronics know the future-oriented procedures. They are able to individually and creatively solve interdisciplinary questions and learn to effectively combine tools from the individual disciplines.

Prerequisites
none

Content
The topic mechatronics offers a broad, multidisciplinary body of knowledge. The graduates are qualified to solve essential mechatronic questions. In particular the following disciplines are covered by the major mechatronics:

§ Mechanics and fluidics

§ Electronics

§ Information processing

§ Automation.

Workload
The work load is about 360 hours, corresponding to 12 credit points.

Learning type
The contents of this major field are taught in form of lectures, exercises and practical experiences.

M 7.19 Module: Major Field: Modeling and Simulation in Dynamics (SP 61) [M-MACH-104430]

Responsible: Prof. Dr.-Ing. Wolfgang Seemann
Organisation: KIT Department of Mechanical Engineering

Part of: Specialization in Mechanical Engineering (Major Field)

Credits	Recurrence	Language	Level	Version
12	Each term	German	3	3

Election block: Modeling and Simulation in Dynamics (K) (at least 8 credits)			
T-MACH-105209	Introduction into the Multi-Body Dynamics	5 CR	Seemann
T-MACH-105210	Machine Dynamics	5 CR	Proppe
T-MACH-105293	Mathematical Methods in Dynamics	6 CR	Proppe
T-MACH-105226	Dynamics of the Automotive Drive Train	5 CR	Fidlin
T-MACH-105290	Vibration Theory	5 CR	Fidlin, Seemann
Election block: Modeling and Simulation in Dynamics (E) (at most 5 credits)			
T-MACH-105308	Atomistic Simulations and Molecular Dynamics	4 CR	Brandl, Gumbsch, Schneider
T-MACH-105514	Experimental Dynamics	5 CR	Fidlin
T-MACH-105224	Machine Dynamics II	4 CR	Proppe
T-MACH-105294	Mathematical Methods of Vibration Theory	6 CR	Seemann
T-MACH-105349	Computational Dynamics	4 CR	Proppe
T-MACH-105350	Computational Vehicle Dynamics	4 CR	Proppe
T-MACH-105384	Computerized Multibody Dynamics	4 CR	Seemann
T-MACH-105172	Simulation of Coupled Systems	4 CR	Geimer, Xiang
T-MACH-108888	Simulation of Coupled Systems - Advance	0 CR	Geimer, Xiang

Competence Certificate
oral examination

Competence Goal
The module provides modeling competences and continues thus the compulsory courses in dynamics. To this end analytical methods for the modeling and examination of dynamical systems are presented. The simulation of the systems enables the students to do simulation studies in typical applications in dynamical systems of mechanical engineering to be able to evaluate and interpret the results.

Prerequisites
None

Content
This module deals with procedures, methods and applications for mechanical dynamical systems. Subjects are different methods to describe kinematics of multibody systems and to derive the equations of motion for such systems. Solutions of the equations of motion are obtained analytically by mathematical methods or approximately by numerical integration. Applications range from industrial systems like machines and cars down to atomistic simulation.

Workload
360 h

Learning type
Lectures, tutorials

M 7.20 Module: Major Field: Powertrain Systems (SP 02) [M-MACH-102812]

Responsible: Prof. Dr.-Ing. Albert Albers
Prof. Dr.-Ing. Sven Matthiesen

Organisation: KIT Department of Mechanical Engineering

Part of: Specialization in Mechanical Engineering (Major Field)

Credits	Recurrence	Language	Level	Version
12	Each term	German/English	3	3

Election notes
In the core area of each Major Field at least 8 ECTS have to be chosen.

Election block: Powertrain Systems (K) (at least 8 credits)			
T-MACH-105307	Drive Train of Mobile Machines	4 CR	Geimer, Wydra
T-MACH-105233	Powertrain Systems Technology A: Automotive Systems	4 CR	Albers, Matthiesen, Ott
T-MACH-105216	Powertrain Systems Technology B: Stationary Machinery	4 CR	Albers, Matthiesen, Ott
T-MACH-105226	Dynamics of the Automotive Drive Train	5 CR	Fidlin
Election block: Powertrain Systems (E) ()			
T-MACH-105215	Applied Tribology in Industrial Product Development	4 CR	Albers, Lorentz, Matthiesen
T-MACH-105536	Dimensioning and Optimization of Power Train System	4 CR	Albers, Faust, Kirchner, Matthiesen
T-MACH-105209	Introduction into the Multi-Body Dynamics	5 CR	Seemann
T-MACH-105151	Energy Efficient Intralogistic Systems	4 CR	Braun, Schönung
T-ETIT-100784	Hybrid and Electric Vehicles	4 CR	Becker
T-MACH-105187	IT-Fundamentals of Logistics	3 CR	Thomas
T-MACH-105231	Leadership and Management Development	4 CR	Albers, Matthiesen, Ploch
T-MACH-105210	Machine Dynamics	5 CR	Proppe
T-MACH-105224	Machine Dynamics II	4 CR	Proppe
T-MACH-102152	Novel Actuators and Sensors	4 CR	Kohl, Sommer
T-MACH-105442	Intellectual Property Rights and Strategies in Industrial Companies	4 CR	Albers, Matthiesen, Zacharias
T-MACH-105441	Development of Oil-Hydraulic Powertrain Systems	4 CR	Ays, Geerling
T-MACH-105347	Project Management in Global Product Engineering Structures	4 CR	Albers, Gutzmer, Matthiesen
T-MACH-105185	Control Technology	4 CR	Gönnheimer
T-MACH-105696	Strategic Product Development - Identification of Potentials of Innovative Products	3 CR	Albers, Matthiesen, Siebe
T-MACH-110396	Strategic Product Development - Identification of Potentials of Innovative Products - Case Study	1 CR	Albers, Matthiesen, Siebe
T-MACH-105358	Sustainable Product Engineering	4 CR	Albers, Matthiesen, Ziegahn
T-MACH-105531	Tribology	8 CR	Dienwiebel, Scherge
T-MACH-102194	Combustion Engines I	4 CR	Koch, Kubach
T-MACH-102140	Failure of Structural Materials: Deformation and Fracture	4 CR	Gumbsch, Weygand
Election block: Powertrain Systems (Ü) ()			
T-MACH-109303	Exercices - Tribology	0 CR	Dienwiebel

Competence Goal

The students know and understand the technical and physical basics and systematic connections of drive systems. The lecture deals vehicle drive systems as well as drive systems for stationary and mobile work machines.

They are able to choose, describe and use complex dimensioning- and design methods for drive systems under consideration of the interactions of the system.

Prerequisites

none

Content

See courses of the SP02

Workload

The work load is about 360 hours, corresponding to 12 credit points.

Learning type

lectures
auditorium exercises
workshops

M 7.21 Module: Major Field: Production Engineering (SP 52) [M-MACH-102644]

Responsible: Prof. Dr.-Ing. Gisela Lanza
Organisation: KIT Department of Mechanical Engineering

Part of: Specialization in Mechanical Engineering (Major Field)

Credits	Recurrence	Language	Level	Version
12	Each term	English	3	1

Election block: Production Engineering (K) (at least 8 credits)			
T-MACH-106731	Global Production Engineering (MEI)	4 CR	Lanza
T-MACH-105379	Global Logistics	4 CR	Furmans
Election block: Production Engineering (E) ()			
T-MACH-106732	Automated Production Systems (MEI)	4 CR	Fleischer
T-MACH-106733	SmartFactory@Industry (MEI)	4 CR	Lanza

Competence Certificate
Oral exams: duration approx. 5 min per credit point
Amount, type and scope of the success control can vary according to the individually choice.

Competence Goal
After completion of this module, the students are able

- to analyse and solve planning and layout problems on the level of the enterprise, production, processes and work tasks,
- to plan and control a production,
- to evaluate and configure the quality and efficiency of production, processes and products.

Prerequisites
none

Content
The students acquire in the compulsory core subjects profound knowledge about the scientific theories, principles and methods of Production Engineering. Afterwards they are able to evaluate and design complex production systems according to problems of manufacturing and process technologies, materials handling, handling techniques, information engineering as well as production organisation and management.

Workload
The work load is about 360 hours, corresponding to 12 credit points.

Learning type
Lectures, seminars, workshops, excursions

M 7.22 Module: Major Field: Production Systems (SP 38) [M-MACH-102589]

Responsible: Prof. Dr.-Ing. Volker Schulze
Organisation: KIT Department of Mechanical Engineering

Part of: Specialization in Mechanical Engineering (Major Field)

Credits	Recurrence	Language	Level	Version
12	Each term	German	3	3

Election block: Production Systems (K) (at least 8 credits)			
T-MACH-105518	Human Factors Engineering I	4 CR	Deml
T-MACH-105519	Human Factors Engineering II	4 CR	Deml
T-MACH-102105	Manufacturing Technology	8 CR	Schulze, Zanger
T-MACH-108849	Integrated Production Planning in the Age of Industry 4.0	8 CR	Lanza
T-MACH-102151	Material Flow in Logistic Systems	9 CR	Furmans
T-MACH-109055	Machine Tools and Industrial Handling	8 CR	Fleischer
Election block: Production Systems (E) ()			
T-MACH-102162	Automated Manufacturing Systems	9 CR	Fleischer
T-MACH-105147	Product Lifecycle Management	4 CR	Ovtcharova
T-MACH-102107	Quality Management	4 CR	Lanza
T-MACH-102083	Integrated Information Systems for Engineers	4 CR	Ovtcharova
Election block: Production Systems (P) (at most 4 credits)			
T-MACH-108878	Laboratory Production Metrology	4 CR	Häfner

Competence Certificate
Oral exams: duration approx. 5 min per credit point

Written exams: duration approx. 20 - 25 min per credit point

Amount, type and scope of the success control can vary according to the individually choice.

Competence Goal
The students...

- are able to choose methods of production science target-oriented in familiar situations and are able to justify their selection.
- are able to describe and compare production processes exemplarily.
- are able to transfer known solutions to given problems in the field of production science under consideration of scientific theories, principles and methods.
- are able to solve tasks in the field of production science team oriented and proceed responsible and adequate to the situation.
- are able to integrate results of others at the solution of given problems.
- have the ability to present their own results in written form and are able to interpret them.
- are able to identify, dissect and develop further systems and processes and apply given sets of criteria under consideration of technical, economic and social conditions.

Prerequisites
None

Content
Within this module the students will get to know and learn about production science. Manifold lectures and excursions as part of several lectures provide specific insights into the field of production science.

Workload
The work load is about 360 hours, corresponding to 12 credit points.

Learning type
Lectures, seminars, workshops, excursions

M 7.23 Module: Major Field: Rail System Technology (SP 50) [M-MACH-102638]

Responsible: Prof. Dr.-Ing. Peter Gratzfeld

Organisation: KIT Department of Mechanical Engineering

Part of: Specialization in Mechanical Engineering (Major Field)

Credits	Recurrence	Language	Level	Version
12	Each term	German	3	1

Mandatory			
T-MACH-106424	Rail System Technology	4 CR	Gratzfeld
T-MACH-105353	Rail Vehicle Technology	4 CR	Gratzfeld
Election block: Rail System Technology (E) ()			
T-MACH-105540	Railways in the Transportation Market	4 CR	Gratzfeld
T-MACH-102121	Electric Rail Vehicles	4 CR	Gratzfeld
T-MACH-105237	Vehicle Lightweight Design - Strategies, Concepts, Materials	4 CR	Henning
T-MACH-105218	Automotive Vision	6 CR	Lauer, Stiller
T-MACH-105535	Composite Manufacturing - Polymers, Fibers, Semi-Finished Products, Manufacturing Technologies	4 CR	Henning
T-MACH-104599	Project Management in Rail Industry	4 CR	Gratzfeld
T-MACH-105350	Computational Vehicle Dynamics	4 CR	Proppe
T-MACH-108692	Seminar for Rail System Technology	3 CR	Gratzfeld

Competence Certificate
Oral exams: duration approx. 5 minutes per credit point.

However, amount, type and scope of the success control can vary according the individual choice.

Competence Goal

- The students understand relations and interdependencies between rail vehicles, infrastructure and operation in a rail system.
- Based on operating requirements and legal framework they derive the requirements concerning a capable infrastructure and suitable concepts of rail vehicles.
- They recognize the impact of alignment, understand the important function of the wheel-rail-contact and estimate the impact of driving dynamics on the operating program.
- They evaluate the impact of operating concepts on safety and capacity of a rail system.
- They know the infrastructure to provide power supply to rail vehicles with different drive systems.

- The students learn the role of rail vehicles and understand their classification. They understand the basic structure und know the functions of the main systems. They understand the overall tasks of vehicle system technology.
- They learn functions and requirements of car bodies and jugde advantages and disadvantages of design principles. They know the functions of the car body's interfaces.
- They know about the basics of running dynamics and bogies.
- 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 the basic setup of train control management system and understand the most important functions.
- They specify and define suitable vehicle concepts based on requirements for modern rail vehicles.

- Supplementary lectures present further major aspects of a rail system.

Prerequisites
None

Content

1. Railway System: railway as system, subsystems and interdependencies, definitions, laws, rules, railway and environment, economic impact
2. Operation: Transportation, public transport, regional transport, long-distance transport, freight service, scheduling
3. Infrastructure: rail facilities, track alignment, railway stations, clearance diagram
4. Wheel-rail-contact: carrying of vehicle mass, adhesion, wheel guidance, current return
5. Vehicle dynamics: tractive and brake effort, driving resistance, inertial force, load cycles
6. Signaling and Control: operating procedure, succession of trains, European Train Control System, blocking period, automatic train control
7. Traction power supply: power supply of rail vehicles, power networks, filling stations
8. Vehicle system technology: structure and main systems of rail vehicles
9. Car body: functions, requirements, design principles, crash elements, interfaces
10. Bogies: forces, running gears, axle configuration
11. Drives: vehicle with/without contact wire, dual-mode vehicle
12. Brakes: tasks, basics, principles, blending, brake control
13. Train control management system: definitions, networks, bus systems, components, examples
14. Vehicle concepts: trams, metros, regional trains, intercity trains, high speed trains, double deck coaches, locomotives, freight wagons
15. History (optional)
16. Further contents in supplementary lectures

Annotation
A bibliography is available for download (Ilias-platform).

Workload

- Total effort at 12 ECTS (B.Sc.): about 360 hours
- Regular attendance: 63 hours
- Self-study: 63 hours
- Exam and preparation: 234 hours

Learning type
Lectures in the core part.

Lectures and seminars are offered in the supplementary part.

M 7.24 Module: Major Field: Technical Logistics (SP 44) [M-MACH-102821]

Responsible: Prof. Dr.-Ing. Kai Furmans
Organisation: KIT Department of Mechanical Engineering

Part of: Specialization in Mechanical Engineering (Major Field)

Credits	Recurrence	Language	Level	Version
12	Each term	German	3	2

Mandatory			
T-MACH-109919	Basics of Technical Logistics I	4 CR	Mittwollen, Oellerich
T-MACH-109920	Basics of Technical Logistics II	5 CR	Hochstein
Election block: Technical Logistics (E) ()			
T-MACH-102160	Selected Applications of Technical Logistics	4 CR	Milushev, Mittwollen
T-MACH-108945	Selected Applications of Technical Logistics - Project	2 CR	Milushev, Mittwollen
T-MACH-102159	Elements and Systems of Technical Logistics	4 CR	Fischer, Mittwollen
T-MACH-108946	Elements and Systems of Technical Logistics - Project	2 CR	Fischer, Mittwollen
T-MACH-105174	Warehousing and Distribution Systems	3 CR	Furmans
T-MACH-105151	Energy Efficient Intralogistic Systems	4 CR	Braun, Schönung
T-MACH-105175	Airport Logistics	3 CR	Richter
T-MACH-105187	IT-Fundamentals of Logistics	3 CR	Thomas
T-MACH-105171	Safety Engineering	4 CR	Kany
T-MACH-102107	Quality Management	4 CR	Lanza
T-MACH-108844	Automated Manufacturing Systems	8 CR	Fleischer
T-MACH-105378	Cognitive Automobiles - Laboratory	6 CR	Kitt, Lauer, Stiller
T-MACH-105367	Behaviour Generation for Vehicles	4 CR	Stiller, Werling

Competence Certificate
Written and oral exams, see brick courses

Competence Goal
Students are able to:

- Describe main functional elements of of technical logistics,
- Determine the main parameters necessary for functionality,
- Combines those functional elements to solve material handling tasks appropriate, and
- Evalute resulting material handling installations.

Prerequisites
None

Content
The emphasis module *Technical Logistics* provides in-depth basics on the main topics of technical logistics. The module focuses on technical characteristics of material handling technology. To gain a deeper understanding, the course is accompanied by exercises.

Workload
The work load is about 360 hours, corresponding to 12 credit points.

Learning type
Lectures and practices; self-study

M 7.25 Module: Major Field: Vehicle Technology (SP 12) [M-MACH-102818]

Responsible: Prof. Dr. Frank Gauterin
Organisation: KIT Department of Mechanical Engineering

Part of: Specialization in Mechanical Engineering (Major Field)

Credits	Recurrence	Language	Level	Version
12	Each term	German/English	3	4

Election block: Automotive Technology (K) (at least 8 credits)			
T-MACH-100092	Automotive Engineering I	8 CR	Gauterin, Unrau
Election block: Automotive Technology (E) ()			
T-MACH-105655	Alternative Powertrain for Automobiles	4 CR	Noreikat
T-MACH-105233	Powertrain Systems Technology A: Automotive Systems	4 CR	Albers, Matthiesen, Ott
T-MACH-105536	Dimensioning and Optimization of Power Train System	4 CR	Albers, Faust, Kirchner, Matthiesen
T-MACH-105226	Dynamics of the Automotive Drive Train	5 CR	Fidlin
T-MACH-105152	Handling Characteristics of Motor Vehicles I	4 CR	Unrau
T-MACH-105153	Handling Characteristics of Motor Vehicles II	4 CR	Unrau
T-MACH-108374	Vehicle Ergonomics	4 CR	Heine
T-MACH-105154	Vehicle Comfort and Acoustics I	4 CR	Gauterin
T-MACH-105155	Vehicle Comfort and Acoustics II	4 CR	Gauterin
T-MACH-105237	Vehicle Lightweight Design - Strategies, Concepts, Materials	4 CR	Henning
T-MACH-105156	Vehicle Mechatronics I	4 CR	Ammon
T-MACH-102207	Tires and Wheel Development for Passenger Cars	4 CR	Leister
T-MACH-105218	Automotive Vision	6 CR	Lauer, Stiller
T-MACH-105535	Composite Manufacturing - Polymers, Fibers, Semi-Finished Products, Manufacturing Technologies	4 CR	Henning
T-MACH-102117	Automotive Engineering II	4 CR	Gauterin, Unrau
T-MACH-105044	Fundamentals of Catalytic Exhaust Gas Aftertreatment	4 CR	Deutschmann, Grunwaldt, Kubach, Lox
T-MACH-102116	Fundamentals for Design of Motor-Vehicle Bodies I	2 CR	Bardehle
T-MACH-102119	Fundamentals for Design of Motor-Vehicle Bodies II	2 CR	Bardehle
T-MACH-105160	Fundamentals in the Development of Commercial Vehicles I	2 CR	Zürn
T-MACH-105161	Fundamentals in the Development of Commercial Vehicles II	2 CR	Zürn
T-MACH-105162	Fundamentals of Automobile Development I	2 CR	Frech
T-MACH-105163	Fundamentals of Automobile Development II	2 CR	Frech
T-ETIT-100784	Hybrid and Electric Vehicles	4 CR	Becker
T-MACH-105375	Industrial Aerodynamics	4 CR	Breitling, Frohnapfel
T-MACH-105188	Integrative Strategies in Production and Development of High Performance Cars	4 CR	Schlichtenmayer
T-MACH-105221	Lightweight Engineering Design	4 CR	Albers, Burkardt
T-MACH-105164	Laser in Automotive Engineering	4 CR	Schneider
T-MACH-105442	Intellectual Property Rights and Strategies in Industrial Companies	4 CR	Albers, Matthiesen, Zacharias
T-MACH-102155	Product, Process and Resource Integration in the Automotive Industry	4 CR	Mbang
T-MACH-102156	Project Workshop: Automotive Engineering	6 CR	Frey, Gauterin, Gießler
T-MACH-105441	Development of Oil-Hydraulic Powertrain Systems	4 CR	Ays, Geerling

T-MACH-105347	Project Management in Global Product Engineering Structures	4 CR	Albers, Gutzmer, Matthiesen
T-MACH-105350	Computational Vehicle Dynamics	4 CR	Proppe
T-MACH-105696	Strategic Product Development - Identification of Potentials of Innovative Products	3 CR	Albers, Matthiesen, Siebe
T-MACH-105358	Sustainable Product Engineering	4 CR	Albers, Matthiesen, Ziegahn
T-MACH-102194	Combustion Engines I	4 CR	Koch, Kubach
T-MACH-105367	Behaviour Generation for Vehicles	4 CR	Stiller, Werling
T-MACH-102148	Gear Cutting Technology	4 CR	Klaiber
T-MACH-108844	Automated Manufacturing Systems	8 CR	Fleischer
T-MACH-110318	Product- and Production-Concepts for modern Automobiles	4 CR	Kienzle, Steegmüller
T-MACH-110396	Strategic Product Development - Identification of Potentials of Innovative Products - Case Study	1 CR	Albers, Matthiesen, Siebe
T-MACH-110796	Python Algorithm for Vehicle Technology	4 CR	Rhode

Competence Certificate
Valid for all degree programmes, for which no value is indicated in the following.

The assessment is carried out as partial exams of the single courses of this module, whose sum of credits must meet the minimum requirement of credits of this module. The assessment procedures are described for each course of the module separately. Amount, type and scope of the success controll can vary according to the individually choice. Oral exams: duration approx. 5 min. per credit point. Within the scope of lab courses maximum 4 credits may be aquired.

The overall grade of the module is the average of the grades for each course weighted by the credits and truncated after the first decimal.

Competence Goal
The student

• knows the most important components of a vehicle,

• knows and understands the functioning and the interaction of the individual components,

• knows the basics of dimensioning the components,

• knows and understands the procedures in automobile development,

• knows and understands the technical specifications at the development procedures,

• is aware of notable boundaries like legislation,

• is ready to analyze and judge vehicle concepts and to participate competently in the development of vehicles.

Prerequisites
None

Content
In the module Automotive Technology the basics are taught, which are important for the development, the design, the production and the operation of vehicles. Particularly the primary important aggregates like engine, gear, drive train, chasis and auxiliary equipment are explained, but also all technical equipment, which make the operation safer and easier. Additionally the interior equipment is examined, which shall provide a preferably comfortable, optimum ambience to the user.

In the module Automotive Technology the focus is on passenger cars and commercial vehicles, which are designed for road applications.

Workload
The work load is about 360 hours, corresponding to 12 credit points.

Learning type
The teaching and learning procedures (lecture, lab course, workshop) are described for each course of the module separately.

M 7.26 Module: Major Field: Vibration Theory [M-MACH-104442]

Responsible: Prof. Dr.-Ing. Alexander Fidlin
Organisation: KIT Department of Mechanical Engineering

Part of: Specialization in Mechanical Engineering (Major Field)

Credits	Recurrence	Language	Level	Version
12	Each term	German	3	1

Election block: Vibration Theory (K) (at least 8 credits)			
T-MACH-105290	Vibration Theory	5 CR	Fidlin, Seemann
T-MACH-105210	Machine Dynamics	5 CR	Proppe
T-MACH-105294	Mathematical Methods of Vibration Theory	6 CR	Seemann
T-MACH-105372	Theory of Stability	6 CR	Fidlin
T-MACH-105439	Introduction to Nonlinear Vibrations	7 CR	Fidlin
Election block: Vibration Theory (E) (at most 1 item)			
T-MACH-105224	Machine Dynamics II	4 CR	Proppe
T-MACH-105443	Wave Propagation	4 CR	Seemann
T-MACH-105226	Dynamics of the Automotive Drive Train	5 CR	Fidlin
T-MACH-105514	Experimental Dynamics	5 CR	Fidlin
T-MACH-105154	Vehicle Comfort and Acoustics I	4 CR	Gauterin
T-MACH-105155	Vehicle Comfort and Acoustics II	4 CR	Gauterin
T-MACH-105349	Computational Dynamics	4 CR	Proppe
Election block: Vibration Theory (P) (at most 4 credits)			
T-MACH-105373	Practical Training in Measurement of Vibrations	4 CR	Fidlin

Competence Certificate
oral examination

Prerequisites
None

Content
The students know different methods which may be applied for the analysis of investigation of vibration problems. They are able to treat one or multiple degree of freedom systems as well as vibrating continua. The goal is to establish a chain from physical modeling via mathematical solution to an interpretation of the results. Based on the courses which are chosen the knowledge has emphasis on theoretical investigations, approximation methods or experimental methods and applications in automotive engineering.

M 7.27 Module: Manufacturing Processes [M-MACH-102549]

Responsible: Prof. Dr.-Ing. Volker Schulze
Dr.-Ing. Frederik Zanger

Organisation: KIT Department of Mechanical Engineering

Part of: Fundamentals of Engineering

Credits	Recurrence	Language	Level	Version
4	Each winter term	German	3	1

Mandatory			
T-MACH-105219	Basics of Manufacturing Technology	4 CR	Schulze, Zanger

Competence Certificate
written exam (duration: 60 min)

Competence Goal
The students …

- are able to classify the manufacturing processes by their general functionality according to the specific main groups (DIN 8580).
- have the ability to declare and explain the function of the significant manufacturing processes of the main groups (DIN 8580).
- are enabled to describe the characteristic process features (geometry, materials, accuracy, tools, machines) of the significant manufacturing processes of the main groups (DIN 8580).
- have the ability to derive the relevant process specific technical advantages and disadvantages of the characteristic process features.
- are enabled to perform a selection of suitable manufacturing processes for given components.
- are enabled to classify the required manufacturing processes in the expiry of a process chain for the production of given sample products.

Prerequisites
none

Content
The objective of the lecture is to classify the manufacturing technology within the wider context of production engineering, to provide an overview of the different manufacturing processes and to establish basic process knowledge of the common processes. The lecture conveys the basic principles of manufacturing technology and deals with the manufacturing processes based on example components according to their classification into main groups regarding technical and economic aspects.

The following topics will be covered:

- Primary processing (casting, plastics engineering, sintering, additive manufacturing processes)
- Forming (sheet-metal forming, massive forming)
- Cutting (machining with geometrically defined and geometrically undefined cutting edges, separating, abrading)
- Joining
- Coating
- Heat treatment and surface treatment

Workload
regular attendance: 21 hoursself-study: 99 hours

Learning type
Lecture

M 7.28 Module: Materials Science (BSc-Modul 04, WK) [M-MACH-102562]

Responsible: Prof. Dr.-Ing. Martin Heilmaier
Organisation: KIT Department of Mechanical Engineering

Part of: Fundamentals of Engineering

Credits	Recurrence	Duration	Language	Level	Version
14	Each winter term	2 term	German/English	3	2

Mandatory			
T-MACH-105145	Materials Science I & II	11 CR	Gibmeier, Heilmaier, Pundt
T-MACH-105146	Materials Science Lab Course	3 CR	Gibmeier, Heilmaier, Pundt

Competence Certificate
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, about 25 minutes.

Competence Goal
Within this Module the students should

- gain knowledge of basics about structural and functional materials
- be able to draw relationships between atomic structure, microstructure and properties
- be able to apply appropriate methods to determine mechanical and other relevant properties as well as to characterize the microstructure of materials
- be able to assess material properties and corresponding applications

Prerequisites
none

Content
WK I

Structure of atoms and atomic bonding

Crystalline solids

Defects in crystalline solids

Amorphous and partially crystalline solids

Constitution of alloys and materials

Diffusion and phase transformation in the solid state

Microscopic characterization method

Characterization with X-Rays and neutrons

Non-destructive Testing

Mechanical Testing

WK II

Iron based alloys

Non-iron based alloys

Ceramics

Glases

Polymers

Composite Materials

Annotation

For the Bachelor’s program Mechanical Engineering the module (including all brick details, exams and courses) is offered in German.

For the Bachelor’s program Mechanical Engineering (International) the module (including all brick details, exams and courses) is offered in English.

Workload

The work load of the module is about 420 hours.

The workload for the lab course Materials Science is 90 h in total and consists of the presence during the 10 experiments (one week half-time, 4 hours per day) as well as preparation and rework time at home.

The workload for the lecture Materials Science I & II is 165 h per semester and consists of the presence during the lectures (WS: 4 SWS, SS: 2SWS) and the exercises (1 SWS per WS and 1 SWS per SS) as well as preparation and rework time at home.

Learning type

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

M 7.29 Module: Measurement and Control Systems (BSc-Modul 11, MRT) [M-MACH-102564]

Responsible: Prof. Dr.-Ing. Christoph Stiller
Organisation: KIT Department of Mechanical Engineering

Part of: Fundamentals of Engineering

Credits	Recurrence	Duration	Language	Level	Version
7	Each winter term	1 term	German/English	3	2

Mandatory			
T-MACH-104745	Basics in Measurement and Control Systems	7 CR	Stiller

Competence Certificate
Type of Examination: written exam

Duration of Examination: 150 minutes

Competence Goal

- Students are able to name, describe and explain control principles applied to physical quantities.
- They are able to name, analyze and assess system theoretic characteristics of dynamical systems.
- Students are able to represent real systems in a system theoretic model and to assess the suitability of a given model.
- Students are able to apply methods for controller design and to analyze their properties.
- Students are able to select appropriate principles of metrology and to model, analyze and assess measurement setups.
- Students are able to quantify and assess measurement uncertainties.

Module grade calculation
result of exam

Prerequisites
none

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

Annotation
For the Bachelor’s program Mechanical Engineering the module (including all brick details, exams and courses) is offered in German.

For the Bachelor’s program Mechanical Engineering (International) the module (including all brick details, exams and courses) is offered in English.

Workload
84 hours presence time, 126 hours selfstudies

Learning type
Lecture

Tutorials

M 7.30 Module: Mechanical Design (BSc-Modul 06, MKL) [M-MACH-102573]

Responsible: Prof. Dr.-Ing. Albert Albers
Prof. Dr.-Ing. Sven Matthiesen

Organisation: KIT Department of Mechanical Engineering

Part of: Fundamentals of Engineering

Credits	Recurrence	Language	Level	Version
20	Each winter term	German/English	3	2

Mandatory			
T-MACH-105286	Mechanical Design I & II	5 CR	Albers, Burkardt, Matthiesen
T-MACH-104810	Mechanical Design III & IV	13 CR	Albers, Burkardt, Matthiesen
T-MACH-105282	Mechanical Design I, Prerequisites	1 CR	Albers, Matthiesen
T-MACH-105283	Mechanical Design II, Prerequisites	1 CR	Albers, Matthiesen
T-MACH-105284	Mechanical Design III, Constructing the Team	0 CR	Albers, Matthiesen
T-MACH-105285	Mechanical Design IV, Constructing the Team	0 CR	Albers, Matthiesen

Competence Certificate
Mechanical Design I & II:

Preliminary examination: Successful participation in workshops in the field of mechanical Design I, as well as successful processing of output power in mechanical design II

Written examination in the field of mechanical engineering I and II: duration 60 min plus reading time

Mechanical Design III & IV:

Preliminary examination: Successful participation in workshops in the field of mechanical Design III & IV

- Examination in the field of mechanical Design III & IV consisting of
  written part with duration 60 min plus reading time and
- constructive part with duration 180 min plus reading ime

Competence Goal

Learning object springs:

- be able to recognize spring types and explain stress
- Identify and describe the properties of a resilient LSS in machine elements presented later on
- Understanding and explaining the principle of action
- Know and list areas of application for springs
- graphically illustrate the load and the resulting stresses
- be able to describe the degree of species usefulness as a means of lightweight construction
- be able to analyse different solution variants with regard to lightweight construction (use species efficiency)
- Being able to explain several springs as a circuit and calculate total spring stiffness

Learning objects Technical Systems:

- Being able to explain what a technical system is
- "Thinking in systems."
- Using system technology as an abstraction tool for handling complexity
- Recognizing functional relationships of technical systems
- Getting to know the concept of function
- be able to use C&C²-A as a means of system technology

Learning objects Visualization:

- Ability to create and interpret schematics
- Using freehand technical drawing as a means of communication
- To be able to apply the technical basics of freehand drawing
- Derivation of 2D representations into different perspective representations of technical structures and vice versa
- Master reading of technical drawings
- Dedicated dimensioning of technical drawings
- Create sectional views of technical systems as a technical sketch

Learning objects Bearings:

- be able to recognize bearings in machine systems and explain their basic functions
- name bearings (type/type/function) and recognize them in machine systems and technical drawings
- Being able to name areas of application and selection criteria for the various bearings and bearing arrangements and explain interrelationships
- Ability to functionally explain the design of the bearing definitions in different directions radially/axially and circumferentially
- Know and describe selection as an iterative process as an example
- be able to perform dimensioning of bearing arrangements as an example of the engineer's approach to dimensioning machine elements
- Develop first ideas for probabilities in predicting the life of machine elements
- Recognise from the damage pattern whether static or dynamic overload was the cause of material failure
- Calculate equivalent static and dynamic bearing loads from the catalogue and given external forces on the bearing
- Being able to name, explain and transfer the basic equation of the dimensioning to the bearing dimensioning

Learning objectives seals:

The students…

- can discuss the basic functions of seals
- can describe the physical causes for mass transfer
- can apply the C&C-Model on seals
- can name, describe and apply the three most important classification criteria of seals
- can explain the function of a contacting seal and a non-contacting seal.
- can differentiate the seal types and organize them to the classification criteria.
- can discuss the structure and the effect of a radial shaft seal
- can evaluate radial shaft seals, compression packings, mechanical seals, gap seals and labyrinth seals
- can describe and apply the constructional principle of selffortification
- can describe the stick-slip phenomenon during the movement sequences of a reciprocating seal

Learning design:

The students…

- understand the meaning of design
- are able to recognize and implement basic rules and principles of design
- are able to design the connection of partial systems into the total system
- can name requirements of design and take them into account
- know the main groups of manufacturing methods
- are able to explain the manufacturing processes
- are able to depict a casted design in a drawing clearly, e.g. draft of the mold, no material accumulation, …
- know how components are designed

- Know how the production of the components has an effect on
- their design
- Know the requirements and boundary conditions on design

Learning bolted connections:

The students…

- can list and explain various bolt applications.
- can recognize bolt types and explain their function
- can build a C&C² model of a bolted joint and discuss the influences on its function
- can explain the function of a bolted connection with the help of a spring model
- can reproduce, apply and discuss the screw equation.
- Can estimate the load-bearing capacity of low-loaded bolted joints for dimensioning purposes
- Can indicate which bolted joint is to be calculated and which only roughly dimensioned.
- Can carry out the dimensioning of bolted connections as flange connections
- Can create, explain and discuss the force deflection diagram of a bolted connection

Learning objectives tolerances and fits:

The students…

- know the importance of the microstructure of working surfaces on technical surfaces on the function. They are familiar with a system for describing the surface microstructure in technology and parameters for describing the surface fine structure of working surfaces both in their definition and in their statement and in the quantitative order of magnitude.
- know and can explain surface measurement principles.
- know the relationship between the surface structure and the manufacturing processes and the costs.
- know the purpose of standards, standard types and preferred numbers.
- know and can define tolerances as a description of the geometry of working surfaces. They know the ISO fitting systems in type and structure and can apply it.
- can explain the different types of toleration and their significance for the economic product development process.

Learning objectives component connections:

The students…

- can generally explain basic functions of shaft-hub-connections.
- know and can explain a selection of different component connections to the respective working principles.
- can explain the component connection "centering" in its function and draw it in a technical drawing.
- understand form-closing and force-closing shaft-hub connections and can explain them. They can dimension a cylindrical interference fit (calculation and dimensioning criteria) and understand the stresses on a cylindrical interference fit and can display them graphically.

Learning objectives gears:

The students…

- Understand the function of gearboxes in the context of drive systems.
- are familiar with different operating principles of gearboxes and different types of gearboxes.
- know and understand the law of gearing. They know names on the gear and different flank curves.
- Understand engagement of gears, application limits and damage to gears. They know the basic ideas of gear dimensioning.
- know and understand planetary gearboxes. They understand the operating principle of hydraulic transmissions.

Learning objects dimensioning

Students can...

- Explain the target values of the economic dimensioning
- explain what are the main results of a dimensioning process
- explain the scope of the dimensioning (economic and legal significance)
- Explain the basic sizing procedure and record it as a generic flowchart
- Explain uncertainties in dimensioning
- specify the different basic procedures, both for dimensioning and for determining the influencing variables, e.g. loads, as well as their advantages or disadvantages in relation to each other
- explain different types of calculation methods and their characteristics (static/dynamic, local vs. nominal voltages)
- Name different types of failure (implies the definition of failure)
- Explain possible causes of failure
- provide suitable replacement models for simple subsystems of technical systems as a basis for dimensioning
- Explain different basic load types for given examples Dominant load types relevant to design
- Use the basics of elastostatics for all basic load cases to design components that can be modeled as linear structures according to the nominal stress concept.
- describe the dimensioning parameters presented in the VL and their use (shape number, shape yield strength, shape yield strength ratio)
- explain the purpose of strength hypotheses

- explain the strength hypotheses for metallic materials presented in the VL and select them according to the specific situation
- explain the principal effects of notches, including the factors affecting the magnitude of these effects
- describe how notches can be taken into account in the dimensioning process
- notched components that can be modeled as linear load-bearing structures for static loads
- Explain possibilities for determining the strength of a material or component
- Name influencing variables on the loadability and derive measures from them in order to influence the loadability of a component if necessary.
- describe different types of material behaviour under overelastic stressing of metallic materials
- Describe dynamic loads
- from Wöhler, Haigh- or Smith diagrams determine material characteristics for the loadability under given load conditions
- construct the Smith chart approximately with the given characteristic values
- explain the difference between strength and fatigue strength
- Components that can be modeled as linear structures according to the nominal stress concept for dynamic loads in base load cases and combined loads in the same phase
- for components that can be modeled as linear structures, explain the design approach presented in the lecture for any combined, dynamic loads
- Perform strength analyses in accordance with DIN 743, in the course of which even failure-critical points in the component can be identified and, if the result is negative, appropriate measures can be derived and evaluated.
- Name factors influencing the safety factors to be selected and explain what type of influence this is

Learning objectives shaft couplings:

Students can...

- Name the reasons for using shaft couplings (in short: "Couplings")
- name exemplary applications of couplings
- List basic functions of clutches and delimit clutches to transmissions
- indicate the basic power balance of a coupling
- mention various ancillary functions that occur with clutches
- name various criteria for classifying couplings
- describe the embodiment-function relationship for a given coupling for both main and secondary functions
- If necessary, derive the main and auxiliary functions required for the application, select a suitable coupling (and if necessary also a specific size) or combine several couplings if necessary.
- Explain interactions of couplings with adjacent subsystems, possibly specific to certain designs or groups of couplings
- Specify selection criteria for couplings
- explain central design principles for different groups of couplings, including the designation of key design targets
- for frictionally engageable clutches, slip time, transferable torque and thermal resistance should be designed roughly under the assumptions and simplifications dealt with in the lecture, estimate the relevant loads by the surrounding technical system and, if necessary, influence the specified target values by design measures.
- Apply relevant standards for the design of couplings
- Name possible failure modes for given couplings
- specify which design measures on a coupling can be used to influence the dynamic behaviour of the surrounding system in a desired direction
- explain the various possible actuation types for switchable clutches and give examples of corresponding clutch designs

Learning Objectives Fundamentals of Fluid Technology:

Students can...

- differentiate between different areas of fluid technology on the basis of essential aspects of the operating principles
- Identify properties/ special features of fluid technology systems and the resulting areas of application
- explain basic approaches for the design of hydraulic systems
- differentiate the flow types shown in the lecture
- with the basic equations (continuity equation, Bernoulli,...) of hydrostatics and hydrodynamics explained in the lecture.
- Identify sources of pressure losses in hydraulic systems and influencing factors
- designate basic subsystems of a hydraulic system
- Assign system and component examples shown in the lecture to components of a hydraulic system
- name the symbols shown in the lecture and assign them to the respective system/component
- use symbols to explain the function of simple hydraulic systems
- Draw up function diagrams for hydraulic systems that are similar in complexity to the systems shown in the lecture.

Prerequisites
None

Content
MKL I:

Introduction to mechanical design

Tools for visualization (technical drawing)

Product Development as a problem solution

Technical Systems Product Development

- Systems theroy
- Contact and Channel Approach C&C²-A

Basics of selected construction and machine elements

- springs
- Bearing and fence

The lecture is accompanied by exercises with the following content:

gear workshop

Exercises for visualization tools (technical drawing)

Exercise on Technical Systems Product Creation

- Systems theroy
- Contact and Channel Approach C&C²-A

Exercise on the spring module

Exercise on the bearing and fence Module

MKL II:

- Basics bearings
- Sealings
- Design
- Tolerances and fits
- component connections
- The lecture is accompanied by exercises to deepen the contents of the lecture.

MKL III:

- component connections
- tolerances and fits
- gears
-

MKL IV:

Elementary component connections - Part 2

Basics of clutches

- Function and operating principles
- Characteristic features and classification
- Non-engaging shaft clutches
- Switchable shaft clutches
- Flexible clucthes

Basics of gearboxes

- Function and operating principles
- Basics of gear drives
- Characteristic features and classification
- selection criteria
- Basics of other transmissions
- Fundamentals of lubrication and lubricants

Basics of gearing

- Function and operating principles
- Types of thoothing
- Cycloid as flank curve
- Involute as flank curve
  Method of manufacturing gears
- Profil overlap
- Profil offset
- Limits of application and damage

- Dimensioning
- Thooth strength
- Pitting resistance

Basics of hydraulics

- Basic functions and operating principles
- Characteristic features and classification
- Types and properties
- Sample
- Application
- Design calculation

Annotation

For the Bachelor’s program Mechanical Engineering the module (including all brick details, exams and courses) is offered in German.

For the Bachelor’s program Mechanical Engineering (International) the module (including all brick details, exams and courses) is offered in English.

Workload

MKL1:

Attendance at lectures (15 VL): 22,5h

Presence exercises (8 exercises): 12h

Attendance (3x 2h) and preparation (3x3h) Workshop sessions: 15h

Preparation and execution of online test: 6h

Personal preparation and follow-up of lecture and exercise: 34,5hMKL1:

MKL2:

Attendance lectures (15 VL): 22,5h

Presence exercises (7 ÜB): 10,5h

Personal preparation and follow-up of lecture and exercise, incl. prerequisite and preparation for the exam:: 117h

MKL 3:

Attendance lectures (15 L): 22,5h

Presence exercises (4 exercises): 6h

Attendance milestones project work (3x 4h): 12h

Project work in a team: 80h

Personal preparation and follow-up of lecture and exercise: 29,5h

MKL 4:

Attendance lectures (13 L): 19,5h

Presence exercises (6 exercises): 9h

Attendance milestones project work (3x 4h): 12h

Project work in a team: 120h

Personal preparation and follow-up of lecture and exercise, incl. preparation for the exam: 82,5h

Learning type

Lecture

Tutorial

Project work during the semester

M 7.31 Module: Orientation Exam [M-MACH-104624]

Organisation: University
Part of: Orientation Exam

Credits	Recurrence	Language	Level	Version
0	Each term	German	3	1

Mandatory			
T-MATH-100275	Advanced Mathematics I	7 CR	Arens, Griesmaier, Hettlich
T-MACH-100282	Engineering Mechanics I	7 CR	Böhlke, Langhoff
T-MACH-100283	Engineering Mechanics II	6 CR	Böhlke, Langhoff

Modelled deadline
This module must be passed until the end of the **3. term**.

M 7.32 Module: Physics [M-PHYS-104030]

Responsible: Prof. Dr. Gernot Goll
Prof. Dr. Bernd Pilawa

Organisation: KIT Department of Physics

Part of: Fundamentals of Engineering

Credits	Recurrence	Language	Level	Version
5	Each summer term	German/English	3	1

Mandatory			
T-PHYS-108322	Wave and Quantum Physics	5 CR	Goll, Pilawa

Competence Certificate
The assessment consists of a written exam according to Section 4(2), 1 of the examination regulation.

Competence Goal
The students

- are familiar with the properties of waves and can discuss those
- can reflect on the principles of relativity
- comprehend the coherence of the particle and wave description of light and matter
- can explain the limits of wave physics
- are able the apply the Schrödinger-equation to basic problems in quantum mechanics
- can explain the basic properties of atoms, especially for the hydrogen atom
- can discuss fundamental aspects of the electronic properties of solids

Prerequisites
None

Content

- Properties of waves
- Acoustic and electromagnetic waves
- Interference and diffraction
- Relativity
- Wave-particle dualism
- Basic properties of atoms
- Basic electronic properties of solids

Annotation
For the Bachelor's program Mechanical Engineering the module (including all brick details, exams and courses) is offered in German.

For the Bachelor's program Mechanical Engineering (International) the module (including all brick details, exams and courses) is offered in English.

Workload
150 hours, consisting of attendance times (45), follow-up of the lecture including exam preparation and preparation of exercises (105)

Learning type
Lecture and Tutorial

M 7.33 Module: Production Operations Management [M-MACH-100297]

Responsible: Prof. Dr.-Ing. Kai Furmans
Organisation: KIT Department of Mechanical Engineering

Part of: Fundamentals of Engineering

Credits	Recurrence	Language	Level	Version
5	Each winter term	German/English	3	2

Mandatory			
T-MACH-100304	Production Operations Management	3 CR	Furmans, Lanza, Schultmann
T-MACH-108734	Production Operations Management-Project	2 CR	Furmans, Lanza

Competence Certificate
The success control takes place in the form of partial examinations in the individual courses of the module. These are a written exam (duration: 90 minutes) and a different type of examination. The module grade is made up of the grades of the courses in the module weighted by credit points.

Competence Goal
If you successfully passed this course you will be able to:

- state the relevant technical terms of business administration, logistics and production engineering
- describe the interrelation between these technical terms
- describe the most important decision problems qualitatively and quantitatively
- apply the appropriate decision models to solve the respective decision problems
- critically evaluate the results and draw appropriate conclusions
- extend the learned methods and models by researching on you own

Prerequisites
none

Content
The institutes alternate with each cycle. Basic skills about the planning and operation of a production plant are taught. The lecture covers the basics of operations and supply chain management as well as business management basics in accounting, investment calculation and legal forms.

Annotation
It is a joint module of the Institute of Materials Handling and Logistics (IFL) and the Institute of Production Science (WBK).

For the Bachelor's program Mechanical Engineering the module (including all brick details, exams and courses) is offered in German.

For the Bachelor's program Mechanical Engineering (International) the module (including all brick details, exams and courses) is offered in English.

Workload
Attendance time: 42 hours,

Self-study: 108 hours

Learning type

1. Lectures (Obligatory)
2. Tutorials (Obligatory)
3. Group work (Obligatory)
4. Oral defense of the group work (Obligatory)

M 7.34 Module: Technical Thermodynamics (BSc-Modul 05, TTD) [M-MACH-102574]

Responsible: Prof. Dr. Ulrich Maas
Organisation: KIT Department of Mechanical Engineering

Part of: Fundamentals of Engineering

Credits	Recurrence	Duration	Language	Level	Version
15	Each winter term	2 term	German/English	3	1

Mandatory			
T-MACH-104747	Technical Thermodynamics and Heat Transfer I	8 CR	Maas
T-MACH-105287	Technical Thermodynamics and Heat Transfer II	7 CR	Maas
T-MACH-105204	Excercises in Technical Thermodynamics and Heat Transfer I	0 CR	Maas
T-MACH-105288	Excercises in Technical Thermodynamics and Heat Transfer II	0 CR	Maas

Competence Certificate
Prerequisite: attestation each semester by homework assignments

Thermodynamics I: Written exam, graded, 3 hours

Thermodynamics II: Written exam, graded, 3 hours

Competence Goal
The students acquire the competency to master the fundamentals of thermodynamics and the ability to apply the knowledge an problem-solving in various branches of mechanical engineering and especially in the Energy Technology sector.

An integral part of the model is that students can define the fundamental laws of thermodynamics and their application. The students are competent in describing and comparing the main processes in energy conversion. Using tools also applied in Industry they are capable of analysing and rating the efficiency of processes. The students are capable of discussing the thermodynamical correlation of ideal gas mixtures, real gases and of humid air as well analysing them with the help of the laws of thermodynamic. Furthermore the students are capable of defining and applying the heattransfer mechanisms.

Module grade calculation
weight according to CP

Prerequisites
None

Content
Thermodynamics I:

- System, properties of state
- Chemical and thermodynamic properties of pure components
- 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

Thermodynamics II:

- 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

Annotation
For the Bachelor’s program Mechanical Engineering the module (including all brick details, exams and courses) is offered in German.

For the Bachelor’s program Mechanical Engineering (International) the module (including all brick details, exams and courses) is offered in English.

Workload
lectures and exercises: 150h

homework and preparation of examination: 300h

Learning type
Lecture
Exercise course
Tutorial

8 Courses

T 8.1 Course: Advanced Mathematics I [T-MATH-100275]

Responsible: PD Dr. Tilo Arens
Prof. Dr. Roland Griesmaier
PD Dr. Frank Hettlich

Organisation: KIT Department of Mathematics

Part of: M-MACH-104624 - Orientation Exam
M-MATH-102859 - Advanced Mathematics

Type	Credits	Recurrence	Version
Written examination	7	Each term	3

Events					
WS 19/20	0131000	Höhere Mathematik I für die Fachrichtung Maschinenbau, Geodäsie, Materialwissenschaft und Werkstofftechnik	4 SWS	Lecture (V)	Arens
WS 19/20	0131200	Höhere Mathematik I für die Fachrichtungen Chemieingenieurwesen, Verfahrenstechnik, Bioingenieurwesen und MIT	4 SWS	Lecture (V)	Arens
Exams					
WS 19/20	6700007	Advanced Mathematics I		Prüfung (PR)	Arens, Griesmaier, Hettlich

Competence Certificate
Learning assessment is carried out by written examination of 120 minutes length.

Prerequisites
A "pass" result on the pre-requesite in AM I is a requirement for registration for the examination in AM I.

Modeled Conditions
The following conditions have to be fulfilled:

1. The course T-MATH-100525 - Tutorial Advanced Mathematics I must have been passed.

T 8.2 Course: Advanced Mathematics II [T-MATH-100276]

Responsible: PD Dr. Tilo Arens
Prof. Dr. Roland Griesmaier
PD Dr. Frank Hettlich

Organisation: KIT Department of Mathematics

Part of: M-MATH-102859 - Advanced Mathematics

Type	Credits	Recurrence	Version
Written examination	7	Each term	2

Events					
SS 2020	0180800	Höhere Mathematik II für die Fachrichtungen Maschinenbau, Geodäsie, Materialwissenschaft und Werkstofftechnik	4 SWS	Lecture (V)	Hettlich
SS 2020	0181000	Höhere Mathematik II für die Fachrichtungen Chemieingenieurwesen, Verfahrenstechnik, Bioingenieurwesen und MIT	4 SWS	Lecture (V)	Hettlich
Exams					
WS 19/20	6700008	Advanced Mathematics II		Prüfung (PR)	Arens, Griesmaier, Hettlich

Competence Certificate
Learning assessment is carried out by written examination of 120 minutes length.

Prerequisites
A "pass" result on the pre-requesite in AM II is a requirement for registration for the examination in AM II.

Modeled Conditions
The following conditions have to be fulfilled:

1. The course T-MATH-100526 - Tutorial Advanced Mathematics II must have been passed.

8.3 Course: Advanced Mathematics III [T-MATH-100277]

Responsible: PD Dr. Tilo Arens
Prof. Dr. Roland Griesmaier
PD Dr. Frank Hettlich

Organisation: KIT Department of Mathematics

Part of: M-MATH-102859 - Advanced Mathematics

Type	Credits	Recurrence	Version
Written examination	7	Each term	2

Events					
WS 19/20	0131400	Höhere Mathematik III für die Fachrichtungen Maschinenbau, Chemieingenieurwesen, Verfahrenstechnik, Bioingenieurwesen und das Lehramt Maschinenbau	4 SWS	Lecture (V)	Griesmaier
Exams					
WS 19/20	6700009	Advanced Mathematics III		Prüfung (PR)	Arens, Griesmaier, Hettlich

Competence Certificate
Learning assessment is carried out by written examination of 120 minutes length.

Prerequisites
A "pass" result on the pre-requesite in AM III is a requirement for registration for the examination in AM III.

Modeled Conditions
The following conditions have to be fulfilled:

1. The course T-MATH-100527 - Tutorial Advanced Mathematics III must have been passed.

T 8.4 Course: Advanced Methods in Strength of Materials [T-MACH-110835]

Responsible: Prof. Dr.-Ing. Thomas Böhlke
Prof. Dr.-Ing. Bettina Frohnapfel

Organisation:

Part of: M-MACH-102582 - Major Field: Continuum Mechanics

Type	Credits	Recurrence	Expansion	Version
Written examination	4	Each summer term	1 terms	1

Events					
WS 19/20	2161252	Continuum mechanics of solids and fluids	2 SWS	Lecture (V)	Böhlke, Frohnapfel

Competence Certificate
written examination (90 min); Additives as announced

There are no prerequisites within the Major Field 13 (Continuum Mechanics)

Annotation
This brick can only be chosen within the Major field 13 (Continuum Mechanics) of the Bachelor studies in Mechanical Engineering

Below you will find excerpts from events related to this course:

V Continuum mechanics of solids and fluids

Lecture (V)

2161252, WS 19/20, 2 SWS, Language: German, Open in study portal

Content

- introduction into tensor calculus
- kinematics
- balance laws of mechanics and thermodynamics
- material theory of solids and fluids
- field equations for solids and fluids
- thermomechanical couplings
- dimensional analysis

Literature
Vorlesungsskript

Greve, R.: Kontinuumsmechanik, Springer 2003

Liu, I-S.: Continuum Mechanics. Springer, 2002

Schade, H.: Strömungslehre, de Gruyter 2013

T 8.5 Course: Advanced Methods in Strength of Materials [T-MACH-110377]

Responsible: Prof. Dr.-Ing. Thomas Böhlke
Prof. Dr.-Ing. Bettina Frohnapfel

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102746 - Compulsory Elective Module

Type	Credits	Recurrence	Expansion	Version
Written examination	4	Each winter term	1 terms	1

Events					
WS 19/20	2161252	Continuum mechanics of solids and fluids	2 SWS	Lecture (V)	Böhlke, Frohnapfel
Exams					
WS 19/20	76-T-MACH-110377	Continuum mechanics of solids and fluids		Prüfung (PR)	Böhlke, Frohnapfel

Competence Certificate
Written examination (90 min). Additives as announced

prerequisites to the exam: passing the corresponding Tutorial Continuum Mechanics of Solids and Fluids (T-MACH-110333)

Prerequisites
passing the corresponding Tutorial Continuum Mechanics of Solids and Fluids (T-MACH-110333)

Modeled Conditions
The following conditions have to be fulfilled:

1. The course T-MACH-110333 - Tutorial Continuum Mechanics of Solids and Fluids must have been passed.

Below you will find excerpts from events related to this course:

V Continuum mechanics of solids and fluids

2161252, WS 19/20, 2 SWS, Language: German, Open in study portal

Lecture (V)

Content

- introduction into tensor calculus
- kinematics
- balance laws of mechanics and thermodynamics
- material theory of solids and fluids
- field equations for solids and fluids
- thermomechanical couplings
- dimensional analysis

Literature
Vorlesungsskript

Greve, R.: Kontinuumsmechanik, Springer 2003

Liu, I-S.: Continuum Mechanics. Springer, 2002

Schade, H.: Strömungslehre, de Gruyter 2013

T 8.6 Course: Agile Product Innovation Management - Value-driven Planning of New Products [T-MACH-106744]

Responsible: Dr.-Ing. Roland Kläger
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102583 - Major Field: Information Management

Type	Credits	Recurrence	Version
Oral examination	4	Each summer term	3

Competence Certificate
Oral examination, 20 min.

Prerequisites
None

T 8.7 Course: Airport Logistics [T-MACH-105175]

Responsible: Dr.-Ing. André Richter
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102821 - Major Field: Technical Logistics

Type	Credits	Recurrence	Version
Oral examination	3	Each winter term	2

Events					
WS 19/20	2117056	Airport logistics	2 SWS	Lecture (V)	Richter
Exams					
WS 19/20	76-T-MACH-105175	Airport Logistics		Prüfung (PR)	Richter, Furmans

Competence Certificate
The assessment consists of an oral exam (20 min.) taking place in the recess period according to § 4 paragraph 2 Nr. 2 of the examination regulation.

Prerequisites
none

Below you will find excerpts from events related to this course:

V Airport logistics

2117056, WS 19/20, 2 SWS, Language: German, Open in study portal

Lecture (V)

Content
Media
Presentations

Learning content

- Introduction
- Airport installations
- Luggage transport
- Passenger transport
- Security on the airport
- Legal bases of the air traffic
- Freight on the airport

Learning goals
The students are able to:

- Describe material handling and informations technology activities on airports,
- Evaluate processes and systems on airports as the law stands, and
- Choose appropriate processes and material handling systems for airports.

Recommendations
None

Workload
Regular attendance: 21 hours
Self-study: 99 hours

Note
Limited number of participants: allocation of places in sequence of registration (first come first served). Registration via "ILIAS" mandatory.
Personal presence during lectures mandatory.

Literature
„Gepäcklogistik auf Flughäfen“ à http://www.springer.com/de/book/9783642328527

T 8.8 Course: Alternative Powertrain for Automobiles [T-MACH-105655]

Responsible: Prof.Dipl.-Ing. Karl Ernst Noreikat
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102818 - Major Field: Vehicle Technology

Type	Credits	Recurrence	Version
Written examination	4	Each winter term	1

Events					
WS 19/20	2133132	Alternative Powertrains for Automobiles	2 SWS	Lecture (V)	Noreikat
Exams					
WS 19/20	76-T-MACH-105655	Alternative Powertrain for Automobiles		Prüfung (PR)	Noreikat
SS 2020	76-T-MACH-105655	Alternative Powertrain for Automobiles		Prüfung (PR)	Noreikat

Competence Certificate
written exam

Below you will find excerpts from events related to this course:

V Alternative Powertrains for Automobiles

2133132, WS 19/20, 2 SWS, Open in study portal

Lecture (V)

Content
History

Infrastructure

Market Situation

Legislation

Alternative Fuels

Innovative Drivetrains

Hybrids

Plug-In Hybrids

BEV

Fuel Cells

T 8.9 Course: Analysis of Exhaust Gas and Lubricating Oil in Combustion Engines [T-MACH-105173]

Responsible: Dr.-Ing. Marcus Gohl
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102645 - Major Field: Combustion Engine Techniques

Type	Credits	Recurrence	Version
Oral examination	4	Each summer term	1

Events					
SS 2020	2134150	Analysis of Exhaust Gas und Lubricating Oil in Combustion Engines	2 SWS	Lecture (V)	Gohl
Exams					
WS 19/20	76-T-MACH-105173	Analysis of Exhaust Gas and Lubricating Oil in Combustion Engines		Prüfung (PR)	Koch
SS 2020	76--T-Mach-105173	Analysis of Exhaust Gas and Lubricating Oil in Combustion Engines		Prüfung (PR)	Gohl

Competence Certificate
Letter of attendance or oral exam (25 minutes, no auxillary means)

Prerequisites
none

Below you will find excerpts from events related to this course:

V Analysis of Exhaust Gas und Lubricating Oil in Combustion Engines — Lecture (V)
2134150, SS 2020, 2 SWS, Language: German, Open in study portal

Literature
Die Vorlesungsunterlagen werden vor jeder Veranstaltung an die Studenten verteilt.

T 8.10 Course: Applied Tribology in Industrial Product Development [T-MACH-105215]

Responsible: Prof. Dr.-Ing. Albert Albers
Dr.-Ing. Benoit Lorentz
Prof. Dr.-Ing. Sven Matthiesen

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102812 - Major Field: Powertrain Systems
M-MACH-102815 - Major Field: Engineering Design

Type	Credits	Recurrence	Version
Oral examination	4	Each winter term	2

Events					
WS 19/20	2145181	Applied Tribology in Industrial Product Development	2 SWS	Lecture (V)	Lorentz
Exams					
WS 19/20	76-T-MACH-105215	Applied Tribology in Industrial Product Development		Prüfung (PR)	Lorentz, Albers

Competence Certificate
oral exam (20 min)

Prerequisites
None

Below you will find excerpts from events related to this course:

V Applied Tribology in Industrial Product Development — Lecture (V)

2145181, WS 19/20, 2 SWS, Language: German, Open in study portal

Content
The aim of the lecture is to discuss tribological problems, tribological features and the tribological variety on examples of the industry.

The students are able to

- define a tribological system,
- design a tribological system,
- discuss wear and damage impacts,
- explain measurement techniques to investigate tribological systems and
- show the limits of a tribological system.

Further content:

- Friction, Wear, Wear Measurement
- Lubricant (Oil, Grease, etc.)
- Hydrodynamic and elastohydrodynamic Lubrication
- Design of Tribologic Working Surface Pairs
- Technique of Measurement in Lubricated Contacts
- Prevention of Maschine Failure
- Protective Surface Layers
- Journal Bearings, Roller Bearings
- Gear Wheels and Transmissions

Regular attendance: 21 h

Self-study: 99 h

Exam: oral exam

Literature
Vorlesungsfolien werden im Ilias veröffentlicht.

The lecture script will be allocated at Ilias.

T 8.11 Course: Atomistic Simulations and Molecular Dynamics [T-MACH-105308]

Responsible: Dr. Christian Brandl
Prof. Dr. Peter Gumbsch
Dr.-Ing. Johannes Schneider

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102819 - Major Field: Materials Science and Engineering
M-MACH-104430 - Major Field: Modeling and Simulation in Dynamics

Type	Credits	Recurrence	Version
Oral examination	4	Each summer term	2

Events					
SS 2020	2181740	Atomistic simulations and molecular dynamics	2 SWS	Lecture (V)	Gumbsch, Weygand
SS 2020	2181741	Lab for 'Atomistic simulations and molecular dynamics'	2 SWS	Practice (Ü)	Gumbsch, Weygand
Exams					
WS 19/20	76-T-MACH-105308	Atomistic Simulations and Molecular Dynamics		Prüfung (PR)	Gumbsch

Competence Certificate
oral exam ca. 30 minutes

Prerequisites
none

Recommendation
preliminary knowlegde in mathematics, physics and materials science

Below you will find excerpts from events related to this course:

V Atomistic simulations and molecular dynamics

2181740, SS 2020, 2 SWS, Language: English, Open in study portal

Lecture (V)

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. statics, dynamics, thermodynamics
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

Exercises (2181741, 2 SWS) are used for complementing and deepening the contents of the lecture as well as for answering more extensive questions raised by the students.

The student can

- describe the physical foundation of particle based simulation method (e.g. molecular dynamics)
- apply particle based simulation methods to problems in materials science

preliminary knowlegde in mathematics, physics and materials science recommended

regular attendance: 22,5 hours
exercise: 22,5 hours
self-study: 75 hours

oral exam ca. 30 minutes

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.

V **Lab for 'Atomistic simulations and molecular dynamics'** **Practice (Ü)**
2181741, SS 2020, 2 SWS, Language: English, Open in study portal

Content
Introduction to the basic usage of the MD software package IMD:

* generating initial structures
* energy calculations
* defects in lattices
* visualization of MD structures

The students will be able to use a standard molecular dyanamics software package.

Literature
siehe Voprlesung

T 8.12 Course: Automated Manufacturing Systems [T-MACH-102162]

Responsible: Prof. Dr.-Ing. Jürgen Fleischer
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102589 - Major Field: Production Systems

Type	Credits	Recurrence	Version
Written examination	9	Each summer term	2

Events					
SS 2020	2150904	Automated Manufacturing Systems	6 SWS	Lecture / Practice (VÜ)	Fleischer
Exams					
WS 19/20	76-T-MACH-102162	Automated Manufacturing Systems		Prüfung (PR)	Fleischer

Competence Certificate
written exam (120 minutes)

Prerequisites
"T-MACH-108844 - Automatisierte Produktionsanlagen" must not be commenced.

Modeled Conditions
The following conditions have to be fulfilled:

1. The course T-MACH-108844 - Automated Manufacturing Systems must not have been started.

Below you will find excerpts from events related to this course:

V Automated Manufacturing Systems

Lecture / Practice (VÜ)

2150904, SS 2020, 6 SWS, Language: German, Open in study portal

Content

The lecture provides an overview of the structure and functioning of automated manufacturing systems. In the introduction chapter the basic elements for the realization of automated manufacturing systems are given. This includes:

- Drive and control technology
- Handling technology for handling work pieces and tools
- Industrial Robotics
- Quality assurance in automated manufacturing
- automatic machines, cells, centers and systems for manufacturing and assembly
- structures of multi-machine systems
- planning of automated manufacturing systems

An interdisciplinary view of these subareas enables Industry 4.0 solutions.
In the second part of the lecture, the basics are illustrated using implemented manufacturing processes for the production of automotive components (chassis and drive technology).The analysis of automated manufacturing systems for manufacturing of defined components is also included.
In the field of vehicle power train both, the automated manufacturing process for the production of the conventional internal-combustion engine and the automated manufacturing process for the production of the prospective electric power train
(electric motor and battery) are considered. In the field of car body, the focus is on the analysis of the process chain for the automated manufacturing of conventional sheet metal body parts, as well as for automated manufacturing of body components made out of
fiber-reinforced plastics.
Within tutorials, the contents from the lecture are advanced and applied to specific problems and tasks.

Learning Outcomes:

The students …

- are able to analyze implemented automated manufacturing systems and describe their components.
- are capable to assess the implemented examples of implemented automated manufacturing systems and apply them to new problems.
- are able to name automation tasks in manufacturing plants and name the components which are necessary for the implementation of each automation task.
- are capable with respect to a given task to plan the configuration of an automated manufacturing system and to determine the necessary components to its realization.
- are able to design and select components for a given use case of the categories: "Handling Technology", "Industrial Robotics", "Sensory" and "Controls".
- are capable to compare different concepts for multi-machine systems and select a suitable concept for a given use case.

Workload:

MACH:
regular attendance: 63 hours
self-study: 177 hours
WING:
regular attendance: 63 hours
self-study: 207 hours

Literature
Medien:
Skript zur Veranstaltung wird über (https://ilias.studium.kit.edu/) bereitgestellt.

Media:
Lecture notes will be provided in Ilias (https://ilias.studium.kit.edu/).

T 8.13 Course: Automated Manufacturing Systems [T-MACH-108844]

Responsible: Prof. Dr.-Ing. Jürgen Fleischer
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102818 - Major Field: Vehicle Technology
M-MACH-102820 - Major Field: Mechatronics
M-MACH-102821 - Major Field: Technical Logistics

Type	Credits	Recurrence	Version
Oral examination	8	Each summer term	1

Events					
SS 2020	2150904	Automated Manufacturing Systems	6 SWS	Lecture / Practice (VÜ)	Fleischer
Exams					
WS 19/20	76-T-MACH-108844	Automated Manufacturing Systems		Prüfung (PR)	Fleischer

Competence Certificate
oral exam (40 minutes)

Prerequisites
"T-MACH-102162 - Automatisierte Produktionsanlagen" must not be commenced.

Modeled Conditions
The following conditions have to be fulfilled:

1. The course T-MACH-102162 - Automated Manufacturing Systems must not have been started.

Below you will find excerpts from events related to this course:

V Automated Manufacturing Systems
2150904, SS 2020, 6 SWS, Language: German, Open in study portal

Lecture / Practice (VÜ)

Content
The lecture provides an overview of the structure and functioning of automated manufacturing systems. In the introduction chapter the basic elements for the realization of automated manufacturing systems are given. This includes:

- Drive and control technology
- Handling technology for handling work pieces and tools
- Industrial Robotics
- Quality assurance in automated manufacturing
- automatic machines, cells, centers and systems for manufacturing and assembly
- structures of multi-machine systems
- planning of automated manufacturing systems

An interdisciplinary view of these subareas enables Industry 4.0 solutions.
In the second part of the lecture, the basics are illustrated using implemented manufacturing processes for the production of automotive components (chassis and drive technology).The analysis of automated manufacturing systems for manufacturing of defined components is also included.
In the field of vehicle power train both, the automated manufacturing process for the production of the conventional internal-combustion engine and the automated manufacturing process for the production of the prospective electric power train
(electric motor and battery) are considered. In the field of car body, the focus is on the analysis of the process chain for the automated manufacturing of conventional sheet metal body parts, as well as for automated manufacturing of body components made out of
fiber-reinforced plastics.
Within tutorials, the contents from the lecture are advanced and applied to specific problems and tasks.

Learning Outcomes:

The students …

- are able to analyze implemented automated manufacturing systems and describe their components.
- are capable to assess the implemented examples of implemented automated manufacturing systems and apply them to new problems.
- are able to name automation tasks in manufacturing plants and name the components which are necessary for the implementation of each automation task.
- are capable with respect to a given task to plan the configuration of an automated manufacturing system and to determine the necessary components to its realization.
- are able to design and select components for a given use case of the categories: "Handling Technology", "Industrial Robotics", "Sensory" and "Controls".
- are capable to compare different concepts for multi-machine systems and select a suitable concept for a given use case.

Workload:

MACH:
regular attendance: 63 hours
self-study: 177 hours
WING:
regular attendance: 63 hours
self-study: 207 hours

Literature
Medien:
Skript zur Veranstaltung wird über (https://ilias.studium.kit.edu/) bereitgestellt.

Media:
Lecture notes will be provided in Ilias (https://ilias.studium.kit.edu/).

T 8.14 Course: Automated Production Systems (MEI) [T-MACH-106732]

Responsible: Prof. Dr.-Ing. Jürgen Fleischer
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102644 - Major Field: Production Engineering

Type	Credits	Recurrence	Version
Oral examination	4	Each summer term	1

Events					
SS 2020	3150012	Automated Production Systems (MEI)	2 SWS	Lecture (V)	Fleischer
Exams					
WS 19/20	76-T-MACH-106732	Automated Production Systems (MEI)		Prüfung (PR)	Fleischer

Competence Certificate
oral exam (20 min)

Prerequisites
none

Below you will find excerpts from events related to this course:

V Automated Production Systems (MEI)
3150012, SS 2020, 2 SWS, Language: English, Open in study portal

Lecture (V)

Content
The lecture provides an overview of the structure and functioning of automated production systems. In the introduction chapter the basic elements for the realization of automated production systems are given. This includes:

- Drive and control technology
- Handling technology for handling work pieces and tools
- Industrial Robotics
- automatic machines, cells, centers and systems for manufacturing and assembly
- planning of automated manufacturing systems

In the second part of the lecture, the basics are illustrated using implemented manufacturing processes for the production of automotive components. The analysis of automated manufacturing systems for manufacturing of defined components is also included.

Learning Outcomes:
The students …

- are able to analyze implemented automated manufacturing systems and describe their components.
- are capable to assess the implemented examples of implemented automated manufacturing systems and apply them to new problems.
- are able to name automation tasks in manufacturing plants and name the components which are necessary for the implementation of each automation task.

T 8.15 Course: Automotive Engineering I [T-MACH-100092]

Responsible: Prof. Dr. Frank Gauterin
Dr.-Ing. Hans-Joachim Unrau

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102815 - Major Field: Engineering Design
M-MACH-102818 - Major Field: Vehicle Technology

Type	Credits	Recurrence	Expansion	Language	Version
Written examination	8	Each winter term	1 terms		3

Events					
WS 19/20	2113805	Automotive Engineering I	4 SWS	Lecture (V)	Gauterin, Unrau
WS 19/20	2113809	Automotive Engineering I	4 SWS	Lecture (V)	Gauterin, Gießler
Exams					
WS 19/20	76-T-MACH-100092	Automotive Engineering		Prüfung (PR)	Unrau, Gauterin

Competence Certificate
Written examination

Duration: 120 minutes

Auxiliary means: none

Prerequisites
The brick "T-MACH-102203 - Automotive Engineering I" is not started or finished. The bricks "T-MACH-100092 - Grundlagen der Fahrzeugtechnik I" and "T-MACH-102203 - Automotive Engineering I" can not be combined.

Below you will find excerpts from events related to this course:

V Automotive Engineering I

2113805, WS 19/20, 4 SWS, Language: German, Open in study portal

Lecture (V)

Content
1. History and future of the automobile

2. Driving mechanics: driving resistances and driving performance, mechanics of longitudinal and lateral forces, active and passive safety

3. Drive systems: combustion engine, hybrid and electric drive systems

4. Transmission: clutches (e.g. friction clutch, visco clutch), transmission (e.g. mechanical transmission, hydraulic fluid transmission)

5. Power transmission and distribution: drive shafts, cardon joints, differentials

Learning Objectives:

The students know the movements and the forces at the vehicle and are familiar with active and passive safety. 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 have the basic knowledge, to analyze, to evaluate, and to develop the complex system "vehicle".

Literature
1. Mitschke, M. / Wallentowitz, H.: Dynamik der Kraftfahrzeuge, Springer Vieweg, Wiesbaden 2014

2. Pischinger, S. / Seiffert, U.: Handbuch Kraftfahrzeugtechnik, Springer Vieweg, Wiesbaden 2016

3. Gauterin, F. / Unrau, H.-J. / Gnadler, R.: Scriptum zur Vorlesung "Grundlagen der Fahrzeugtechnik I", KIT, Institut für Fahrzeugsystemtechnik, Karlsruhe, jährlich aktualisiert

V **Automotive Engineering I**
2113809, WS 19/20, 4 SWS, Language: English, Open in study portal

Lecture (V)

Content
1. History and future of the automobile

2. Driving mechanics: driving resistances and driving performances, mechanics of longitudinal and lateral forces, active and passive safety

3. Drive systems: combustion engine, hybrid and electric drive systems

4. Transmission: clutches (e.g. friction clutch, visco clutch), transmission (e.g. mechanical transmission, hydraulic fluid transmission)

5.Power transmission and distribution: drive shafts, cardon joints, differentials

Learning Objectives:

The students know the movements and the forces at the vehicle and are familiar with active and passive safety. 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 have the basic knowledge, to analyze, to evaluate, and to develop the complex system "vehicle".

Literature
1. Robert Bosch GmbH: Automotive Handbook, 9th Edition, Wiley, Chichister 2015

2. Onori, S. / Serrao, L: / Rizzoni, G.: Hybrid Electric Vehicles - Energy Management Strategies, Springer London, Heidelberg, New York, Dordrecht 2016

3. Reif, K.: Brakes, Brake Control and Driver Assistance Systems - Function, Regulation and Components, Springer Vieweg, Wiesbaden 2015

4. Gauterin, F. / Gießler, M. / Gnadler, R.: Scriptum zur Vorlesung 'Automotive Engineering I', KIT, Institut für Fahrzeugsystemtechnik, Karlsruhe, jährlich aktualisiert

T 8.16 Course: Automotive Engineering II [T-MACH-102117]

Responsible: Prof. Dr. Frank Gauterin
Dr.-Ing. Hans-Joachim Unrau

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102818 - Major Field: Vehicle Technology

Type	Credits	Recurrence	Version
Written examination	4	Each summer term	1

Events					
SS 2020	2114835	Automotive Engineering II	2 SWS	Lecture (V)	Unrau
SS 2020	2114855	Automotive Engineering II	2 SWS	Lecture (V)	Gießler
Exams					
WS 19/20	76-T-MACH-102117	Automotive Engineering II		Prüfung (PR)	Unrau, Gauterin
WS 19/20	76T-MACH-102117-2	Automotive Engineering II		Prüfung (PR)	Gauterin, Unrau

Competence Certificate
Written Examination

Duration: 90 minutes

Auxiliary means: none

Prerequisites
none

Below you will find excerpts from events related to this course:

V Automotive Engineering II

2114835, SS 2020, 2 SWS, Language: German, Open in study portal

Lecture (V)

Content
1. Chassis: Wheel suspensions (rear axles, front axles, kinematics of axles), tyres, springs, damping devices
2. Steering elements: Manual steering, servo steering, steer by wire
3. Brakes: Disc brake, drum brake, comparison of designs

Learning Objectives:

The students have an overview of the modules which are necessary for the tracking of a motor vehicle and the power transmission between vehicle bodywork and roadway. They have knowledge of different wheel suspensions, tyres, steering elements, and brakes. They know different design versions, functions and the influence on driving and braking behavior. They are able to correctly develop the appropriate components. They are ready to analyze, to evaluate, and to optimize the complex interaction of the different components under consideration of boundary conditions.

Literature
1. Heißing, B. / Ersoy, M.: Fahrwerkhandbuch: Grundlagen, Fahrdynamik, Komponenten, Systeme, Mechatronik, Perspektiven, Springer Vieweg, Wiesbaden, 2013

2. Breuer, B. / Bill, K.-H.: Bremsenhandbuch: Grundlagen - Komponenten - Systeme - Fahrdynamik, Springer Vieweg, Wiesbaden, 2017

3. Unrau, H.-J. / Gnadler, R.: Scriptum zur Vorlesung 'Grundlagen der Fahrzeugtechnik II', KIT, Institut für Fahrzeugsystemtechnik, Karlsruhe, jährliche Aktualisierung

V

Automotive Engineering II

2114855, SS 2020, 2 SWS, Language: English, Open in study portal

Lecture (V)

Content

1. Chassis: Wheel suspensions (rear axles, front axles, kinematics of axles), tyres, springs, damping devices
2. Steering elements: Manual steering, servo steering, steer by wire
3. Brakes: Disc brake, drum brake, comparison of the designs

Learning Objectives:

The students have an overview of the modules which are necessary for the tracking of a motor vehicle and the power transmission between vehicle and roadway. They have knowledge of different wheel suspensions, tyres, steering elements, and brakes. They know different design versions, functions and the influence on driving and braking behavior. They are able to correctly develop the appropriate components. They are ready to analyze, to evaluate, and to optimize the complex interaction of the different components under consideration of boundary conditions.

Literature
Elective literature:

1. Robert Bosch GmbH: Automotive Handbook, 9th Edition, Wiley, Chichester 2015
2. Heißing, B. / Ersoy, M.: Chassis Handbook - fundamentals, driving dynamics, components, mechatronics, perspectives, Vieweg+Teubner, Wiesbaden 2011
3. Gießler, M. / Gnadler, R.: Script to the lecture "Automotive Engineering II", KIT, Institut of Vehicle System Technology, Karlsruhe, annual update

T 8.17 Course: Automotive Vision [T-MACH-105218]

Responsible: Dr. Martin Lauer
Prof. Dr.-Ing. Christoph Stiller

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102638 - Major Field: Rail System Technology
M-MACH-102817 - Major Field: Information Technology
M-MACH-102818 - Major Field: Vehicle Technology
M-MACH-102820 - Major Field: Mechatronics

Type	Credits	Recurrence	Version
Written examination	6	Each summer term	2

Events					
SS 2020	2138340	Automotive Vision	3 SWS	Lecture (V)	Lauer
Exams					
WS 19/20	76-T-MACH-105218	Automotive Vision		Prüfung (PR)	Stiller, Lauer

Competence Certificate
Type of Examination: written exam

Duration of Examination: 60 minutes

Prerequisites
none

Below you will find excerpts from events related to this course:

V Automotive Vision
2138340, SS 2020, 3 SWS, Language: German, Open in study portal

Lecture (V)

Content
Lernziele (EN):

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.

Lehrinhalt (EN):

1. Driver assistance systems
2. Binocular vision
3. Feature point methods
4. Optical flow/tracking in images
5. Tracking and state estimation
6. Self-localization and mapping
7. Lane recognition
8. Behavior recognition

Nachweis: Written examination 60 minutes

Arbeitsaufwand (EN): 120 hours

Literature
Foliensatz zur Veranstaltung wird als kostenlose pdf-Datei bereitgestellt. Weitere Empfehlungen werden in der Vorlesung bekannt gegeben.

T 8.18 Course: Bachelor Thesis [T-MACH-109188]

Responsible:	Prof. Dr.-Ing. Martin Heilmaier
Organisation:	KIT Department of Mechanical Engineering
Part of:	M-MACH-104494 - Bachelor Thesis

Type	Credits	Recurrence	Version
Final Thesis	12	Each term	1

Competence Certificate
The bachelor thesis is designed to show that the student is able to deal with a problem of his/her subject area in an independent manner and within the given period of time using scientific methods.

The work load of the bachelor thesis corresponds to 12 ECTS. The maximal processing time of the bachelor thesis takes three months. The date of issue of the subject has to be fixed by the supervisor and the student and to be put on record at the examination board. The subject of the bachelor thesis may be only returned once and only within the first month of processing time.

On a reasoned request of the student, the examination board can extend the processing time by up to one month. If the bachelor thesis is not completed in time, this examination is "failed" (5,0), unless the student is not responsible.

The bachelor thesis is to be evaluated by not less than a professor or a senior scientist according to § 14 Abs. 3 Ziff. 1 KITG and another examiner. Generally, one of the two examiners is the person who has assigned the thesis. If the examiners do not agree, the bachelor thesis is graded by the examination board within this assessment; another expert can be appointed too. The bachelor thesis has to be graded within a period of six weeks after the submission.

Prerequisites
The requirement for admission to the bachelor thesis module are 120 ECTS. As to exceptions, the examination board decides on a request of the student (see § 14 (1) SPO).

Modeled Conditions
The following conditions have to be fulfilled:

1. You need to earn at least 120 credits in the following fields:
    - Fundamentals of Engineering
    - Interdisciplinary Qualifications
    - Specialization in Mechanical Engineering

Final Thesis
This course represents a final thesis. The following periods have been supplied:

Submission deadline	3 months
Maximum extension period	1 months
Correction period	6 weeks

Annotation
The workload for the preparation of the bachelor thesis is about 360 hours.

T 8.19 Course: Basics in Measurement and Control Systems [T-MACH-104745]

Responsible: Prof. Dr.-Ing. Christoph Stiller
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102564 - Measurement and Control Systems

Type	Credits	Recurrence	Version
Written examination	7	Each winter term	3

Events					
WS 19/20	2137301	Measurement and Control Systems	3 SWS	Lecture (V)	Stiller
WS 19/20	2137302	Measurement and Control Systems (Tutorial)	1 SWS	Practice (Ü)	Stiller, Kroeper, Fischer
WS 19/20	3137020	Measurement and Control Systems	3 SWS	Lecture (V)	Stiller
WS 19/20	3137021	Measurement and Control Systems (Tutorial)	1 SWS	Practice (Ü)	Stiller, Kroeper, Fischer
Exams					
WS 19/20	76-T-MACH-104745	Basis of Measurement and Control Systems		Prüfung (PR)	Stiller

Competence Certificate
written exam

2,5 hours

Prerequisites
none

Below you will find excerpts from events related to this course:

V Measurement and Control Systems

Lecture (V)

2137301, WS 19/20, 3 SWS, Language: German, Open in study portal

Content
Lehrinhalt (EN):

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

Lernziele (EN):

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.

Voraussetzungen (EN)

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

Nachweis (EN)

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

Arbeitsaufwand (EN):

210 hours

Literature
Buch zur Vorlesung:
C. Stiller: Grundlagen der Mess- und Regelungstechnik, Shaker Verlag, Aachen, 2005

- 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

V **Measurement and Control Systems** **Lecture (V)**
3137020, WS 19/20, 3 SWS, Language: English, Open in study portal

Content
Lehrinhalt (EN):

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 measuremen

Lernhziele (EN):

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.

Nachweis (EN): written exam; duration 2,5 h; paper reference materials only (no calculator)

Arbeitsaufwand (EN): 180 hours

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

V **Measurement and Control Systems (Tutorial)** **Practice (Ü)**
3137021, WS 19/20, 1 SWS, Language: English, Open in study portal

Content
Tutorial for Event 3137020

T 8.20 Course: Basics of Manufacturing Technology [T-MACH-105219]

Responsible: Prof. Dr.-Ing. Volker Schulze
Dr.-Ing. Frederik Zanger

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102549 - Manufacturing Processes

Type	Credits	Recurrence	Version
Written examination	4	Each winter term	1

Events					
WS 19/20	2149658	Basics of Manufacturing Technology	2 SWS	Lecture / Practice (VÜ)	Schulze, Zanger
Exams					
WS 19/20	76-T-MACH-105219	Fundamentals of Manufacturing Technology		Prüfung (PR)	Schulze

Competence Certificate
written exam (duration: 60 min)

Prerequisites
none

Below you will find excerpts from events related to this course:

V Basics of Manufacturing Technology

Lecture / Practice (VÜ)

2149658, WS 19/20, 2 SWS, Language: German, Open in study portal

Content

The objective of the lecture is to classify the manufacturing technology within the wider context of production engineering, to provide an overview of the different manufacturing processes and to establish basic process knowledge of the common processes. The lecture conveys the basic principles of manufacturing technology and deals with the manufacturing processes based on example components according to their classification into main groups regarding technical and economic aspects. Regard is paid to classic manufacturing processes as well as new developments like additive manufacturing processes.

The following topics will be covered:

- Primary processing (casting, plastics engineering, sintering, additive manufacturing processes)
- Forming (sheet-metal forming, massive forming)
- Cutting (machining with geometrically defined and geometrically undefined cutting edges, separating, abrading)
- Joining
- Coating
- Heat treatment and surface treatment

Learning Outcomes:

The students ...

- are able to classify the manufacturing processes by their general functionality according to the specific main groups (DIN 8580).
- have the ability to declare and explain the function of the significant manufacturing processes of the main groups (DIN 8580).
- are enabled to describe the characteristic process features (geometry, materials, accuracy, tools, machines) of the significant manufacturing processes of the main groups (DIN 8580).
- have the ability to derive the relevant process specific technical advantages and disadvantages of the characteristic process features.
- are enabled to perform a selection of suitable manufacturing processes for given components.
- are enabled to classify the required manufacturing processes in the expiry of a process chain for the production of given sample products.

Workload:

regular attendance: 21 hours
self-study: 99 hours

Literature

Medien:

Skript zur Veranstaltung wird über ilias (https://ilias.studium.kit.edu/)
bereitgestellt.

Media:

Lecture notes will be provided in ilias (https://ilias.studium.kit.edu/).

T 8.21 Course: Basics of Technical Logistics I [T-MACH-109919]

Responsible: Dr.-Ing. Martin Mittwollen
Jan Oellerich

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102746 - Compulsory Elective Module
M-MACH-102821 - Major Field: Technical Logistics

Type	Credits	Recurrence	Version
Written examination	4	Each winter term	1

Events					
WS 19/20	2117095	Basics of Technical Logistics	3 SWS	Lecture / Practice (VÜ)	Mittwollen, Oellerich
Exams					
WS 19/20	76-T-MACH-109919	Basics of Technical Logistics I		Prüfung (PR)	Mittwollen

Competence Certificate
The assessment consists of a written exam (60 min.) according to § 4 paragraph 2 Nr. 1 of the examination regulation.

Prerequisites
none

Recommendation
Knowledge of the basics of technical mechanics preconditioned.

Below you will find excerpts from events related to this course:

V Basics of Technical Logistics
2117095, WS 19/20, 3 SWS, Language: German, Open in study portal

Lecture / Practice (VÜ)

Content

- effect model of conveyor machines
- elements 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
- sample applications and calculations in addition to the lectures inside practical lectures

Students are able to:

- Describe processes and machines of technical logistics,
- Model the fundamental structures and the impacts of material handling machines with mathematical models,
- Refer to industrially used machines
- Model real machines applying knowledge from lessons and calculate their dimensions.

Literature
Empfehlungen in der Vorlesung / Recommendations during lessons

T 8.22 Course: Basics of Technical Logistics II [T-MACH-109920]

Responsible: Maximilian Hochstein
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102821 - Major Field: Technical Logistics

Type	Credits	Recurrence	Version
Written examination	5	Each winter term	1

Events					
WS 19/20	2100001	Basics of Technical Logistics II	3 SWS	Lecture / Practice (VÜ)	Hochstein
Exams					
WS 19/20	76-T-MACH-109920	Basics of Technical Logistics II		Prüfung (PR)	Mittwollen

Competence Certificate
The assessment consists of a written exam (60 min.) according to § 4 paragraph 2 Nr. 1 of the examination regulation.

Prerequisites
none

Recommendation
Knowledge of the basics of technical mechanics and out of "Basic of Technical Logstics I" (T-MACH-109919) preconditioned.

T 8.23 Course: Behaviour Generation for Vehicles [T-MACH-105367]

Responsible: Prof. Dr.-Ing. Christoph Stiller
Dr. Moritz Werling

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102817 - Major Field: Information Technology
M-MACH-102818 - Major Field: Vehicle Technology
M-MACH-102820 - Major Field: Mechatronics
M-MACH-102821 - Major Field: Technical Logistics

Type	Credits	Recurrence	Version
Written examination	4	Each summer term	1

Events					
WS 19/20	2138336	Behaviour Generation for Vehicles	2 SWS	Lecture (V)	Werling, Stiller
SS 2020	2138336	Behaviour Generation for Vehicles	2 SWS	Lecture (V)	Werling, Stiller
Exams					
WS 19/20	76-T-MACH-105367	Behaviour Generation for Vehicles		Prüfung (PR)	Stiller

Competence Certificate
written examination

60 min.

Simple calculators are allowed, programmable or graphical ones are prohibited.

Prerequisites
none

Below you will find excerpts from events related to this course:

V Behaviour Generation for Vehicles

2138336, WS 19/20, 2 SWS, Language: German, Open in study portal

Lecture (V)

Content
Lernziele (EN):

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.

Nachweis: written exam

Arbeitsaufwand: 120 hours

Literature
Foliensatz zur Veranstaltung wird als kostenlose pdf-Datei bereitgestellt. Weitere Empfehlungen werden in der Vorlesung bekannt gegeben.

V Behaviour Generation for Vehicles

2138336, SS 2020, 2 SWS, Language: German, Open in study portal

Lecture (V)

Content
Lernziele (EN):

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.

Nachweis: written exam 60 minutes

Arbeitsaufwand: 120 hours

Literature
Foliensatz zur Veranstaltung wird als kostenlose pdf-Datei bereitgestellt. Weitere Empfehlungen werden in der Vorlesung bekannt gegeben.

T 8.24 Course: Biomechanics: Design in Nature and Inspired by Nature [T-MACH-105651]

Responsible: Prof. Dr. Claus Mattheck
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102819 - Major Field: Materials Science and Engineering

Type	Credits	Recurrence	Version
Completed coursework	4	Each winter term	1

Events					
WS 19/20	2181708	Biomechanics: Design in Nature and Inspired by Nature	3 SWS		Mattheck
Exams					
WS 19/20	76-T-MACH-105651	Biomechanics: design in nature and inspired by nature		Prüfung (PR)	Mattheck

Competence Certificate
Colloquium, ungraded.

Prerequisites
The number of participants is limited. Prior registration through ILIAS is necessary, In case of too many registrations, a selection (in accordance with SPO) will take place.

Before the registration in SP 26 (ME) or SP 01 (MSMT) the participation at the seminar must be confirmed.

Below you will find excerpts from events related to this course:

V Biomechanics: Design in Nature and Inspired by Nature
2181708, WS 19/20, 3 SWS, Language: German, Open in study portal

Content
* mechanics and growth laws of trees
* failure criteria and safety factors
* computer simulation of adaptive growth
* notches and damage case studies
* optimization inspired by nature
* structural shape optimization without computers
* universal shapes of nature
* fibre reinforces materials
* failure of trees, hillsides, dikes, walls and pipes

The students know and understand mechanical optimization schemes which are realized in nature. The students can analyze the derived thinking tools and can apply them for simple technical cases.

regular attendance: 30 hours
self-study: 90 hours

T 8.25 Course: BUS-Controls [T-MACH-102150]

Responsible: Simon Becker
Prof. Dr.-Ing. Marcus Geimer

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102817 - Major Field: Information Technology
M-MACH-102820 - Major Field: Mechatronics

Type	Credits	Recurrence	Version
Oral examination	4	Each summer term	2

Events					
SS 2020	2114092	BUS-Controls	2 SWS	Lecture (V)	Geimer, Daiß
Exams					
WS 19/20	76T-MACH-102150	BUS-Controls		Prüfung (PR)	Geimer
WS 19/20	76-T-MACH-102150	BUS-Controls		Prüfung (PR)	Geimer
SS 2020	76T-MACH-102150	BUS-Controls		Prüfung (PR)	Geimer

Competence Certificate
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.

Prerequisites
Required for the participation in the examination is the preparation of a report during the semester. The partial service with the code T-MACH-108889 must have been passed.

Modeled Conditions
The following conditions have to be fulfilled:

1. The course T-MACH-108889 - BUS-Controls - Advance must have been passed.

Recommendation
Basic knowledge of electrical engineering is recommended. Programming skills are also helpful.

The number of participants is limited. A registration in mandatory, the details will be announced on the webpages of the *Institute of Vehicle System Technology / Institute of Mobile Machines.* In case of too many applications, attendance will be granted based on pre-qualification.

Annotation
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.
Hereunto the students program in the practical orientated lessons IFM-controllers using the programming environment CoDeSys.

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:

- 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.

Below you will find excerpts from events related to this course:

V

BUS-Controls

2114092, SS 2020, 2 SWS, Language: German, Open in study portal

Lecture (V)

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)

Basic knowledge of electrical engineering is recommended. Programming skills are also helpful.

- regular attendance: 21 hours
- self-study: 92 hours

Literature
Weiterführende Literatur:

- 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.

T 8.26 Course: BUS-Controls - Advance [T-MACH-108889]

Responsible: Kevin Daiß
Prof. Dr.-Ing. Marcus Geimer

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102817 - Major Field: Information Technology
M-MACH-102820 - Major Field: Mechatronics

Type	Credits	Recurrence	Version
Completed coursework	0	Each summer term	1

Exams				
WS 19/20	76-T-MACH-108889	BUS-Controls - Advance	Prüfung (PR)	Geimer
SS 2020	76-T-MACH-108889	BUS-Controls - Advance	Prüfung (PR)	Geimer

Competence Certificate
Creation of control program

Prerequisites
none

T 8.27 Course: CAD-NX Training Course [T-MACH-102187]

Responsible: Prof. Dr.-Ing. Jivka Ovtcharova
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102583 - Major Field: Information Management

Type	Credits	Recurrence	Version
Completed coursework (practical)	2	Each term	2

Events					
WS 19/20	2123357	CAD-NX training course	2 SWS	Practical course (P)	Ovtcharova, Mitarbeiter
SS 2020	2123357	CAD-NX training course	2 SWS	Practical course (P)	Ovtcharova, Mitarbeiter
Exams					
WS 19/20	76-T-MACH-102187	CAD-NX Training Course		Prüfung (PR)	Ovtcharova

Competence Certificate
Practical examination on CAD computer, duration: 60 min.

Prerequisites
None

Recommendation
Dealing with technical drawings is required.

Annotation
For the practical course compulsory attendance exists.

Below you will find excerpts from events related to this course:

V CAD-NX training course

2123357, WS 19/20, 2 SWS, Language: German, Open in study portal

Practical course (P)

Content

- Overview of the functional range
- Introduction to the work environment of NX
- 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 NX

Students are able to:

- create their own 3D geometric models in the CAD system NX and generate drawings due to the created geometry
- carry out FE-studies and kinematic simulations using the integrated CAE tools
- use advanced, knowledge-based functionalities of NX to automate the creation of geometry and thus to ensure the reusability of the models.

Literature
Praktikumsskript

V **CAD-NX training course** **Practical course (P)**

2123357, SS 2020, 2 SWS, Language: German, Open in study portal

Content

- Overview of the functional range
- Introduction to the work environment of NX
- 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 NX

Students are able to:

- create their own 3D geometric models in the CAD system NX and generate drawings due to the created geometry
- carry out FE-studies and kinematic simulations using the integrated CAE tools
- use advanced, knowledge-based functionalities of NX to automate the creation of geometry and thus to ensure the reusability of the models.

Literature
Praktikumsskript

T 8.28 Course: CAE-Workshop [T-MACH-105212]

Responsible: Prof. Dr.-Ing. Albert Albers
Prof. Dr.-Ing. Sven Matthiesen

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102583 - Major Field: Information Management
M-MACH-102746 - Compulsory Elective Module
M-MACH-102815 - Major Field: Engineering Design
M-MACH-102820 - Major Field: Mechatronics

Type	Credits	Recurrence	Version
Examination of another type	4	Each term	2

Events					
WS 19/20	2147175	CAE-Workshop	3 SWS	Block (B)	Albers, Mitarbeiter
SS 2020	2147175	CAE-Workshop	3 SWS	Block (B)	Albers, Mitarbeiter
Exams					
WS 19/20	76-T-MACH-105212	CAE-Workshop		Prüfung (PR)	Albers

Competence Certificate
Written test (with practical part on the computer), duration 60 min.

Prerequisites
None

Annotation
For a successful participation in the examination a continuous attendance at the workshop days is necessary. Limited number of participants. Selection is made according to a selection procedure.

Below you will find excerpts from events related to this course:

V CAE-Workshop

2147175, WS 19/20, 3 SWS, Language: German, Open in study portal

Block (B)

Content
Content:

- 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 Abaqus optimization package

The students are able to:

- name the purposes and limits of numerical simulation and optimization of the virtual product development.
- solve simple realistic tasks in the field of finite element analysis, multi-body-simulation and structure optimization with industrial common software (the content in winter and summer term is different).
- evaluate and to question the results of a simulation.
- identify and improve the mistakes of a simulation or optimization.

Exam: 1h Regularly written

Regular attendance: 31.5 h

Self-study: 58 h

Literature
Kursunterlagen werden in Ilias bereitgestellt.

Content is provided on Ilias.

V CAE-Workshop

2147175, SS 2020, 3 SWS, Language: German, Open in study portal

Block (B)

Content
Content:

- 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 Abaqus optimization package

The students are able to:

- name the purposes and limits of numerical simulation and optimization of the virtual product development.
- solve simple realistic tasks in the field of finite element analysis, multi-body-simulation and structure optimization with industrial common software (the content in winter and summer term is different).
- evaluate and to question the results of a simulation.
- identify and improve the mistakes of a simulation or optimization.

Exam: 1h Regularly written

Regular attendance: 31.5 h

Self-study: 58 h

Literature
Kursunterlagen werden in Ilias bereitgestellt.
Content is provided on Ilias.

T 8.29 Course: CATIA CAD Training Course [T-MACH-102185]

Responsible: Prof. Dr.-Ing. Jivka Ovtcharova
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102583 - Major Field: Information Management

Type	Credits	Recurrence	Version
Completed coursework (practical)	2	Each term	2

Events					
WS 19/20	2123358	CATIA CAD training course	2 SWS	Practical course (P)	Ovtcharova, Mitarbeiter
SS 2020	2123358	CATIA CAD training course	3 SWS	Practical course (P)	Ovtcharova, Mitarbeiter
Exams					
WS 19/20	76-T-MACH-102185	CATIA CAD Training Course		Prüfung (PR)	Ovtcharova

Competence Certificate
Practical examination on CAD computer, duration: 60 min.

Prerequisites
None

Recommendation
Dealing with technical drawings is required.

Annotation
For the practical course attendance is compulsory.

Below you will find excerpts from events related to this course:

V CATIA CAD training course

2123358, WS 19/20, 2 SWS, Language: German, Open in study portal

Practical course (P)

Content

- Basics of CATIA 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

Students are able to:

- create their own 3D geometric models in the CAD system CATIA and generate drawings due to the created geometry
- carry out FE-studies and kinematic simulations using the integrated CAE tools
- use advanced, knowledge-based functionalities of CATIA to automate the creation of geometry and thus to ensure the reusability of the models.

Literature
Praktikumskript

V **CATIA CAD training course** **Practical course (P)**
2123358, SS 2020, 3 SWS, Language: German, Open in study portal

Content

- Basics of CATIA 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

Students are able to:

- create their own 3D geometric models in the CAD system CATIA and generate drawings due to the created geometry
- carry out FE-studies and kinematic simulations using the integrated CAE tools
- use advanced, knowledge-based functionalities of CATIA to automate the creation of geometry and thus to ensure the reusability of the models.

Literature
Praktikumskript

T 8.30 Course: Cognitive Automobiles - Laboratory [T-MACH-105378]

Responsible: Bernd Kitt
Dr. Martin Lauer
Prof. Dr.-Ing. Christoph Stiller

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102821 - Major Field: Technical Logistics

Type	Credits	Recurrence	Version
Oral examination	6	Each summer term	1

Events					
SS 2020	2138341	Cogitive Automobiles - Laboratory	3 SWS		Stiller, Lauer, Kamran

Competence Certificate
oral exam

30 minutes

Prerequisites
none

Annotation
The number of participants is limited. A registration is mandatory, the details are announced on the webpages of the institute of measurement and control systems (mrt). In case of too many interested students a subset will be selected (see website).

Below you will find excerpts from events related to this course:

V Cogitive Automobiles - Laboratory
2138341, SS 2020, 3 SWS, Language: German, Open in study portal

Content
Lehrinhalt (EN):

1. Lane recognition
2. Object detection
3. Vehicle lateral control
4. Vehicle longitudinal control
5. Collision avoidance

Lernziele (EN):

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.

Nachweis: Colloquia, final race

Arbeitsaufwand: 120 hours

Literature
Dokumentation zur SW und HW werden als pdf bereitgestellt.

T 8.31 Course: Combustion Engines I [T-MACH-102194]

Responsible: Prof. Dr. Thomas Koch
Dr.-Ing. Heiko Kubach

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102812 - Major Field: Powertrain Systems
M-MACH-102818 - Major Field: Vehicle Technology
M-MACH-102838 - Major Field: Energy Converting Engines

Type	Credits	Recurrence	Version
Oral examination	4	Each winter term	1

Events					
WS 19/20	2133113	Combustion Engines I	4 SWS	Lecture / Practice (VÜ)	Koch
Exams					
WS 19/20	76-T-MACH-102194	Combustion Engines I		Prüfung (PR)	Kubach, Koch
SS 2020	76-T-MACH-102194	Combustion Engines I		Prüfung (PR)	Koch, Kubach

Competence Certificate
oral examination, Duration: 25 min., no auxiliary means

Prerequisites
none

Below you will find excerpts from events related to this course:

V Combustion Engines I

2133113, WS 19/20, 4 SWS, Language: German, Open in study portal

Lecture / Practice (VÜ)

Content
Introduction, History, Concepts

Working Principle and Applications

Characteristic Parameters

Engine Parts

Drive Train

Fuels

Gasoline Engines

Diesel Engines

Exhaust Gas Aftertreatment

T 8.32 Course: Composite Manufacturing - Polymers, Fibers, Semi-Finished Products, Manufacturing Technologies [T-MACH-105535]

Responsible: Prof. Dr.-Ing. Frank Henning
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102638 - Major Field: Rail System Technology
M-MACH-102818 - Major Field: Vehicle Technology

Type	Credits	Recurrence	Version
Written examination	4	Each summer term	2

Events					
SS 2020	2114053	Composite Manufacturing – Polymers, Fibers, Semi-Finished Products, Manufacturing Technologies	2 SWS	Lecture (V)	Henning
Exams					
WS 19/20	76-T-MACH-105535	Composite Manufacturing - Polymers, Fibers, Semi-Finished Products, Manufacturing Technologies		Prüfung (PR)	Henning
SS 2020	76-T-MACH-105535	Composite Manufacturing - Polymers, Fibers, Semi-Finished Products, Manufacturing Technologies		Prüfung (PR)	Henning

Competence Certificate
written exam 90 minutes

Prerequisites
none

Below you will find excerpts from events related to this course:

V Composite Manufacturing – Polymers, Fibers, Semi-Finished Products, Manufacturing Technologies

Lecture (V)

2114053, SS 2020, 2 SWS, Language: German, Open in study portal

Literature
Literatur Leichtbau II

[1-7]

[1] M. Flemming and S. Roth, *Faserverbundbauweisen : Eigenschaften; mechanische, konstruktive, thermische, elektrische, ökologische, wirtschaftliche Aspekte*. Berlin: Springer, 2003.

[2] M. Flemming, *et al.*, *Faserverbundbauweisen : Halbzeuge und Bauweisen*. Berlin: Springer, 1996.

[3] M. Flemming, *et al.*, *Faserverbundbauweisen : Fasern und Matrices*. Berlin: Springer, 1995.

[4] M. Flemming, *et al.*, *Faserverbundbauweisen : Fertigungsverfahren mit duroplastischer Matrix*. Berlin: Springer, 1999.

[5] H. Schürmann, *Konstruieren mit Faser-Kunststoff-Verbunden : mit ... 39 Tabellen*, 2., bearb. und erw. Aufl. ed. Berlin: Springer, 2007.

[6] A. Puck, *Festigkeitsanalyse von Faser-Matrix-Laminaten : Modelle für die Praxis*. München: Hanser, 1996.

[7] M. Knops, *Analysis of failure in fibre polymer laminates : the theory of Alfred Puck*. Berlin, Heidelberg [u.a.]: Springer, 2008.

T 8.33 Course: Computational Dynamics [T-MACH-105349]

Responsible: Prof. Dr.-Ing. Carsten Proppe
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-104430 - Major Field: Modeling and Simulation in Dynamics
M-MACH-104442 - Major Field: Vibration Theory

Type	Credits	Recurrence	Version
Oral examination	4	Each summer term	1

Events					
SS 2020	2162246	Computational Dynamics	2 SWS		Proppe

Competence Certificate
oral exam, 30 min.

Prerequisites
none

Below you will find excerpts from events related to this course:

V Computational Dynamics
2162246, SS 2020, 2 SWS, Language: German, Open in study portal

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. Ein Vorlesungsskript wird bereitgestellt!
2. M. Géradin, B. Rixen: Mechanical Vibrations, Wiley, Chichester, 1997

T 8.34 Course: Computational Intelligence [T-MACH-105314]

Responsible: Dr. Wilfried Jakob
Prof. Dr. Ralf Mikut
PD Dr.-Ing. Markus Reischl

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102817 - Major Field: Information Technology
M-MACH-102820 - Major Field: Mechatronics

Type	Credits	Recurrence	Version
Written examination	4	Each winter term	1

Events					
WS 19/20	2105016	Computational Intelligence	2 SWS	Lecture (V)	Mikut, Jakob, Reischl
Exams					
WS 19/20	76-T-MACH-105314	Computational Intelligence		Prüfung (PR)	Mikut

Competence Certificate
Written exam (Duration: 1h)

Prerequisites
none

Below you will find excerpts from events related to this course:

V Computational Intelligence

2105016, WS 19/20, 2 SWS, Language: German, Open in study portal

Lecture (V)

Content
The students are able to apply the fundamental methods of computational intelligence (fuzzy logic, artificial neural networks, evolutionary algorithms) efficiently. They know the basic mathematical foundations and are able to transfer these methods to practical applications.

Content:

- Terms and definitions Computational Intelligence, application fields and examples
- Fuzzy logic: fuzzy sets; fuzzification and membership functions; inference: T-norms and -conorms, operators, aggregation, activation, accumulation; defuzzification methods, structures for fuzzy control
- Artificial Neural Nets: biology of neurons, Multi-Layer-Perceptrons, Radial-Basis-Function nets, Kohonen maps, training strategies (Backpropagation, Levenberg-Marquardt)
- Evolutionary Algorithms: Basic algorithm, Genetic Algorithms and Evolution Strategies, Evolutionary Algorithm GLEAM, integration of local search strategies, memetic algorithms, application examples

Learning objectives:

The students are able to apply the fundamental methods of computational intelligence (fuzzy logic, artificial neural networks, evolutionary algorithms) efficiently. They know the basic mathematical foundations and are able to transfer these methods to practical applications.

Literature
Kiendl, H.: Fuzzy Control. Methodenorientiert. Oldenbourg-Verlag, München, 1997

S. Haykin: Neural Networks: A Comprehensive Foundation. Prentice Hall, 1999

Kroll, A. Computational Intelligence: Eine Einführung in Probleme, Methoden und technische Anwendungen Oldenbourg Verlag, 2013

Blume, C, Jakob, W: GLEAM - General Learning Evolutionary Algorithm and Method: ein Evolutionärer Algorithmus und seine Anwendungen. KIT Scientific Publishing, 2009 (PDF frei im Internet)

H.-P. Schwefel: Evolution and Optimum Seeking. New York: John Wiley, 1995

Mikut, R.: Data Mining in der Medizin und Medizintechnik. Universitätsverlag Karlsruhe; 2008 (PDF frei im Internet)

T 8.35 Course: Computational Vehicle Dynamics [T-MACH-105350]

Responsible: Prof. Dr.-Ing. Carsten Proppe
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102638 - Major Field: Rail System Technology
M-MACH-102818 - Major Field: Vehicle Technology
M-MACH-104430 - Major Field: Modeling and Simulation in Dynamics

Type	Credits	Recurrence	Version
Oral examination	4	Each summer term	1

Events					
SS 2020	2162256	Computational Vehicle Dynamics	2 SWS	Lecture (V)	Proppe
Exams					
WS 19/20	76-T-MACH-105350	Computational Vehicle Dynamics		Prüfung (PR)	Proppe

Competence Certificate
oral exam, 30 min.

Prerequisites
none

Below you will find excerpts from events related to this course:

V Computational Vehicle Dynamics

Lecture (V)

2162256, SS 2020, 2 SWS, Language: German, Open in study portal

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

T 8.36 Course: Computer Engineering [T-MACH-105360]

Responsible: Dr. Hubert Keller
Dr.-Ing. Maik Lorch

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102817 - Major Field: Information Technology

Type	Credits	Recurrence	Version
Written examination	6	Each summer term	1

Events					
SS 2020	2106002	Computer Engineering	2 SWS	Lecture (V)	Keller
Exams					
WS 19/20	76-T-MACH-105360	Computer Engineering		Prüfung (PR)	Keller

Competence Certificate
written exam (Duration: 2 hours)

Prerequisites
none

Below you will find excerpts from events related to this course:

V Computer Engineering

2106002, SS 2020, 2 SWS, Language: German, Open in study portal

Lecture (V)

Content
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.

Learning objectives:

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 have basic knowledge of real-time systems and their development. Students can use the knowledge to develop real-time systems for reliable automation of technological systems in mechanical engineering.

Literature
Vorlesungsskript (Ilias)

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.

Ada Reference Manual, ISO/IEC 8652:2012(E), Language and Standard Libraries. Springer Heidelberg

Benra, J.; Keller, H.B.; Schiedermeier, G.; Tempelmeier, T.: Synchronisation und Konsistenz in Echtzeitsystemen. Benra, J.T. [Hrsg.] Software-Entwicklung für Echtzeitsysteme Berlin [u.a.] : Springer, 2009, S.49-65

Färber, G.:Prozeßrechentechnik. Springer-Lehrbuch. Springer; Auflage: 3., überarb. Aufl. (7. September 1994)

Leitfaden Informationssicherheit, IT-Grundschutz kompakt. Bundesamt für Sicherheit in der Informationstechnik – BSI53133 Bonn, 2012, BSI-Bro12/311

Cooling, J.: Software Engineering for Real Time Systems. Addison-Wesley, Pearson, Harlow, 2002.

Stallings, W.: Betriebssysteme. 4. Auflage. Pearson Studium, München, 2003.

Summerville, I.: Software Engineering. Pearson Studium, München, 2007.

8.37 Course: Computer Science for Engineers [T-MACH-105205]

Responsible: Prof. Dr.-Ing. Jivka Ovtcharova
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102563 - Computer Science

Type	Credits	Recurrence	Version
Written examination	6	Each summer term	1

Events					
SS 2020	2121390	Computer Science for Engineers	4 SWS	Lecture / Practice (VÜ)	Ovtcharova, Elstermann
SS 2020	3121034	Computer Science for Engineers	4 SWS	Lecture / Practice (VÜ)	Ovtcharova, Elstermann
Exams					
WS 19/20	76-T-MACH-105205	Computer Science for Engineers - German		Prüfung (PR)	Ovtcharova
WS 19/20	76-T-MACH-105205-English	Computer Science for Engineers - English		Prüfung (PR)	Ovtcharova

Competence Certificate
Written exam [180 min]

Prerequisites
Computer Science for Engineers, passed

Modeled Conditions
The following conditions have to be fulfilled:

1. The course T-MACH-105206 - Computer Science for Engineers, Prerequisite must have been passed.

Below you will find excerpts from events related to this course:

Computer Science for Engineers

2121390, SS 2020, 4 SWS, Language: German, Open in study portal

Lecture / Practice (VÜ)

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
Propädeutikum Java (2. Auflage), KIT Scientific Publishing; ISBN: 978 3 86644 914 5

„Grundkurs Programmieren in Java“ Carl Hanser Verlag GmbH & CO. KG; Auflage 6, ISBN 10: 3446426639

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

Peter Drake: Data Structures and Algorithms in Java 1. Auflage. Prentice Hall, 2005, ISBN 0131469142

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

V **Computer Science for Engineers** **Lecture / Practice (VÜ)**
3121034, SS 2020, 4 SWS, Language: English, Open in study portal

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
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

Peter Drake: Data Structures and Algorithms in Java 1. Auflage. Prentice Hall, 2005, ISBN 0131469142

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

T 8.38 Course: Computer Science for Engineers, Prerequisite [T-MACH-105206]

Responsible: Prof. Dr.-Ing. Jivka Ovtcharova
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102563 - Computer Science

Type	Credits	Recurrence	Version
Completed coursework (practical)	0	Each summer term	2

Events					
SS 2020	2121392	Computer Lab for Computer Science in Mechanical Engineering	2 SWS		Ovtcharova, Mitarbeiter
SS 2020	3121036	Computer Science for Engineers Lab Course	2 SWS		Ovtcharova, Elstermann

Competence Certificate
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. Therefore online tests must be solved by the students to assess the understanding of the tasks and the lecture material. All assignments have to be handed in, before they can take part in the exam.

Prerequisites
none

Below you will find excerpts from events related to this course:

V Computer Lab for Computer Science in Mechanical Engineering
2121392, SS 2020, 2 SWS, Language: German, Open in study portal

Content
JAVA 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. Therefore online tests must be solved by the students to assess the understanding of the tasks and the lecture material. All assignments have to be handed in, before they can take part in the exam.

Literature
Übungsblätter / exercise sheets

V Computer Science for Engineers Lab Course
3121036, SS 2020, 2 SWS, Language: English, Open in study portal

Content
JAVA 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. Therefore online tests must be solved by the students to assess the understanding of the tasks and the lecture material. All assignments have to be handed in, before they can take part in the exam.

Literature
Exercise sheets / Übungsblätter

T 8.39 Course: Computerized Multibody Dynamics [T-MACH-105384]

Responsible: Prof. Dr.-Ing. Wolfgang Seemann
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-104430 - Major Field: Modeling and Simulation in Dynamics

Type	Credits	Recurrence	Version
Oral examination	4	Each summer term	1

Competence Certificate
Oral exam, 30 min.

Prerequisites
none

Recommendation
Knowledge of EM III/IV

T 8.40 Course: Constitution and Properties of Wearresistant Materials [T-MACH-102141]

Responsible: Prof. Dr. Sven Ulrich
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102819 - Major Field: Materials Science and Engineering

Type	Credits	Recurrence	Version
Oral examination	4	Each summer term	2

Events					
SS 2020	2194643	Constitution and Properties of Wear resistant materials	2 SWS	Lecture (V)	Ulrich
Exams					
WS 19/20	76-T-MACH-102141	Constitution and Properties of Wearresistant Materials		Prüfung (PR)	Ulrich

Competence Certificate
oral examination (about 30 min)

no tools or reference materials

Prerequisites
none

Below you will find excerpts from events related to this course:

V Constitution and Properties of Wear resistant materials

2194643, SS 2020, 2 SWS, Language: German, Open in study portal

Lecture (V)

Content
The assessment consists of an oral exam (ca. 30 min) taking place at the agreed date (according to Section 4(2), 2 of the examination regulation). The re-examination is offered upon agreement.

Teaching 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

regular attendance: 22 hours
self-study: 98 hours

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.

Recommendations: none

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

Kopien der Abbildungen und Tabellen werden verteilt; Copies with figures and tables will be distributed

T 8.41 Course: Control Technology [T-MACH-105185]

Responsible: Christoph Gönnheimer
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102812 - Major Field: Powertrain Systems
M-MACH-102817 - Major Field: Information Technology

Type	Credits	Recurrence	Version
Written examination	4	Each summer term	2

Events					
SS 2020	2150683	Control Technology	2 SWS	Lecture (V)	Gönnheimer
Exams					
WS 19/20	76-T-MACH-105185	Control Technology		Prüfung (PR)	Gönnheimer

Competence Certificate
Written Exam (60 min)

Prerequisites
none

Below you will find excerpts from events related to this course:

V Control Technology

2150683, SS 2020, 2 SWS, Language: German, Open in study portal

Lecture (V)

Content

The lecture control technology gives an integral overview of available control components within the field of industrial production systems.
The first part of the lecture deals with the fundamentals of signal processing and with control peripherals in the form of sensors and actors which are used in production systems for the detection and manipulation of process states.
The second part handles with the function of electric control systems in the production environment. The main focus in this chapter is laid on programmable logic controls, computerized numerical controls and robot controls. Finally the course ends with the topic of cross-linking and decentralization with the help of bus systems.
The lecture is very practice-oriented and illustrated with numerous examples from different branches.

The following topics will be covered:

- Signal processing
- Control peripherals
- Programmable logic controls
- Numerical controls
- Controls for industrial robots
- Distributed control systems
- Field bus
- Trends in the area of control technology

Learning Outcomes:

The students …

- are able to name the electrical controls which occur in the industrial environment and explain their function.
- can explain fundamental methods of signal processing. This involves in particular several coding methods, error protection methods and analog to digital conversion.
- are able to choose and to dimension control components, including sensors and actors, for an industrial application, particularly in the field of plant engineering and machine tools. Thereby, they can consider both, technical and economical issues.
- can describe the approach for projecting and writing software programs for a programmable logic control named Simatic S7 from Siemens. Thereby they can name several programming languages of the IEC 1131.

Workload:

regular attendance: 21 hours
self-study: 99 hours

Literature
Medien:
Skript zur Veranstaltung wird über ilias (https://ilias.studium.kit.edu/) bereitgestellt.

Media:
Lecture notes will be provided in ilias (https://ilias.studium.kit.edu/).

T 8.42 Course: Data Analytics for Engineers [T-MACH-105694]

Responsible: Nicole Ludwig
Prof. Dr. Ralf Mikut
PD Dr.-Ing. Markus Reischl

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102817 - Major Field: Information Technology
M-MACH-102820 - Major Field: Mechatronics

Type	Credits	Recurrence	Version
Written examination	5	Each summer term	2

Events					
SS 2020	2106014	Data Analytics for Engineers	3 SWS	Lecture / Practice (VÜ)	Mikut, Reischl, Ludwig
Exams					
WS 19/20	76-T-MACH-105694	Data Analytics for Engineers		Prüfung (PR)	Mikut

Competence Certificate
Written exam (Duration: 1h)

Prerequisites
none

Below you will find excerpts from events related to this course:

V Data Analytics for Engineers
2106014, SS 2020, 3 SWS, Language: German, Open in study portal

Lecture / Practice (VÜ)

Content
Content:

- Introduction and motivation
- Terms and definitions (types of multidimensional features - time series and images, problem classes)
- Scenario: Problem formulation, feature extraction, evaluation, selection and transformation, distance measures, Bayes classifiers, Support-Vector-Machines, decision trees, clustering, regression, validation
- Biweekly computer exercises (Software practice with SciXMiner): Data import, benchmark datasets, control of hand prostheses, energy prediction
- 2 hours per week lectures, 1 hour per week computer training

Learning objectives:
The students are able to apply the methods of data analysis efficiently. They know the basic mathematical data mining 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.

Literature
Vorlesungsunterlagen (ILIAS)

Mikut, R.: Data Mining in der Medizin und Medizintechnik. Universitätsverlag Karlsruhe.

2008 (PDF frei im 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 SciXMiner. Techn. Ber., Forschungszentrum Karlsruhe GmbH. 2006 (Internet)

T 8.43 Course: Design and Development of Mobile Machines [T-MACH-105311]

Responsible: Prof. Dr.-Ing. Marcus Geimer
Jan Siebert

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102815 - Major Field: Engineering Design

Type	Credits	Recurrence	Version
Oral examination	4	Each winter term	1

Events					
WS 19/20	2113079	Design and Development of Mobile Machines	2 SWS	Lecture (V)	Geimer, Siebert, Lehr, Geiger
Exams					
WS 19/20	76-T-MACH-105311	Design and Development of Mobile Machines		Prüfung (PR)	Geimer
SS 2020	76-T-MACH-105311	Design and Development of Mobile Machines		Prüfung (PR)	Geimer

Competence Certificate
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.

A registration is mandatory, the details will be announced on the webpages of the *Institute of Vehicle System Technology / Institute of Mobile Machines.* In case of too many applications, attendance will be granted based on pre-qualification.

The course will be replenished by interestung lectures of professionals from leading hydraulic companies.

Prerequisites
Required for the participation in the examination is the preparation of a report during the semester. The partial service with the code T-MACH-108887 must have been passed.

Modeled Conditions
The following conditions have to be fulfilled:

1. The course T-MACH-108887 - Design and Development of Mobile Machines - Advance must have been passed.

Recommendation
Knowledge in Fluid Power Systems (LV 2114093)

Annotation
After completion of the lecture, studens can:

- design working and travel drive train hydraulics of mobile machines and can derive characteristic key factors.
- choose and apply suitable state of the art designing methods succesfully
- analyse a mobile machines and break its structure down from a complex system to subsystems with reduced complexity
- identify and desrcibe interactions and links between subsystems of a mobile maschine
- present and document solutions of a technical problem according to R&D standards

The number of participants is limited.

Conent:

The working scenario of a mobile machine depends strongly on the machine itself. Highly specialised machines, e.g. pavers are also as common as universal machines with a wide range of applications, e.g. hydraulic excavators. In general, all mobile machines are required to do their intended work in an optimal way and satisfy various critera at the same time. This makes designing mobile machines to a great and interesting challenge. Nevertheless, usually key factors can be derived for every mobile machine, which affect all other machine parameters. During this lecture, those key factors and designing mobile machines accordingly will be adressed. To do so, an exemplary mobile machine will be discussed and designed in the lecture an as a semester project.

Literature:

See german recommendations

Below you will find excerpts from events related to this course:

V **Design and Development of Mobile Machines** **Lecture (V)**
2113079, WS 19/20, 2 SWS, Language: German, Open in study portal

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 electric drive train,
- the dimensioning of the primary energy supply,
- 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.

Recommendations:

Knowledge in Fluid Technology (SoSe, LV 21093)

- regular attendance: 21 hours
- self-study: 99 hours

Literature
Keine.

T 8.44 Course: Design and Development of Mobile Machines - Advance [T-MACH-108887]

Responsible: Prof. Dr.-Ing. Marcus Geimer
Jan Siebert

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102815 - Major Field: Engineering Design

Type	Credits	Recurrence	Version
Completed coursework	0	Each term	1

Exams				
WS 19/20	76-T-MACH-108887	Design and Development of Mobile Machines - Advance	Prüfung (PR)	Geimer
SS 2020	76-T-MACH-108887	Design and Development of Mobile Machines - Advance	Prüfung (PR)	Geimer

Competence Certificate
Preparation of semester report

Prerequisites
none

T 8.45 Course: Design of a Jet Engine Combustion Chamber [T-CIWVT-105780]

Responsible: Prof. Dr.-Ing. Nikolaos Zarzalis
Organisation: KIT Department of Chemical and Process Engineering
Part of: M-MACH-102838 - Major Field: Energy Converting Engines

Type	Credits	Recurrence	Version
Oral examination	6	Each winter term	2

Events					
WS 19/20	22527	Design of a Jet Engine Combustion Chamber	SWS		Zarzalis

Competence Certificate
The examination is an oral examination on lecture 22527 with a duration of 20 minutes.

Prerequisites
None

T 8.46 Course: Design with Plastics [T-MACH-105330]

Responsible: Markus Liedel
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102815 - Major Field: Engineering Design
M-MACH-102819 - Major Field: Materials Science and Engineering

Type	Credits	Recurrence	Version
Oral examination	4	Each summer term	1

Events					
SS 2020	2174571	Design with Plastics	2 SWS	Lecture (V)	Liedel

Competence Certificate
Oral exam, about 20 minutes

Prerequisites
none

Recommendation
Poly I

Below you will find excerpts from events related to this course:

V Design with Plastics
2174571, SS 2020, 2 SWS, Language: German, Open in study portal

Lecture (V)

Content

Structure and properties of plastics materials,

Processing of plastics,

Behavior of plastics under environmental impacts,

Classic strength dimensioning,

Geometric dimensioning,

Plastic appropriate design,

Failure examples,

Joining of plastic parts,

Supporting simulation tools,

Structural foams,

Plastics Technology trends.

learning objectives:

Students will be able to

- distinguish polymer compounds from other construction materials regarding chemical differences, thermal behavior and solid conditions.
- discuss main plastics processes regarding advantages and disadvantages of materials selection and part geometry design and to make appropriate selections.
- analyze complex application requirements concerning material impacts on strength and to use the classic dimensioning method specific to the application to evaluate the lifetime part strength limit.
- evaluate part tolerances and geometry by appropriate methods considering molding shrinkage, production tolerances, post shrinkage, heat expansion, swelling, elastic and creep deformation.
- design plastic specific joining geometries like snap fits, screw bosses, weld seams and film hinges.
- detect classic molding failures and understand potential causes as well as to reduce the probability of molding failures by defining an optimized design.
- understand benefits and limits of selected simulation tools in the plastic technology discipline (strength, deformation, filling, warpage).
- assess polymer classes and plastic part designs with respect to suitable recycling concepts and ecological consequences.

requirements:

none,

recommendation: Polymerengineering I

workload:

The workload for the lecture Design with Plastics is 120 h per semester and consists of the presence during the lecture (21 h) as well as preparation and rework time at home (99 h).

Literature

Materialien werden in der Vorlesung ausgegeben.
Literaturhinweise werden in der Vorlesung gegeben.

T 8.47 Course: Development of hybrid drivetrains [T-MACH-110817]

Responsible: Prof. Dr. Thomas Koch
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102645 - Major Field: Combustion Engine Techniques

Type	Credits	Recurrence	Version
Written examination	4	Each summer term	1

Events					
SS 2020	2134155	Development of Hybrid Powertrains	2 SWS	Lecture (V)	Koch, Doppelbauer
Exams					
SS 2020	76-T-MACH-110817	Development of hybrid drivetrains		Prüfung (PR)	Koch

Competence Certificate
written exam, 1 hour

Prerequisites
None

Below you will find excerpts from events related to this course:

V Development of Hybrid Powertrains
2134155, SS 2020, 2 SWS, Language: German, Open in study portal

Lecture (V)

Content

1. Introduction and Goal
2. Alternative Powertrains
3. Fundamentals of Hybrid Powertrains
4. Fundamentals of Electric Components of Hybrid Powertrains
5. Interactions in Hybrid Powertrain Development
6. Overall System Optimization

T 8.48 Course: Development of Oil-Hydraulic Powertrain Systems [T-MACH-105441]

Responsible: Isabelle Ays
Dr.-Ing. Gerhard Geerling

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102812 - Major Field: Powertrain Systems
M-MACH-102815 - Major Field: Engineering Design
M-MACH-102818 - Major Field: Vehicle Technology
M-MACH-102838 - Major Field: Energy Converting Engines

Type	Credits	Recurrence	Version
Oral examination	4	Each winter term	1

Events					
WS 19/20	2113072	Development of Oil-Hydraulic Powertrain Systems	2 SWS	Block (B)	Geerling, Becker
Exams					
WS 19/20	76-T-MACH-105441	Development of Oil-Hydraulic Powertrain Systems		Prüfung (PR)	Geimer

Competence Certificate
oral exam (20 min)

Prerequisites
none

Below you will find excerpts from events related to this course:

V Development of Oil-Hydraulic Powertrain Systems

2113072, WS 19/20, 2 SWS, Language: German, Open in study portal

Block (B)

Content
The bloc course offered by the Chair of Mobile Machines (Mobima) conveys the basics of planning and development of mobile and industrial hydrostatic systems. The lecturer works for a market leading company producing fluid power drives and controls and gives a deep view into the process of planning and development using real life examples. The contents of the course are:

- marketing, project planning
- hydrostatic circuits
- heat balance, hydraulic accumulators
- filtration, noise lowering
- development exercises + laboratory tutorial

knowledge in the fluidics

- regular attendance: 19 hours
- self-study: 90 hours

T 8.49 Course: Digital Control [T-MACH-105317]

Responsible: Dr.-Ing. Michael Knoop
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102817 - Major Field: Information Technology
M-MACH-102820 - Major Field: Mechatronics

Type	Credits	Recurrence	Version
Written examination	4	Each winter term	1

Events					
WS 19/20	2137309	Digital Control	2 SWS	Lecture (V)	Knoop
Exams					
WS 19/20	76-T-MACH-105317	Digital Control		Prüfung (PR)	Stiller

Competence Certificate
written exam

60 min.

Prerequisites
none

Below you will find excerpts from events related to this course:

V Digital Control
2137309, WS 19/20, 2 SWS, Language: German, Open in study portal

Lecture (V)

Content
Lehrinhalt (EN):

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

Voraussetzungen (EN):

Basic studies and preliminary examination; basic lectures in automatic control

Lernziele (EN):

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.

Nachweis: written examination; duration: 60 minutes; no tools or reference materials may be used during the exam.

Arbeitsaufwand: 120 hours

Literature

- Lunze, J.: Regelungstechnik 2, 9. Auflage, Springer Verlag, Berlin Heidelberg 2016.
- 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

T 8.50 Course: Dimensioning and Optimization of Power Train System [T-MACH-105536]

Responsible: Prof. Dr.-Ing. Albert Albers
Dr.-Ing. Hartmut Faust
Dr. Eckhard Kirchner
Prof. Dr.-Ing. Sven Matthiesen

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102812 - Major Field: Powertrain Systems
M-MACH-102818 - Major Field: Vehicle Technology

Type	Credits	Recurrence	Version
Oral examination	4	Each summer term	1

Events					
SS 2020	2146208	Design & Optimization of Conventional & Electrified Automotive Transmissions	2 SWS	Lecture (V)	Faust

Competence Certificate
oral exam (20 min)

Prerequisites
none

Below you will find excerpts from events related to this course:

V Design & Optimization of Conventional & Electrified Automotive Transmissions

Lecture (V)

2146208, SS 2020, 2 SWS, Language: German, Open in study portal

Content

- Transmission types: Manual (MT) & automated manual transmissions (AMT), planetary torque converter machines (AT), double clutch (DCT), continuously variable (CVT) and geared neutral transmissions (IVT), hybrid transmissions (serial, parallel, multimode, Powersplit hybrid), E-axles
- Torsional vibration damper: damped clutch disc, dual mass flywheel, centrifugal pendulum (FKP), lock-up damper for torque converter
- Starting elements: dry single clutch, dry and wet double clutch, hydrodynamic torque converter, special shapes, e-motor
- Power transmission: countershaft transmission, planetary gear set, CVT variator, chain, synchronization, shift and claw clutches, reversing, differentials and locking systems, coaxial and axially parallel E-axis drives
- Transmission control: shift systems for MT, actuators for clutches and gear shifting, hydraulic control, electronic control, software application, comfort and sportiness
- Special designs: drive trains of commercial vehicles, hydrostat with power split, torque vectoring
- E-mobility: Classification into 5 stages of electrification, 4 hybrid configurations, 7 parallel hybrid architectures, hybridized transmissions (P2, P2.5, P3, P4), dedicated hybrid transmissions (DHT; serial / parallel / multimode, powersplit, new ones Concepts), gearbox for electric vehicles (E-axle gearbox, coaxial and axially parallel)

T 8.51 Course: Drive Train of Mobile Machines [T-MACH-105307]

Responsible: Prof. Dr.-Ing. Marcus Geimer
Marco Wydra

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102812 - Major Field: Powertrain Systems

Type	Credits	Recurrence	Version
Oral examination	4	Each winter term	1

Events					
WS 19/20	2113077	Drive Train of Mobile Machines	2 SWS	Lecture (V)	Geimer, Herr
WS 19/20	2113078	Übung zu 'Antriebsstrang mobiler Arbeitsmaschinen'	1 SWS	Practice (Ü)	Geimer, Herr
Exams					
WS 19/20	76-T-MACH-105307	Drive Train of Mobile Machines		Prüfung (PR)	Geimer
SS 2020	76-T-MACH-105307	Drive Train of Mobile Machines		Prüfung (PR)	Geimer

Competence Certificate
The final assessment will be an oral examination (20 min) taking place during the recess period. The examination will be offered in ervery semester and can be repeated at any regular examination date.

Prerequisites
none

Recommendation

- General principles of mechanicals engineering
- Basic knowledge of hydraulics
- Interest in mobile machinery

Annotation
At the end of the lecture, participants can explain the structure and function of all discussed drive trains of mobile machines. They can analyze complex gearbox schematics and synthesize simple transmission functions using rough calculations.

Content:

In this course the different drive trains of mobile machinery will be discussed. The focus of this course is:

- mechanical gears
- torque converter
- hydrostatic drives
- power split drives
- electrical drives
- hybrid drives
- axles
- terra mechanics

Media: projector presentation

Literature: Download of lecture slides from ILIAS. Further literature recommendations during lectures.

Below you will find excerpts from events related to this course:

V Drive Train of Mobile Machines

Lecture (V)

2113077, WS 19/20, 2 SWS, Language: German, Open in study portal

Content
In this course will be discussed the different drive train of mobile machinerys. The fokus of this course is:
- improve knowledge of fundamentals
- mechanical gears
- torque converter
- hydrostatic drives
- continuous variable transmission
- eletrical drives
- hybrid drives
- axles
- terra mechanic

Recommendations:

- general basics of mechanical engineering
- basic knowledge in hydraulics
- interest in mobile machines

- regular attendance: 21 hours
- self-study: 89 hours

Literature
Skriptum zur Vorlesung downloadbar über ILIAS

T 8.52 Course: Dynamics of the Automotive Drive Train [T-MACH-105226]

Responsible: Prof. Dr.-Ing. Alexander Fidlin
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102812 - Major Field: Powertrain Systems
M-MACH-102818 - Major Field: Vehicle Technology
M-MACH-104430 - Major Field: Modeling and Simulation in Dynamics
M-MACH-104442 - Major Field: Vibration Theory

Type	Credits	Recurrence	Version
Oral examination	5	Each winter term	1

Events					
WS 19/20	2163111	Dynamics of the Automotive Drive Train	2 SWS	Lecture (V)	Fidlin
WS 19/20	2163112	Übungen zu Dynamik des Kfz-Antriebsstrangs	2 SWS	Practice (Ü)	Fidlin, Yüzbasioglu
Exams					
WS 19/20	76-T-MACH-105226	Dynamics of the Automotive Drive Train		Prüfung (PR)	Fidlin
SS 2020	76-T-MACH-105226	Dynamics of the Automotive Drive Train		Prüfung (PR)	Fidlin

Competence Certificate
Oral examination, 30 min.

Prerequisites
none

Recommendation
Powertrain Systems Technology A: Automotive SystemsMachine DynamicsVibration Theory

Below you will find excerpts from events related to this course:

V Dynamics of the Automotive Drive Train — Lecture (V)
2163111, WS 19/20, 2 SWS, Language: German, Open in study portal

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

V Übungen zu Dynamik des Kfz-Antriebsstrangs — Practice (Ü)
2163112, WS 19/20, 2 SWS, Language: German, Open in study portal

Content
Exercises related to the lecture

T 8.53 Course: Electric Rail Vehicles [T-MACH-102121]

Responsible: Prof. Dr.-Ing. Peter Gratzfeld
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102638 - Major Field: Rail System Technology

Type	Credits	Recurrence	Version
Oral examination	4	Each summer term	1

Events					
SS 2020	2114346	Electric Rail Vehicles	2 SWS	Lecture (V)	Gratzfeld
Exams					
WS 19/20	76-T-MACH-102121	Electric Rail Vehicles		Prüfung (PR)	Gratzfeld
WS 19/20	76-T-MACH-102122	Electric Rail Vehicles		Prüfung (PR)	Gratzfeld
SS 2020	76-T-MACH-102121	Electrical Railway Traction Systems		Prüfung (PR)	Gratzfeld

Competence Certificate
Oral examination

Duration: ca. 20 minutes

No tools or reference materials may be used during the exam.

Prerequisites
none

Below you will find excerpts from events related to this course:

V Electric Rail Vehicles
2114346, SS 2020, 2 SWS, Language: German, Open in study portal

Lecture (V)

Content

1. Introduction: history of electric traction in railway vehicles, economic impact
2. Wheel-rail-contact: carrying of vehicle mass, adhesion, current return
3. Vehicle dynamics: tractive and brake effort, driving resistance, inertial force, load cycles
4. Electric drives: purpose of electric drive and basic configurations, traction motors (induction machine, synchronous machine with permanent magnets), drives for vehicles at dc and ac lines, drives for vehicle without contact wire, hybrids, conventional drives for existing vehicles
5. Train control management system: definitions, networks, bus systems, components, examples
6. Vehicle concepts: modern vehicle concepts for mass transit and electric main line
7. Traction power supply: dc and ac networks, energy management, design aspects

Literature
Eine Literaturliste steht den Studierenden auf der Ilias-Plattform zum Download zur Verfügung.

A bibliography is available for download (Ilias-platform).

T 8.54 Course: Electrical Engineering and Electronics [T-ETIT-109820]

Responsible: Dr.-Ing. Klaus-Peter Becker
Organisation: KIT Department of Electrical Engineering and Information Technology
Part of: M-ETIT-104801 - Electrical Engineering

Type	Credits	Recurrence	Version
Written examination	8	Each winter term	1

Events					
WS 19/20	2306339	Electrical Engineering and Electronics foir Mechanical Engineers	4 SWS	Lecture (V)	Becker
WS 19/20	2306340	Electrical Engineering and Electronics foir Mechanical Engineers	2 SWS	Lecture (V)	Becker
Exams					
WS 19/20	7306351	Electrical Engineering and Electronics for Mechanical Engineers		Prüfung (PR)	Becker

Annotation
Exam will be held in german language

T 8.55 Course: Elements and Systems of Technical Logistics [T-MACH-102159]

Responsible: Georg Fischer
Dr.-Ing. Martin Mittwollen

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102821 - Major Field: Technical Logistics

Type	Credits	Recurrence	Version
Oral examination	4	Each winter term	1

Events					
WS 19/20	2117096	Elements and systems of Technical Logistics	3 SWS	Lecture / Practice (VÜ)	Mittwollen, Rauscher
Exams					
WS 19/20	76-T-MACH-102159	Elements and Systems of Technical Logistics		Prüfung (PR)	Mittwollen

Competence Certificate
The assessment consists of an oral exam (20min) taking place in the recess period according to § 4 paragraph 2 Nr. 2 of the examination regulation.

Prerequisites
none

Recommendation
Knowledge out of "Basics of Technical Logistics I" (T-MACH-109919) preconditioned.

Below you will find excerpts from events related to this course:

V Elements and systems of Technical Logistics

2117096, WS 19/20, 3 SWS, Language: German, Open in study portal

Lecture / Practice (VÜ)

Content
Learning goals:

Students are able to:

- Describe elements and systems of technical logistics,
- Model and calculate structures and functions of special conveying machines,
- Describe interdependence of material flow systems and technique quantitatively and qualitatively
- Equip material flow systems with appropriate machines.

Content of teaching:

- 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

Presence: 36h

Rework: 84h

Annotations:

- Knowledge out of **Basics of Technical Logistics** (LV 2117095) preconditioned.
- The assessment consists of an oral exam (20 min.) taking place in the recess period according to § 4 paragraph 2 Nr. 2 of the examination regulation.

Literature
Empfehlungen in der Vorlesung.

Recommendations during lectures.

T 8.56 Course: Elements and Systems of Technical Logistics - Project [T-MACH-108946]

Responsible: Georg Fischer
Dr.-Ing. Martin Mittwollen

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102821 - Major Field: Technical Logistics

Type	Credits	Recurrence	Version
Examination of another type	2	Each winter term	1

Events					
WS 19/20	2117097	Elements and systems of Technical Logistics - project	SWS	Project (PRO)	Mittwollen, Rauscher
Exams					
WS 19/20	76-T-MACH-108946	Elements and Systems of Technical Logistics - Project		Prüfung (PR)	Mittwollen

Competence Certificate
Presentation of performed project and defense (30min) according to $4 (2), No. 3 of the examination regulation

Prerequisites
T-MACH-102159 (Elements and Systems of Technical Logistics) must have been started

Modeled Conditions
The following conditions have to be fulfilled:

1. The course T-MACH-102159 - Elements and Systems of Technical Logistics must have been started.

Recommendation
Knowledge out of "Basics of Technical Logistics I" (T-MACH-109919) preconditioned.

Below you will find excerpts from events related to this course:

V Elements and systems of Technical Logistics - project

2117097, WS 19/20, SWS, Language: German, Open in study portal

Project (PRO)

Content

Learing goals:

Students are able to:

- Describe elements and systems of technical logistics,
- Model and calculate structures and functions of special conveying machines,
- Describe interdependence of material flow systems and technique quantitatively and qualitatively,
- Equip material flow systems with appropriate machines
- Judge about systems in place and justify it in front of subject related persons.

Content of teaching:

- 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
- Self manufacturing of a project report to recesses the topic.

Media:

supplementary sheets,presentations, blackboard

Prerequisites:

T-MACH-102159 (Elements and Systems of technical logistics) must have been started.

Annotations:

- Knowledge out of **Basics of Technical Logistics (LV 2117095)** preconditioned.
- Presentation of performed project and defense (30min) according to $4 (2), No. 3 of the examination regulation.

T 8.57 Course: Energy Efficient Intralogistic Systems [T-MACH-105151]

Responsible: Dr.-Ing. Meike Braun
Dr. Frank Schönung

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102812 - Major Field: Powertrain Systems
M-MACH-102816 - Major Field: Fundamentals of Energy Technology
M-MACH-102821 - Major Field: Technical Logistics

Type	Credits	Recurrence	Version
Oral examination	4	Each winter term	1

Events					
WS 19/20	2117500	Energy efficient intralogistic systems	2 SWS	Lecture (V)	Braun, Schönung
Exams					
WS 19/20	76-T-MACH-105151	Energy Efficient Intralogistic Systems		Prüfung (PR)	Braun

Competence Certificate
Oral, 30 min. examination dates after the end of each lesson period.

Prerequisites
none

Recommendation
The content of course "Basics of Technical Logistics I" (T-MACH-109919) should be known.

Annotation
Visit the IFL homepage of the course for the course dates and/or possible limitations of course participation.

Below you will find excerpts from events related to this course:

V Energy efficient intralogistic systems
2117500, WS 19/20, 2 SWS, Language: German, Open in study portal

Lecture (V)

Content
The content of course "Basics of Technical Logistics" should be knownn.

Literature
Keine.

8.58 Course: Energy Storage and Network Integration [T-MACH-105952]

Responsible: Dr.-Ing. Wadim Jäger
Prof. Dr. Robert Stieglitz

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102816 - Major Field: Fundamentals of Energy Technology

Type	Credits	Recurrence	Version
Oral examination	4	Each winter term	1

Events					
WS 19/20	2189487	Energy Storage and Grid Integration	2 SWS	Lecture (V)	Jäger, Stieglitz
Exams					
WS 19/20	76-T-MACH-105952	Energiespeicher und Netzintegration		Prüfung (PR)	Jäger, Stieglitz
SS 2020	76-T-MACH-105952	Energiespeicher und Netzintegration		Prüfung (PR)	Jäger, Stieglitz

Competence Certificate
oral exam, about 30 minutes

Prerequisites
The courses T-MACH-105952 Energiespeicher und Netzintegration and T-ETIT-104644 - Energy Storage and Network Integration can not be combined.

Below you will find excerpts from events related to this course:

Energy Storage and Grid Integration

Lecture (V)

2189487, WS 19/20, 2 SWS, Language: German, Open in study portal

Content
The lecture provides an overview of the different storage types and their fundamental integration into the power supply grid.

Thereby, within the scope of this lecture, the necessity and the motivation for converting and storing energy will be given. Starting from the definition of fundamental terms different physical and chemical storage types along with their theoretical and practical basis are described. In particular, the decoupling of energy production and energy consumption, and the provision of different energy scales (time, power, density) will be discussed. Furthermore, the challenge of energy transport and re-integration into the different grid types is considered.

Students understand the different types of energy storage and apply their knowledge for the selection and principal dimensioning of relevant energy storage tasks.

Furthermore, students can reflect the state-of-the-art of most important energy storage types, their fundamental characterisitics and viability at given boundary conditions and they are enabled to elaborate and apply basic integration issues dependent on the grid structure for the different network types.

Oral exam, duration approximately 30 min, tools: non

T 8.59 Course: Energy Systems I: Renewable Energy [T-MACH-105408]

Responsible: Dr. Ron Dagan
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102816 - Major Field: Fundamentals of Energy Technology

Type	Credits	Recurrence	Version
Oral examination	4	Each winter term	2

Events					
WS 19/20	2129901	Energy Systems I - Renewable Energy	3 SWS	Lecture (V)	Dagan
Exams					
WS 19/20	76-T-MACH-105408	Energy Systems I: Renewable Energy		Prüfung (PR)	Dagan
SS 2020	76-T-MACH-105408	Energy Systems I: Renewable Energy		Prüfung (PR)	Dagan

Competence Certificate
oral exam, 1/2 hour

Prerequisites
none

Below you will find excerpts from events related to this course:

V Energy Systems I - Renewable Energy

2129901, WS 19/20, 3 SWS, Language: German, Open in study portal

Lecture (V)

Content
The course deals with fundamental aspects of renewable energies.

1. The first part deals with the basic concepts of absorbing solar beans, in an efficient manner accounting for the minimization of heat losses. In this context, selective topics on thermodynamics as well as fluid dynamics are introduced. In the second part few applications are discussed and optimizations techniques of solar collectors construction and their heat transfer are presented.
2. The use of solar energy as a source for heat generation is followed by the idea of electricity generation. Introductive aspects of Photovoltaic technologies are illuminated.
3. The last part presents additional regenerative energy sources such as wind and geothermal energy.

The student knows the principles of the feasibility of energy gain by means of renewable energies, in particular the solar energy.

regular attendance: 34 hours
self-study: 146 hours

Oral examination – as an elective course 30 minutes, in combination with Energiesysteme-II or other courses within the energy courses, as a major course 1 hour

T 8.60 Course: Engine Laboratory [T-MACH-105337]

Responsible: Dr.-Ing. Uwe Wagner
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102645 - Major Field: Combustion Engine Techniques

Type	Credits	Recurrence	Version
Completed coursework	4	Each summer term	1

Events					
SS 2020	2134001	Engine Laboratory	2 SWS	Practical course (P)	Wagner
Exams					
SS 2020	76-T-MACH-105337	Engine Laboratory		Prüfung (PR)	Koch

Competence Certificate
written documentation of every experiment, certificate of successful attendance, no grading

Prerequisites
none

Below you will find excerpts from events related to this course:

V **Engine Laboratory** **Practical course (P)**
2134001, SS 2020, 2 SWS, Language: German, Open in study portal

Literature
Versuchsbeschreibungen

T 8.61 Course: Engine Measurement Techniques [T-MACH-105169]

Responsible: Dr.-Ing. Sören Bernhardt
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102645 - Major Field: Combustion Engine Techniques
M-MACH-102817 - Major Field: Information Technology

Type	Credits	Recurrence	Version
Oral examination	4	Each summer term	1

Events					
SS 2020	2134137	Engine measurement techniques	2 SWS	Lecture (V)	Bernhardt
Exams					
WS 19/20	76-T-MACH-105169	Engine Measurement Techniques		Prüfung (PR)	Koch
SS 2020	76-T-MACH-105169	Engine Measurement Techniques		Prüfung (PR)	Koch

Competence Certificate
oral examination, Duration: 0,5 hours, no auxiliary means

Prerequisites
none

Recommendation
T-MACH-102194 Combustion Engines I

Below you will find excerpts from events related to this course:

V Engine measurement techniques
2134137, SS 2020, 2 SWS, Language: German, Open in study portal

Lecture (V)

Literature

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

T 8.62 Course: Engineering Mechanics I [T-MACH-100282]

Responsible: Prof. Dr.-Ing. Thomas Böhlke
Dr.-Ing. Tom-Alexander Langhoff

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102572 - Engineering Mechanics
M-MACH-104624 - Orientation Exam

Type	Credits	Recurrence	Version
Written examination	7	Each winter term	2

Events					
WS 19/20	2161245	Engineering Mechanics I	3 SWS	Lecture (V)	Böhlke
WS 19/20	3161010	Engineering Mechanics I (Lecture)	3 SWS	Lecture (V)	Langhoff, Böhlke
Exams					
WS 19/20	76-T-MACH-100282	Engineering Mechanics I		Prüfung (PR)	Böhlke, Langhoff
WS 19/20	76-T-MACH-100282-englisch	Engineering Mechanics I		Prüfung (PR)	Böhlke, Langhoff

Competence Certificate
written exam, 90 min, graded

Prerequisites
successful participation in "Engineering Mechanics I (Tutorial)" (see T-MACH-100528)

Modeled Conditions
The following conditions have to be fulfilled:

1. The course T-MACH-100528 - Tutorial Engineering Mechanics I must have been passed.

Below you will find excerpts from events related to this course:

V Engineering Mechanics I

2161245, WS 19/20, 3 SWS, Language: German, Open in study portal

Lecture (V)

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

- Vorlesungsskript
- 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

T 8.63 Course: Engineering Mechanics II [T-MACH-100283]

Responsible: Prof. Dr.-Ing. Thomas Böhlke
Dr.-Ing. Tom-Alexander Langhoff

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102572 - Engineering Mechanics
M-MACH-104624 - Orientation Exam

Type	Credits	Recurrence	Version
Written examination	6	Each summer term	2

Events					
SS 2020	2162250	Engineering Mechanics II	3 SWS	Lecture (V)	Böhlke
SS 2020	3162010	Engineering Mechanics II (Lecture)	3 SWS	Lecture (V)	Langhoff, Pallicity
Exams					
WS 19/20	76-T-MACH-100283	Engineering Mechanics II		Prüfung (PR)	Böhlke, Langhoff
WS 19/20	76-T-MACH-100283-englisch	Engineering Mechanics II		Prüfung (PR)	Böhlke, Langhoff

Competence Certificate
written exam, 90 min, graded

Prerequisites
successful participation in "Engineering Mechanics II (Tutorial)" (see T-MACH-100284)

Modeled Conditions
The following conditions have to be fulfilled:

1. The course T-MACH-100284 - Tutorial Engineering Mechanics II must have been passed.

Below you will find excerpts from events related to this course:

V Engineering Mechanics II

2162250, SS 2020, 3 SWS, Language: German, Open in study portal

Lecture (V)

Content

- bending
- shear
- torsion
- stress and strain state in 3D
- Hooke's law in 3D
- elasticity theors in 3D
- energy methods in elastostatics
- approximation methods
- stability of elastic bars

Literature
Vorlesungsskript
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.

V

Engineering Mechanics II (Lecture)

3162010, SS 2020, 3 SWS, Language: English, Open in study portal

Lecture (V)

Content

- bending
- shear
- torsion
- stress and strain state in 3D
- Hooke's law in 3D
- elasticity theors in 3D
- energy methods in elastostatics
- approximation methods
- stability of elastic bars

T 8.64 Course: Engineering Mechanics III & IV [T-MACH-105201]

Responsible: Prof. Dr.-Ing. Wolfgang Seemann
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102572 - Engineering Mechanics

Type	Credits	Recurrence	Version
Written examination	10	Each winter term	2

Events					
WS 19/20	2161203	Engineering Mechanics III	2 SWS	Lecture (V)	Seemann
WS 19/20	3161012	Engineering Mechanics III (Lecture)	2 SWS	Lecture (V)	Seemann
SS 2020	2162231	Engineering Mechanics IV	2 SWS	Lecture (V)	Seemann
SS 2020	3162012	Engineering Mechanics 4	2 SWS	Lecture (V)	Seemann
Exams					
WS 19/20	76-T-MACH-105201	Engineering Mechanics III & IV		Prüfung (PR)	Seemann
SS 2020	76-T-MACH-105201	Engineering Mechanics III & IV		Prüfung (PR)	Seemann

Competence Certificate
Written Exam (3 h), graded

Prerequisites
Succesful accomplishment of the exercise sheets in Engineering Mechanics III (T-MACH-105202) and of the exercise sheets in Engineering Mechanics IV (T-MACH-105203).

Modeled Conditions
The following conditions have to be fulfilled:

1. The course T-MACH-105202 - Tutorial Engineering Mechanics III must have been passed.
2. The course T-MACH-105203 - Tutorial Engineering Mechanics IV must have been passed.

Below you will find excerpts from events related to this course:

V Engineering Mechanics III

2161203, WS 19/20, 2 SWS, Language: German, Open in study portal

Lecture (V)

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.

V Engineering Mechanics III (Lecture)

3161012, WS 19/20, 2 SWS, Language: English, Open in study portal

Lecture (V)

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 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 princicple 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.

V Engineering Mechanics IV

2162231, SS 2020, 2 SWS, Language: German, Open in study portal

Lecture (V)

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

V Engineering Mechanics 4

3162012, SS 2020, 2 SWS, Language: English, Open in study portal

Lecture (V)

Content
The students know some possibilities to describe the position and orientation of a rigid body for an abitrary 3d motion. They realize that the rotational velocity is a vector which may change both magnitude and orientation. They can apply the principle of linear momentum and the principle of moment of momentum to a spatial motion of a rigid boy and notice that this is much more complicated compared to a plain motion. The students can caculate the coordinates of the intertia tensor. They see that many effects which may be seen with gyroscopes can be explained by the principle of moment of momentum. For systems with many particles or bodies but only few degrees of freedom the students know that the application of analytical methods like the principle of D'Alembert in Lagrangian form or the Lagrange equations may be advantageous. They can apply these principles to simple problems. For vibration problems the students can interprete the most important expressions like eigenfrequency, resonance or eigenvalue problem. Forced vibration of systems with the degree of freedom can be investigated by the students.

T 8.65 Course: Excercises in Technical Thermodynamics and Heat Transfer I [T-MACH-105204]

Responsible: Prof. Dr. Ulrich Maas
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102574 - Technical Thermodynamics

Type	Credits	Recurrence	Version
Completed coursework (written)	0	Each winter term	1

Events					
WS 19/20	2165502	Exercise course Technical Thermodynamics and Heat Transfer I	2 SWS	Practice (Ü)	Maas
WS 19/20	3165015	Technical Thermodynamics and Heat Transfer I (Tutorial)	2 SWS	Tutorial (Tu)	Schießl, Maas
Exams					
WS 19/20	76-T-MACH-105204	Excercises in Technical Thermodynamics and Heat Transfer I		Prüfung (PR)	Maas

Competence Certificate
Homework is mandatory.

T 8.66 Course: Excercises in Technical Thermodynamics and Heat Transfer II [T-MACH-105288]

Responsible: Prof. Dr. Ulrich Maas
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102574 - Technical Thermodynamics

Type	Credits	Recurrence	Version
Completed coursework	0	Each summer term	1

Events					
SS 2020	2166556	Technical Thermodynamics and Heat Transfer II (Tutorial)	2 SWS	Practice (Ü)	Maas
SS 2020	3166033	Technical Thermodynamics and Heat Transfer II (Tutorial)	2 SWS	Practice (Ü)	Schießl, Maas
Exams					
WS 19/20	76-T-MACH-105288	Excercises in Technical Thermodynamics and Heat Transfer II		Prüfung (PR)	Maas

Competence Certificate
Homework is mandatory.

Prerequisites
none

Below you will find excerpts from events related to this course:

V Technical Thermodynamics and Heat Transfer II (Tutorial)
2166556, SS 2020, 2 SWS, Language: German, Open in study portal

Practice (Ü)

Content
Calculation of thermodynamical problems

Literature
Vorlesungsskriptum
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.

T 8.67 Course: Exercices - Tribology [T-MACH-109303]

Responsible: Prof. Dr. Martin Dienwiebel
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102812 - Major Field: Powertrain Systems

Type	Credits	Recurrence	Expansion	Version
Completed coursework	0	Each winter term	1 terms	1

Events					
WS 19/20	2181114	Tribology	5 SWS	Lecture / Practice (VÜ)	Dienwiebel, Scherge
Exams					
WS 19/20	76-T-MACH-109303	Exercices - Tribology		Prüfung (PR)	Dienwiebel

Competence Certificate
successful solving of all exercises

Prerequisites
none

Below you will find excerpts from events related to this course:

V Tribology

2181114, WS 19/20, 5 SWS, Language: German, Open in study portal

Lecture / Practice (VÜ)

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.
- Chapter 4: Measurement Techniques
  friction measurement, tribometer, dissipated frictional power, conventional wear measurement, continuous wear measurement(RNT)
- Chapter 5: Roughness
  profilometry, surface roughness parameters, evaluation length and filters, bearing ratio curve, measurement error
- Chapter 6: Accompanying Analysis
  multi-scale topography measurement, chemical surface analysis, structural analysis, mechanical analysis

Exercises are used for complementing and deepening the contents of the lecture as well as for answering more extensive questions raised by the students.

The student can

- describe the fundamental friction and wear mechanisms, which occur in tribologically stressed systems
- evaluate the friction and wear behavior of tribological systems
- explain the effects of lubricants and their most important additives
- identify suitable approaches to optimize tribological systems
- explain the most important experimental methods for the measurement of friction and wear, and is able to use them for the characterisation of tribo pairs
- choose suitable methods for the evaluation of roughness and topography from the nm-scale to the mm-scale and is able to interpret the determined values in respect to their effect on the tribological behavior
- describe the most important surface-analytical methods and their physical principles for the characterization of tribologically stressed sliding surfaces

preliminary knowlegde in mathematics, mechanics and materials science recommended

regular attendance: 45 hours
self-study: 195 hours

oral examination (ca. 40 min)

no tools or reference materials

admission to the exam only with successful completion of the exercises

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)

T 8.68 Course: Exercises for Materials Characterization [T-MACH-107685]

Responsible: Dr.-Ing. Jens Gibmeier
Organisation: KIT Department of Mechanical Engineering
Part of: M-MACH-102819 - Major Field: Materials Science and Engineering

Type	Credits	Recurrence	Version
Completed coursework	2	Each winter term	3

Events					
WS 19/20	2174586	materials characterization	2 SWS	Lecture (V)	Schneider, Gibmeier
Exams					
WS 19/20	76-T-MACH-107685	Exercises for Materials Characterization		Prüfung (PR)	Heilmaier, Gibmeier
SS 2020	76-T-MACH-107685	Exercises for Materials Characterization		Prüfung (PR)	Heilmaier, Gibmeier

Competence Certificate
Regular attendance

Prerequisites
none

Below you will find excerpts from events related to this course:

V materials characterization
2174586, WS 19/20, 2 SWS, Language: German, Open in study portal

Lecture (V)

Content
The following methods will be introduced within this lecture:

- microscopic methods: optical microscopy, electron microscopy (SEM/TEM), atomic force microscopy
- material and microstructure analyses by means of X-ray, neutron and electron beams
- analysis methods at SEM/TEM (e.g. EELS)
- spectroscopic methods (e.g. EDS / WDS)

learning objectives:
The students have fundamental knowledge about methods of material analysis. They have a basic understanding to transfer this fundamental knowledge on problems in engineering science. Furthermore, the students have the ability to describe technical material by its microscopic and submicroscopic structure.
requirements:
none
workload:

The workload for the module "Materials Characterization" is 180 h per semester and consists of the presence during the lectures (21 h) and tutorials (12 h) as well as self-study for the lecture (99 h) and for the tutorials (48 h).

Literature
Vorlesungsskript (wird zu Beginn der Veranstaltung ausgegeben).

Literatur wird zu Beginn der Veranstaltung bekanntgegeben.

T 8.69 Course: Experimental Dynamics [T-MACH-105514]

Responsible: Prof. Dr.-Ing. Alexander Fidlin
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102820 - Major Field: Mechatronics
M-MACH-104430 - Major Field: Modeling and Simulation in Dynamics
M-MACH-104442 - Major Field: Vibration Theory

Type	Credits	Recurrence	Version
Oral examination	5	Each summer term	1

Events					
SS 2020	2162225	Experimental Dynamics	3 SWS	Lecture (V)	Fidlin
SS 2020	2162228	Übungen zu Experimentelle Dynamik	2 SWS	Practice (Ü)	Fidlin, Keller
Exams					
WS 19/20	76-T-MACH-105514	Experimental Dynamics		Prüfung (PR)	Fidlin
SS 2020	76-T-MACH-105514	Experimental Dynamics		Prüfung (PR)	Fidlin

Competence Certificate
oral exam, 30 min.

Prerequisites
Can not be combined with Practical Training in Measurement of Vibrations (T-MACH-105373).

Modeled Conditions
The following conditions have to be fulfilled:

1. The course T-MACH-105373 - Practical Training in Measurement of Vibrations must not have been started.

Below you will find excerpts from events related to this course:

V Experimental Dynamics

2162225, SS 2020, 3 SWS, Language: German, Open in study portal

Lecture (V)

Content

1. Introduction
2. Measurement principles
3. Sensors as coopled multi-physical systems
4. Digital signal processing, measurements in frequency domain
5. Forced non-linear vibrations
6. Stability problems (Mathieu oscillator, friction induces vibrations)
7. Elementary rotor dynamics
8. Modal analysis

T 8.70 Course: Failure Analysis [T-MACH-105724]

Responsible: Dr. Christian Greiner
Dr.-Ing. Johannes Schneider

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102819 - Major Field: Materials Science and Engineering

Type	Credits	Recurrence	Version
Oral examination	4	Each winter term	2

Events					
WS 19/20	2182572	Failure Analysis	2 SWS	Lecture (V)	Greiner, Schneider
Exams					
WS 19/20	76-T-MACH-105724	Failure Analysis		Prüfung (PR)	Schneider, Greiner
SS 2020	76-T-MACH-105724	Failure Analysis		Prüfung (PR)	Schneider

Competence Certificate
oral examination, ca. 30 min

Prerequisites
none

Recommendation
basic knowledge in materials science (e.g. lecture materials science I and II)

Below you will find excerpts from events related to this course:

V Failure Analysis
2182572, WS 19/20, 2 SWS, Open in study portal

Lecture (V)

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

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.

basic knowledge in materials science (e.g. lecture materials science I and II) recommended

regular attendance: 21 hours
self-study: 99 hours

oral exam, duration: ca. 30 minutes
no notes

Literature

1. G. Lange: Systematische Beurteilung technischer Schadensfälle, 6. Auflage, WILEY-VCH Verlag, 2014, ISBN 978-3-527-68316-1, In der KIT-BIB online verfügbar!
2. A. Neidel, et al.: Handbuch Metallschäden -- REM-Atlas und Fallbeispiele zur Ursachenanalyse und Vermeidung, 2. Auflage, Hanser Verlag, 2011, ISBN 978-3-446-42966-6
3. J. Grosch, et al.: Schadenskunde im Maschinenbau: Charakteristische Schadensursachen – Analyse und Aussagen von Schadensfällen, 6. Auflage, Expert-Verlag, 2014, ISBN 978-3-816-93172-0
4. E. Wendler-Kalsch, H. Gräfen: Korrosionsschadenkunde, Springer-Verlag, 1998, ISBN 3-540-63377-4

T 8.71 Course: Failure of Structural Materials: Deformation and Fracture [T-MACH-102140]

Responsible: Prof. Dr. Peter Gumbsch
Dr. Daniel Weygand

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102812 - Major Field: Powertrain Systems
M-MACH-102819 - Major Field: Materials Science and Engineering

Type	Credits	Recurrence	Version
Oral examination	4	Each winter term	1

Events					
WS 19/20	2181711	Failure of structural materials: deformation and fracture	3 SWS	Lecture / Practice (VÜ)	Gumbsch, Weygand
Exams					
WS 19/20	76-T-MACH-102140	Failure of Structural Materials: Deformation and Fracture		Prüfung (PR)	Weygand, Gumbsch, Kraft
SS 2020	76-T-MACH-102140	Failure of Structural Materials: Deformation and Fracture		Prüfung (PR)	Kraft, Weygand, Gumbsch

Competence Certificate
oral exam ca. 30 minutes

no tools or reference materials

Prerequisites
none

Recommendation
preliminary knowlegde in mathematics, mechanics and materials science

Below you will find excerpts from events related to this course:

V Failure of structural materials: deformation and fracture
2181711, WS 19/20, 3 SWS, Language: German, Open in study portal

Lecture / Practice (VÜ)

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
    - hypotheses for failure
    - linear elasic fracture mechanics
    - crack resitance
    - experimental measurement of fracture toughness
    - defect measurement
    - crack propagation
    - application of fracture mechanics
    - atomistics of fracture

The student

- has the basic understanding of mechanical processes to explain the relationship between externally applied load and materials strength.
- can explain the foundation of linear elastic fracture mechanics and is able to determine if this concept can be applied to a failure by fracture.
- can decribe the main empirical materials models for deformation and fracture and can apply them.
- has the physical understanding to describe and explain phenomena of failure.

preliminary knowlegde in mathematics, mechanics and materials science recommended

regular attendance: 22,5 hours
self-study: 97,5 hours

The assessment consists of an oral examination (ca. 30 min) according to Section 4(2), 2 of the examination regulation.

Literature

- Engineering Materials, M. Ashby and D.R. Jones (2nd Edition, Butterworth-Heinemann, Oxford, 1998); sehr lesenswert, relativ einfach aber dennoch umfassend, verständlich
- Mechanical Behavior of Materials, Thomas H. Courtney (2nd Edition, McGraw Hill, Singapur); Klassiker zu den mechanischen Eigenschaften der Werkstoffe, umfangreich, gut
- Bruchvorgänge in metallischen Werkstoffen, D. Aurich (Werkstofftechnische Verlagsgesellschaft Karlsruhe), relativ einfach aber dennoch umfassender Überblick für metallische Werkstoffe

8.72 Course: Failure of Structural Materials: Fatigue and Creep [T-MACH-102139]

Responsible: Dr. Patric Gruber
Prof. Dr. Peter Gumbsch

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102819 - Major Field: Materials Science and Engineering

Type	Credits	Recurrence	Version
Oral examination	4	Each winter term	1

Events					
WS 19/20	2181715	Failure of Structural Materials: Fatigue and Creep	2 SWS	Lecture (V)	Gruber, Gumbsch
Exams					
WS 19/20	76-T-MACH-102139	Failure of Structural Materials: Fatigue and Creep		Prüfung (PR)	Kraft, Gumbsch, Gruber

Competence Certificate
oral exam ca. 30 minutes

no tools or reference materials

Prerequisites
none

Recommendation
preliminary knowlegde in mathematics, mechanics and materials science

Below you will find excerpts from events related to this course:

Failure of Structural Materials: Fatigue and Creep

2181715, WS 19/20, 2 SWS, Language: German, Open in study portal

Lecture (V)

Content
1 Fatigue
1.1 Introduction
1.2 Lifetime
1.3 Fatigue Mechanisms
1.4 Material Selection
1.5 Notches and Shape Optimization
1.6 Case Studies: ICE-Accidents

2 Creep
2.1 Introduction
2.2 High Temperature Plasticity
2.3 Phänomenological DEsciption of Creep
2.4 Creep Mechanisms
2.5 Alloying Effects

The student

- has the basic understanding of mechanical processes to explain the relationships between externally applied load and materials strength.
- can describe the main empirical materials models for fatigue and creep and can apply them.
- has the physical understanding to describe and explain phenomena of failure.
- can use statistical approaches for reliability predictions.
- can use its acquired skills, to select and develop materials for specific applications.

preliminary knowlegde in mathematics, mechanics and materials science recommended

regular attendance: 22,5 hours
self-study: 97,5 hours

The assessment consists of an oral examination (ca. 30 min) according to Section 4(2), 2 of the examination regulation.

Literature

- Engineering Materials, M. Ashby and D.R. Jones (2nd Edition, Butterworth-Heinemann, Oxford, 1998); sehr lesenswert, relativ einfach aber dennoch umfassend, verständlich
- Mechanical Behavior of Materials, Thomas H. Courtney (2nd Edition, McGraw Hill, Singapur); Klassiker zu den mechanischen Eigenschaften der Werkstoffe, umfangreich, gut
- Bruchvorgänge in metallischen Werkstoffen, D. Aurich (Werkstofftechnische Verlagsgesellschaft Karlsruhe), relativ einfach aber dennoch umfassender Überblick für metallische Werkstoffe
- Fatigue of Materials, Subra Suresh (2nd Edition, Cambridge University Press); Standardwerk über Ermüdung, alle Materialklassen, umfangreich, für Einsteiger und Fortgeschrittene

T 8.73 Course: Fatigue of Metallic Materials [T-MACH-105354]

Responsible: Dr.-Ing. Stefan Guth
Dr. Karl-Heinz Lang

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102819 - Major Field: Materials Science and Engineering

Type	Credits	Recurrence	Version
Oral examination	4	Each winter term	2

Events					
WS 19/20	2173585	Fatigue of Metallic Materials	2 SWS	Lecture (V)	Guth, Lang
Exams					
WS 19/20	76-T-MACH-105354	Fatigue of Metallic Materials		Prüfung (PR)	Lang, Guth
SS 2020	76-T-MACH-105354	Fatigue of Metallic Materials		Prüfung (PR)	Lang, Guth

Competence Certificate
Oral exam, about 20 minutes

Prerequisites
none

Recommendation
Basic knowledge in Materials Science will be helpful.

Below you will find excerpts from events related to this course:

V Fatigue of Metallic Materials

2173585, WS 19/20, 2 SWS, Language: German, Open in study portal

Lecture (V)

Content
Introduction: some interesting cases of damage

Cyclic Stress Strain Behaviour

Crack Initiation

Crack Propagation

Lifetime Behaviour under Cyclic Loading

Fatigue of Notched Components

Influence of Residual Stresses

Structural Durability

learning objectives:

The students are able to recognise the deformation and the failure behaviour of metallic materials under cyclic loading and to assign it to the basic microstructural processes. They know the sequence and the development of fatigue damages and can evaluate the initiation and the growth of fatigue cracks.

The students can assess the cyclic strength behaviour of metallic materials and components both qualitatively and quantitatively and know the procedures for the assessment of single-stage, multistage and stochastic cyclical loadings. Furthermore, they can take into account the influence of residual stresses.

requirements:

none, basic knowledge in Material Science will be helpful

workload:

regular attendance: 21 hours
self-study: 99 hours

Literature
Ein Manuskript, das auch aktuelle Literaturhinweise enthällt, wird in der Vorlesung verteilt.

T 8.74 Course: Flows and Heat Transfer in Energy Technology [T-MACH-105403]

Responsible: Prof. Dr.-Ing. Xu Cheng
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102816 - Major Field: Fundamentals of Energy Technology

Type	Credits	Recurrence	Version
Oral examination	4	Each winter term	1

Events					
WS 19/20	2189911	Tutorial 'Flows and Heat Transfer in Energy Technology '	1 SWS	Practice (Ü)	Cheng, Mitarbeiter
Exams					
WS 19/20	76-T-MACH-105403	Flows and Heat Transfer in Energy Technology		Prüfung (PR)	Cheng

Competence Certificate
oral exam, 20 min

Prerequisites
none

T 8.75 Course: Fluid Mechanics 1&2 [T-MACH-105207]

Responsible: Prof. Dr.-Ing. Bettina Frohnapfel
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102565 - Fluid Mechanics

Type	Credits	Recurrence	Version
Written examination	8	Each summer term	2

Events					
WS 19/20	2153512	Fluid Mechanics II	3 SWS	Lecture / Practice (VÜ)	Frohnapfel
WS 19/20	3153511	Fluid Mechanics II	3 SWS	Lecture / Practice (VÜ)	Frohnapfel
SS 2020	2154512	Fluid Mechanics I	3 SWS	Lecture / Practice (VÜ)	Frohnapfel
SS 2020	3154510	Fluid Mechanics I	3 SWS	Lecture / Practice (VÜ)	Frohnapfel
Exams					
WS 19/20	76-T-MACH-105207	Fluid Mechanics (1+2)		Prüfung (PR)	Frohnapfel

Competence Certificate
written exam 3 hours

Prerequisites
none

Below you will find excerpts from events related to this course:

V Fluid Mechanics II

2153512, WS 19/20, 3 SWS, Language: German, Open in study portal

Lecture / Practice (VÜ)

Content
The students know how to derive the fundamental equations for mass and momentum conservation and can introduce material laws for fluids into those. They can discuss the physical meaning of the different terms in the Navier-Stokes-Equations. They are capable of simplifying the mathematical equations that describe the motion of fluids and can compute flow quantities for generic problems based on these simplified equations. This includes the calculation of static and dynamic forces acting from the fluid onto the solid as well as the detailed analysis of two-dimensional viscous flows.

tensor notation, fluid elements in continuum, Reynolds transport theorem, conservation of mass and momentum, continuity equation, constitutive law for Newtonian fluids, Navier-Stokes equations, angular momentum and energy conservation, integral form of the conservation equations, forces between fluids and solids, analytical solutions of the Navier-Stokes equations

Literature
Kundu, P.K., Cohen, K.M.: Fluid Mechanics, Elsevier, 4th Edition, 2008

Durst, F.: Grundlagen der Strömungsmechanik, Springer, 2006

Oertel, H.: Strömungsmechanik, Vieweg-Verlag, 4. Auflage 2006
Oertel, H., Böhle, M.: Übungsbuch Strömungsmechanik, Vieweg-Verlag, 5. Auflage 2006

Zierep, J., Bühler, K.: Strömungsmechanik, Springer Lehrbuch bzw. entsprechende Kapitel in Hütte.Das Ingenieurwissen, Springer

V Fluid Mechanics II

3153511, WS 19/20, 3 SWS, Language: English, Open in study portal

Lecture / Practice (VÜ)

Content
The students know how to derive the fundamental equations for mass and momentum conservation and can introduce material laws for fluids into those. They can discuss the physical meaning of the different terms in the Navier-Stokes-Equations. They are capable of simplifying the mathematical equations that describe the motion of fluids and can compute flow quantities for generic problems based on these simplified equations. This includes the calculation of static and dynamic forces acting from the fluid onto the solid as well as the detailed analysis of two-dimensional viscous flows.

tensor notation, fluid elements in continuum, Reynolds transport theorem, conservation of mass and momentum, continuity equation, constitutive law for Newtonian fluids, Navier-Stokes equations, angular momentum and energy conservation, integral form of the conservation equations, forces between fluids and solids, analytical solutions of the Navier-Stokes equations

Literature
Kundu, P.K., Cohen, K.M.: Fluid Mechanics, Elsevier, 4th Edition, 2008

Durst, F.: Grundlagen der Strömungsmechanik, Springer, 2006

Oertel, H.: Strömungsmechanik, Vieweg-Verlag, 4. Auflage 2006
Oertel, H., Böhle, M.: Übungsbuch Strömungsmechanik, Vieweg-Verlag, 5. Auflage 2006

Zierep, J., Bühler, K.: Strömungsmechanik, Springer Lehrbuch bzw. entsprechende Kapitel in Hütte.Das Ingenieurwissen, Springer

V **Fluid Mechanics I** **Lecture / Practice (VÜ)**
2154512, SS 2020, 3 SWS, Language: German, Open in study portal

Content
Introduction to the fundamentals of fluid mechanics for students of mechanical engineering and related fields, physics and mathematics. The lecture is complemented by a tutorial.

- Introduction
- Flows in Nature and Technologie
- Fundamentals of Fluid Mechanics
- Properties of Fluids and Characteristic Fluid Regimes
- Fundamental Equations of Fluid Mechanics (Conservation of Mass, Momentum and Energy)
    - Continuity equation
    - Navier-Stokes equations (Euler Equations)
    - Energy equation
- Hydro- und Aerostatics
- Flows without dissipation (lossless)
- Technical Flows with Losses
- Introduction to Similarity Analysis
- Two-Dimensional Viscous Flows
- Integral Form of the Governing Equations
- Introduction to Gas Dynamics

Literature
Kundu, P.K., Cohen, K.M.: Fluid Mechanics, Elsevier, 4th Edition, 2008

Durst, F.: Grundlagen der Strömungsmechanik, Springer, 2006

Oertel, H.: Strömungsmechanik, Vieweg-Verlag, 4. Auflage 2006
Oertel, H., Böhle, M.: Übungsbuch Strömungsmechanik, Vieweg-Verlag, 5. Auflage 2006

Zierep, J., Bühler, K.: Strömungsmechanik, Springer Lehrbuch bzw. entsprechende Kapitel in Hütte.Das Ingenieurwissen, Springer

V **Fluid Mechanics I** **Lecture / Practice (VÜ)**
3154510, SS 2020, 3 SWS, Language: English, Open in study portal

Content

Introduction to the fundamentals of fluid mechanics for students of mechanical engineering and related fields, physics and mathematics. The lecture is complemented by a tutorial.

- Introduction
- Flows in Nature and Technologie
- Fundamentals of Fluid Mechanics
- Properties of Fluids and Characteristic Fluid Regimes
- Fundamental Equations of Fluid Mechanics (Conservation of Mass, Momentum and Energy)
    - Continuity equation
    - Navier-Stokes equations (Euler Equations)
    - Energy equation
- Hydro- und Aerostatics
- Flows without dissipation (lossless)
- Technical Flows with Losses
- Introduction to Similarity Analysis
- Two-Dimensional Viscous Flows
- Integral Form of the Governing Equations
- Introduction to Gas Dynamics

Literature

Kundu, P.K., Cohen, K.M.: Fluid Mechanics, Elsevier, 4th Edition, 2008

Durst, F.: Grundlagen der Strömungsmechanik, Springer, 2006

Oertel, H.: Strömungsmechanik, Vieweg-Verlag, 4. Auflage 2006
Oertel, H., Böhle, M.: Übungsbuch Strömungsmechanik, Vieweg-Verlag, 5. Auflage 2006

Zierep, J., Bühler, K.: Strömungsmechanik, Springer Lehrbuch bzw. entsprechende Kapitel in Hütte. Das Ingenieurwissen, Springer

T 8.76 Course: Fluid Power Systems [T-MACH-102093]

Responsible: Prof. Dr.-Ing. Marcus Geimer
Felix Pult

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102746 - Compulsory Elective Module
M-MACH-102838 - Major Field: Energy Converting Engines

Type	Credits	Recurrence	Version
Written examination	4	Each winter term	2

Events					
WS 19/20	2114093	Fluid Technology	2 SWS	Lecture (V)	Geimer, Pult
Exams					
WS 19/20	76T-MACH-102093	Fluid Power Systems		Prüfung (PR)	Geimer
SS 2020	76-T-MACH-102093	Fluid Power Systems		Prüfung (PR)	Geimer

Competence Certificate
The assessment consists of a writen exam (90 minutes) taking place in the recess period. The exam takes place in every semester. Re-examinations are offered at every ordinary examination date.

Prerequisites
none

Below you will find excerpts from events related to this course:

V Fluid Technology

Lecture (V)

2114093, WS 19/20, 2 SWS, Language: German, Open in study portal

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.

- regular attendance: 21 hours
- self-study: 92 hours

Literature
Skriptum zur Vorlesung *Fluidtechnik*
Institut für Fahrzeugsystemtechnik
downloadbar

T 8.77 Course: Foundry Technology [T-MACH-105157]

Responsible: Dr.-Ing. Christian Wilhelm
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102819 - Major Field: Materials Science and Engineering

Type	Credits	Recurrence	Version
Oral examination	4	Each summer term	2

Events					
SS 2020	2174575	Foundry Technology	2 SWS	Lecture (V)	Wilhelm

Competence Certificate
oral exam; about 25 minutes

Prerequisites
M-MACH-102562 - Materials Science must be passed.

Modeled Conditions
The following conditions have to be fulfilled:

1. The module M-MACH-102562 - Materials Science must have been passed.

Below you will find excerpts from events related to this course:

V Foundry Technology
2174575, SS 2020, 2 SWS, Language: German, Open in study portal

Lecture (V)

Content

Moulding and casting processes

Solidifying of melts

Castability

Fe-Alloys

Non-Fe-Alloys

Moulding and additive materials

Core production

Sand reclamation

Design in casting technology

Casting simulation

Foundry Processes

learning objectives:

The students know the specific moulding and casting techniques and are able to describe them in detail. The students know the application of moulding and casting techniques concerning castings and metals, their advantages and disadvantages in comparison, their application limits and are able to describe these in detail.

The students know the applied metals and are able to describe advantages and disadvantages as well as the specific range of use.

The students are able, to describe detailled mould and core materials, technologies, their application focus and mould-affected casting defects.

The students know the basics of casting process of any casting parts concerning the above mentioned criteria and are able to describe detailled.

requirements:

Required: Material Science and Engineering I and II

workload:

The workload for the lecture Foundry Technology is 120 h per semester and consists of the presence during the lecture (21 h) as well as preparation and rework time at home (99 h).

Literature

Literaturhinweise werden in der Vorlesung gegeben

Reference to literature, documentation and partial lecture notes given in lecture

T 8.78 Course: Fuels and Lubricants for Combustion Engines [T-MACH-105184]

Responsible: Dr.-Ing. Bernhard Ulrich Kehrwald
Dr.-Ing. Heiko Kubach

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102645 - Major Field: Combustion Engine Techniques
M-MACH-102838 - Major Field: Energy Converting Engines

Type	Credits	Recurrence	Version
Oral examination	4	Each winter term	1

Events					
WS 19/20	2133108	Fuels and Lubricants for Combustion Engines	2 SWS	Lecture (V)	Kehrwald
Exams					
WS 19/20	76-T-MACH-105184	Fuels and Lubricants for Combustion Engines		Prüfung (PR)	Kehrwald
SS 2020	76-T-MACH-105184	Fuels and Lubricants for Combustion Engines		Prüfung (PR)	Kehrwald

Competence Certificate
oral examination, Duration: ca. 25 min., no auxiliary means

Prerequisites
none

Below you will find excerpts from events related to this course:

V Fuels and Lubricants for Combustion Engines — Lecture (V)
2133108, WS 19/20, 2 SWS, Language: German, Open in study portal

Content
Introduction and basics

Fuels for Gasoline and Diesel engines

Hydrogen

Lubricants for Gasoline and Diesel engines

Coolants for combustion engines

Literature
Skript

T 8.79 Course: Fundamentals for Design of Motor-Vehicle Bodies I [T-MACH-102116]

Responsible: Horst Dietmar Bardehle
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102815 - Major Field: Engineering Design
M-MACH-102818 - Major Field: Vehicle Technology

Type	Credits	Recurrence	Version
Oral examination	2	Each winter term	1

Events					
WS 19/20	2113814	Fundamentals for Design of Motor-Vehicles Bodies I	1 SWS	Lecture (V)	Bardehle
Exams					
WS 19/20	76-T-MACH-102116	Fundamentals for Design of Motor-Vehicle Bodies I		Prüfung (PR)	Unrau, Bardehle

Competence Certificate
Oral group examination

Duration: 30 minutes

Auxiliary means: none

Prerequisites
none

Below you will find excerpts from events related to this course:

V Fundamentals for Design of Motor-Vehicles Bodies I

2113814, WS 19/20, 1 SWS, Language: German, Open in study portal

Lecture (V)

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

Learning Objectives:

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, to be able to analyze and to judge relating components as well as to develop them accordingly.

Literature
1. Automobiltechnische Zeitschrift ATZ, Friedr. Vieweg & Sohn Verlagsges. mbH, Wiesbaden
2. Automobil Revue, Bern (Schweiz)
3. Automobil Produktion, Verlag Moderne Industrie, Landsberg

T 8.80 Course: Fundamentals for Design of Motor-Vehicle Bodies II [T-MACH-102119]

Responsible: Horst Dietmar Bardehle
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102815 - Major Field: Engineering Design
M-MACH-102818 - Major Field: Vehicle Technology

Type	Credits	Recurrence	Version
Oral examination	2	Each summer term	1

Events					
SS 2020	2114840	Fundamentals for Design of Motor-Vehicles Bodies II	1 SWS	Lecture (V)	Bardehle
Exams					
WS 19/20	76-T-MACH-102119	Fundamentals for Design of Motor-Vehicle Bodies II		Prüfung (PR)	Bardehle

Competence Certificate
Oral group examination

Duration: 30 minutes

Auxiliary means: none

Prerequisites
none

Below you will find excerpts from events related to this course:

V Fundamentals for Design of Motor-Vehicles Bodies II

Lecture (V)
2114840, SS 2020, 1 SWS, Language: German, Open in study portal

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

Learning Objectives:

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. Based on this they are ready to analyze and to judge the relation of these single components. They are also able to contribute competently to complex development tasks by imparted knowledge in project management.

Literature
1. Automobiltechnische Zeitschrift ATZ, Friedr. Vieweg & Sohn Verlagsges. mbH,
Wiesbaden
2. Automobil Revue, Bern (Schweiz)
3. Automobil Produktion, Verlag Moderne Industrie, Landsberg

T 8.81 Course: Fundamentals in the Development of Commercial Vehicles I [T-MACH-105160]

Responsible: Prof. Dr. Jörg Zürn
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102815 - Major Field: Engineering Design
M-MACH-102818 - Major Field: Vehicle Technology

Type	Credits	Recurrence	Version
Oral examination	2	Each winter term	1

Events					
WS 19/20	2113812	Fundamentals in the Development of Commercial Vehicles I	1 SWS	Lecture (V)	Zürn
Exams					
WS 19/20	76-T-MACH-105160	Fundamentals in the Development of Commercial Vehicles I		Prüfung (PR)	Zürn

Competence Certificate
Oral group examination

Duration: 30 minutes

Auxiliary means: none

Prerequisites
none

Below you will find excerpts from events related to this course:

V Fundamentals in the Development of Commercial Vehicles I

Lecture (V)

2113812, WS 19/20, 1 SWS, Language: German, Open in study portal

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

Learning Objectives:

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 cab concepts, the interior and the interior design process. Consequently they are ready to analyze and to judge concepts of commercial vehicles as well as to participate competently in the commercial vehicle development.

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.

T 8.82 Course: Fundamentals in the Development of Commercial Vehicles II [T-MACH-105161]

Responsible: Prof. Dr. Jörg Zürn
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102815 - Major Field: Engineering Design
M-MACH-102818 - Major Field: Vehicle Technology

Type	Credits	Recurrence	Version
Oral examination	2	Each summer term	1

Events					
SS 2020	2114844	Fundamentals in the Development of Commercial Vehicles II	1 SWS	Lecture (V)	Zürn
Exams					
WS 19/20	76-T-MACH-105161	Fundamentals in the Development of Commercial Vehicles II		Prüfung (PR)	Zürn

Competence Certificate
Oral group examination

Duration: 30 minutes

Auxiliary means: none

Prerequisites
none

Below you will find excerpts from events related to this course:

V Fundamentals in the Development of Commercial Vehicles II

2114844, SS 2020, 1 SWS, Language: German, Open in study portal

Lecture (V)

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

Learning Objectives:

The students 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. Consequently the student are able to analyze and to judge the general concepts as well as to adjust them precisely with the area of application.

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

T 8.83 Course: Fundamentals of Automobile Development I [T-MACH-105162]

Responsible: Dipl.-Ing. Rolf Frech
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102815 - Major Field: Engineering Design
M-MACH-102818 - Major Field: Vehicle Technology

Type	Credits	Recurrence	Version
Written examination	2	Each winter term	1

Events					
WS 19/20	2113810	Fundamentals of Automobile Development I	1 SWS	Lecture (V)	Frech
WS 19/20	2113851	Principles of Whole Vehicle Engineering I	1 SWS	Lecture (V)	Frech
Exams					
WS 19/20	76-T-MACH-105162	Fundamentals of Automobile Development I		Prüfung (PR)	Frech, Unrau

Competence Certificate
Written examination

Duration: 90 minutes

Auxiliary means: none

Prerequisites
none

Below you will find excerpts from events related to this course:

V Fundamentals of Automobile Development I — Lecture (V)
2113810, WS 19/20, 1 SWS, Language: German, Open in study portal

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

Learning Objecitves:

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. They are ready to judge goal conflicts in the field of automobile development and to work out approaches to solving a problem.

Literature
Skript zur Vorlesung wird zu Beginn des Semesters ausgegeben

The scriptum will be provided during the first lessons

V Principles of Whole Vehicle Engineering I — Lecture (V)
2113851, WS 19/20, 1 SWS, Language: English, Open in study portal

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

Learning Objectives:

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. They are ready to judge goal conflicts in the field of automobile development and to work out approaches to solving a problem.

Literature
Skript zur Vorlesung wird zu Beginn des Semesters ausgegeben

The scriptum will be provided during the first lessons

T 8.84 Course: Fundamentals of Automobile Development II [T-MACH-105163]

Responsible: Dipl.-Ing. Rolf Frech
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102815 - Major Field: Engineering Design
M-MACH-102818 - Major Field: Vehicle Technology

Type	Credits	Recurrence	Version
Written examination	2	Each summer term	2

Events					
SS 2020	2114842	Fundamentals of Automobile Development II	1 SWS	Lecture (V)	Frech
SS 2020	2114860	Principles of Whole Vehicle Engineering II	1 SWS		Frech
Exams					
WS 19/20	76-T-MACH-105163	Fundamentals of Automobile Development II		Prüfung (PR)	Unrau, Frech

Competence Certificate
Written examination

Duration: 90 minutes

Auxiliary means: none

Prerequisites
none

Below you will find excerpts from events related to this course:

V Fundamentals of Automobile Development II — Lecture (V)
2114842, SS 2020, 1 SWS, Language: German, Open in study portal

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

Learning Objectives:

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. They are ready to participate competently in the development process of the complete vehicle.

Literature
Skript zur Vorlesung ist über ILIAS verfügbar.

V Principles of Whole Vehicle Engineering II
2114860, SS 2020, 1 SWS, Language: English, Open in study portal

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

Learning Objectives:

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. They are ready to participate competently in the development process of the complete vehicle.

Literature

Das Skript zur Vorlesung ist über ILIAS verfügbar.

T 8.85 Course: Fundamentals of Catalytic Exhaust Gas Aftertreatment [T-MACH-105044]

Responsible: Prof. Dr. Olaf Deutschmann
Prof. Dr. Jan-Dierk Grunwaldt
Dr.-Ing. Heiko Kubach
Prof. Dr.-Ing. Egbert Lox

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102645 - Major Field: Combustion Engine Techniques
M-MACH-102818 - Major Field: Vehicle Technology
M-MACH-102838 - Major Field: Energy Converting Engines

Type	Credits	Recurrence	Version
Oral examination	4	Each summer term	1

Events					
SS 2020	2134138	Fundamentals of catalytic exhaust gas aftertreatment	2 SWS	Lecture (V)	Lox, Grunwaldt, Deutschmann
Exams					
WS 19/20	76-T-MACH-105044	Fundamentals of Catalytic Exhaust Gas Aftertreatment		Prüfung (PR)	Lox
SS 2020	76-T-MACH-105044	Fundamentals of Catalytic Exhaust Gas Aftertreatment		Prüfung (PR)	Lox

Competence Certificate
oral examination, Duration: 25 min., no auxiliary means

Prerequisites
none

Below you will find excerpts from events related to this course:

V Fundamentals of catalytic exhaust gas aftertreatment

2134138, SS 2020, 2 SWS, Language: German, Open in study portal

Lecture (V)

Literature
Skript, erhältlich in der Vorlesung

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

T 8.86 Course: Fundamentals of Combustion Engine Technology [T-MACH-105652]

Responsible: Dr.-Ing. Sören Bernhardt
Dr.-Ing. Heiko Kubach
Jürgen Pfeil
Dr.-Ing. Olaf Toedter
Dr.-Ing. Uwe Wagner

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102645 - Major Field: Combustion Engine Techniques
M-MACH-102746 - Compulsory Elective Module

Type	Credits	Recurrence	Version
Oral examination	5	Each winter term	1

Events					
WS 19/20	2133123	Fundamentals of Combustion Engine Technology	2 SWS	Lecture (V)	Kubach, Wagner, Toedter, Pfeil, Bernhardt, Velji
Exams					
WS 19/20	76-T-MACH-105652	Fundamentals of Combustion Engine Technology		Prüfung (PR)	Kubach
SS 2020	76-T-MACH-105652	Fundamentals of Combustion Engine Technology		Prüfung (PR)	Kubach

Competence Certificate
oral exam, 30 min

Prerequisites
none

Below you will find excerpts from events related to this course:

V Fundamentals of Combustion Engine Technology

2133123, WS 19/20, 2 SWS, Language: German, Open in study portal

Lecture (V)

Content
Fundamentals of engine processes

Components of combustion engines

Mixture formation systems

Gasexchange systems

Injection systems

Exhaust Gas Aftertreatment Systems

Cooling systems

Ignistion Systems

T 8.87 Course: Fundamentals of Combustion I [T-MACH-105213]

Responsible: Prof. Dr. Ulrich Maas
Dr. Jörg Sommerer

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102746 - Compulsory Elective Module
M-MACH-102838 - Major Field: Energy Converting Engines

Type	Credits	Recurrence	Version
Written examination	4	Each winter term	1

Events					
WS 19/20	2165515	Fundamentals of Combustion I	2 SWS	Lecture (V)	Maas
WS 19/20	2165517	Fundamentals of Combustion I (Tutorial)	1 SWS	Practice (Ü)	Bykov
WS 19/20	3165016	Fundamentals of Combustion I	2 SWS	Lecture (V)	Maas
WS 19/20	3165017	Fundamentals of Combustion I (Tutorial)	1 SWS	Practice (Ü)	Bykov
Exams					
WS 19/20	76-T-MACH-105213	Fundamentals of Combustion I		Prüfung (PR)	Maas
WS 19/20	76-T-MACH-105464	Fundamentals of Combustion I		Prüfung (PR)	Maas

Competence Certificate
Written exam, 3 h

Prerequisites
none

Below you will find excerpts from events related to this course:

V Fundamentals of Combustion I

2165515, WS 19/20, 2 SWS, Language: German, Open in study portal

Lecture (V)

Literature
Vorlesungsskript,

Buch Verbrennung - Physikalisch-Chemische Grundlagen, Modellbildung, Schadstoffentstehung, Autoren: U. Maas, J. Warnatz, R.W. Dibble, Springer-Lehrbuch, Heidelberg 1996

V Fundamentals of Combustion I (Tutorial)

2165517, WS 19/20, 1 SWS, Open in study portal

Practice (Ü)

Literature

- Vorlesungsskript
- J. Warnatz; U. Maas; R.W. Dibble: Verbrennung, Springer, Heidelberg 1996

T 8.88 Course: Fundamentals of Combustion II [T-MACH-105325]

Responsible: Prof. Dr. Ulrich Maas
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102816 - Major Field: Fundamentals of Energy Technology
M-MACH-102838 - Major Field: Energy Converting Engines

Type	Credits	Recurrence	Version
Oral examination	4	Each summer term	2

Events					
SS 2020	2166538	Fundamentals of combustion II	2 SWS	Lecture (V)	Maas
SS 2020	2166539	Übung zu Grundlagen der technischen Verbrennung II	1 SWS	Practice (Ü)	Maas

Competence Certificate
oral exam, 20 min

Prerequisites
none

Below you will find excerpts from events related to this course:

V Fundamentals of combustion II

2166538, SS 2020, 2 SWS, Language: German, Open in study portal

Lecture (V)

Content

- 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
- Thermodynamics of combustion processes
- Transport phenomena

Literature
Vorlesungsskript;

Buch Verbrennung - Physikalisch-Chemische Grundlagen, Modellbildung, Schadstoffentstehung, Autoren: U. Maas, J. Warnatz, R.W. Dibble, Springer-Lehrbuch; Heidelberg, Karlsruhe, Berkley 2006

V Übung zu Grundlagen der technischen Verbrennung II

2166539, SS 2020, 1 SWS, Language: German, Open in study portal

Practice (Ü)

Content
Calculation and Simulation of combustion processes

Literature
Skript Grundlagen der technischen Verbrennung (I+II) von Prof. Dr. rer. nat. habil. U. Maas
Buch Verbrennung - Physikalisch-Chemische Grundlagen, Modellbildung, Schadstoffentstehung, Autoren: U. Maas, J. Warnatz, R.W. Dibble, Springer-Lehrbuch, Heidelberg 1996

T 8.89 Course: Fundamentals of Energy Technology [T-MACH-105220]

Responsible: Dr. Aurelian Florin Badea
Prof. Dr.-Ing. Xu Cheng

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102816 - Major Field: Fundamentals of Energy Technology

Type	Credits	Recurrence	Version
Written examination	8	Each summer term	1

Events					
SS 2020	2130927	Fundamentals of Energy Technology	3 SWS	Lecture (V)	Cheng, Badea
SS 2020	3190923	Fundamentals of Energy Technology	3 SWS	Lecture (V)	Badea
Exams					
WS 19/20	76-MACH-105220 Fundamentals of Energy Technology	Fundamentals of Energy Technology		Prüfung (PR)	Badea
WS 19/20	76-T-MACH-105220	Fundamentals of Energy Technology		Prüfung (PR)	Badea, Cheng
SS 2020	76-T-MACH-105220	Fundamentals of Energy Technology		Prüfung (PR)	Cheng, Badea

Competence Certificate
Written examination, 90 min

Prerequisites
none

Below you will find excerpts from events related to this course:

V Fundamentals of Energy Technology

2130927, SS 2020, 3 SWS, Language: German, Open in study portal

Lecture (V)

Content
The objective of the course is to train the students on state of the art knowledge about the challenging fields of energy industry and the permanent competition between the economical profitability and the long-term sustainability. The students obtain basic knowledge on thermodynamics relevant to the energy sector and comprehensive knowledge on the energy sector: demand, energy types, energy mix, installations for energy production (conventional, nuclear and renewable), transport and energy storage, environmental impact and future tendencies. Students are able to use methods of economic efficiency optimization for the energy sector in a creative way, practice oriented, also specifically trained during the corresponding tutorial. The students are qualified for further training in energy engineering related fields and for (also research-related) professional activity in the energy sector.

The following relevant fields of the energy industry are covered:
- Energy demand and energy situation
- Energy types and energy mix
- Basics. Thermodynamics relevant to the energy sector
- Conventional fossil-fired power plants
- Combined Cycle Power Plants
- Cogeneration
- Nuclear energy
- Regenerative energies: hydropower, wind energy, solar energy, other energy systems
- Energy demand structures. Basics of economic efficiency and calculus. Optimization
- Energy storage
- Transport of energy
- Power generation and environment. Future of the energy industry

V

Fundamentals of Energy Technology

3190923, SS 2020, 3 SWS, Language: English, Open in study portal

Lecture (V)

Content

The objective of the course is to train the students on state of the art knowledge about the challenging fields of energy industry and the permanent competition between the economical profitability and the long-term sustainability. The students obtain basic knowledge on thermodynamics relevant to the energy sector and comprehensive knowledge on the energy sector: demand, energy types, energy mix, installations for energy production (conventional, nuclear and renewable), transport and energy storage, environmental impact and future tendencies. Students are able to use methods of economic efficiency optimization for the energy sector in a creative way, practice oriented, also specifically trained during the corresponding tutorial. The students are qualified for further training in energy engineering related fields and for (also research-related) professional activity in the energy sector.

The following relevant fields of the energy industry are covered:
- Energy forms
- Thermodynamics relevant to energy industry
- Energy sources: fossil fuels, nuclear energy, renewable sources
- Energy industry in Germany, Europe and worldwide
- Power generation and environment
- Evaluation of energy conversion processes
- Thermal/electrical power plants and processes
- Transport of energy / energy carriers
- Energy storage
- Systems utilizing renewable energy sources
- Basics of economic efficiency and calculus / Optimisation
- Future of the energy industry

T 8.90 Course: Gasdynamics [T-MACH-105533]

Responsible: Dr.-Ing. Franco Magagnato
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102816 - Major Field: Fundamentals of Energy Technology
M-MACH-102838 - Major Field: Energy Converting Engines

Type	Credits	Recurrence	Version
Oral examination	4	Each winter term	1

Events					
WS 19/20	2154200	Gasdynamics	2 SWS	Lecture (V)	Magagnato
Exams					
WS 19/20	76-T-MACH-105533	Gasdynamics		Prüfung (PR)	Magagnato

Competence Certificate
oral exam - 30 minutes

Prerequisites
none

Below you will find excerpts from events related to this course:

V Gasdynamics

2154200, WS 19/20, 2 SWS, Language: English, Open in study portal

Lecture (V)

Content
The student can describe the governing equations of Gas Dynamics and the associated basics in Thermodynamics. He will know different flow phenomena of applied Gas Dynamics. He can calculate compressible flows analytically. He is familiar with the Rankine-Hugoniot curve. They can derive the continuity-, the momentum- and the energy equations in differential form. With the help of the stationary flow filament theory they can calculate the normal shock wave and the associated increase of the entropy along past the shock wave. They are able to calculate the stagnation values of the Gas Dynamical variables and to determine their critical values. The students can apply the flow filament theory for variable cross-sectional areas and can distinguish between the different flow fields inside the Laval nozzle that forms with different boundary conditions. He can calculate the values behind an oblique shock wave and can distinguish between detached and attached shock waves. The student can calculate the Prandtl-Meyer expansion wave.

This lecture covers the following topics:

- Introduction to gas dynamics
- Numerical and experimental examples
- Governing equations of gas dynamics
- The transport equations in differential and integral form
- Stationary flow filament theory with and without normal shock waves
- Discussion of the energy equation: Stagnation and critical values
- Flow filament theory at variable cross-sectional area. Flow inside a Laval nozzle
- Oblique shock waves, detached shock waves
- Prandtl-Meyer expansion wave
- Viscous flows (Fanno flow)

Literature
Zierep, J.: Theoretische Gasdynamik, Braun Verlag, Karlsruhe. 1991

Ganzer, U.: Gasdynamik. Springer-Verlag, Berlin, Heidelberg. 1988

John, J., and Keith T. Gas Dynamics. 3rd ed. Harlow: Prentice Hall, 2006

Rathakrishnan, E. *Gas Dynamics*. Prentice Hall of India Pvt. Ltd, 2006

T 8.91 Course: Gear Cutting Technology [T-MACH-102148]

Responsible: Dr.-Ing. Markus Klaiber
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102818 - Major Field: Vehicle Technology

Type	Credits	Recurrence	Version
Oral examination	4	Each winter term	1

Events					
WS 19/20	2149655	Gear Technology	2 SWS	Lecture (V)	Klaiber
Exams					
WS 19/20	76-T-MACH-102148	Gear Technology		Prüfung (PR)	Klaiber

Competence Certificate
Oral Exam (20 min)

Prerequisites
none

Below you will find excerpts from events related to this course:

V Gear Technology
2149655, WS 19/20, 2 SWS, Language: German, Open in study portal

Lecture (V)

Content
Based on the gearing theory, manufacturing processes and machine technologies for producing gearings, the needs of modern gear manufacturing will be discussed in the lecture. For this purpose, various processes for various gear types are taught which represent the state of the art in practice today. A classification in soft and hard machining and furthermore in cutting and non-cutting technologies will be made. For comprehensive understanding the processes, machine technologies, tools and applications of the manufacturing of gearings will be introduced and the current developments presented. For assessment and classification of the applications and the performance of the technologies, the methods of mass production and manufacturing defects will be discussed. Sample parts, reports from current developments in the field of research and an excursion to a gear manufacturing company round out the lecture.

Learning Outcomes:

The students …

- can describe the basic terms of gearings and are able to explain the imparted basics of the gearwheel and gearing theory.
- are able to specify the different manufacturing processes and machine technologies for producing gearings. Furthermore they are able to explain the functional principles and the dis-/advantages of these manufacturing processes.
- can apply the basics of the gearing theory and manufacturing processes on new problems.
- are able to read and interpret measuring records for gearings. are able to make an appropriate selection of a process based on a given application
- can describe the entire process chain for the production of toothed components and their respective influence on the resulting workpiece properties.

Workload:

regular attendance: 21 hours
self-study: 99 hours

Literature
Medien:
Skript zur Veranstaltung wird über (https://ilias.studium.kit.edu/) bereitgestellt.

Media:
Lecture notes will be provided in Ilias (https://ilias.studium.kit.edu/).

T 8.92 Course: Global Logistics [T-MACH-105379]

Responsible: Prof. Dr.-Ing. Kai Furmans
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102644 - Major Field: Production Engineering

Type	Credits	Recurrence	Version
Oral examination	4	Each summer term	1

Events					
SS 2020	3118095	Global Logistics	2 SWS		Furmans, Fleischer-Dörr, Mittwollen, Jacobi

Competence Certificate
oral exam (20 min)

Prerequisites
none

Below you will find excerpts from events related to this course:

V Global Logistics
3118095, SS 2020, 2 SWS, Language: English, Open in study portal

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

Literature

Arnold, Dieter; Furmans, Kai : Materialfluss in Logistiksystemen; Springer-Verlag Berlin Heidelberg

T 8.93 Course: Global Production Engineering (MEI) [T-MACH-106731]

Responsible: Prof. Dr.-Ing. Gisela Lanza
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102644 - Major Field: Production Engineering

Type	Credits	Recurrence	Version
Oral examination	4	Each summer term	1

Events					
SS 2020	3150040	Global Production Engineering (MEI)	2 SWS	Lecture (V)	Lanza, Stricker
Exams					
WS 19/20	76-T-MACH-106731	Global Production Engineering (MEI)		Prüfung (PR)	Lanza

Competence Certificate
oral exam (45 min group examination with 3 students)

Prerequisites
none

Below you will find excerpts from events related to this course:

V Global Production Engineering (MEI) — Lecture (V)

3150040, SS 2020, 2 SWS, Language: English, Open in study portal

Content
Target of the lecture is to depict the challenges of global operating companies and to give an overview of central aspects and methods in production planning. The lecture will regard site-related production factors and give the basic steps in site-selection, before the planning of manufacturing systems is focused. Herein, not only the planning phases are regarded, but also the methods used.

The topics are:

- Challenges of global production
- Establishing of new production sites
- The basic steps in manufacturing system planning
- Steps and methods of factory planning
- Manufacturing and assembly planning. Assembly panning will be focused
- Layout and material flow of production sites
- Production planning and control basics

Learning Outcomes:

The students …

- can explain the challenges of global production.
- can explain site-related production factors.
- can name the basic steps in site-selection.
- can explain the basic steps in planning a production site.
- are able to explain methods of production analysis, layout planning, production planning and control, etc.
- can apply the methods to new problems.
- can explain links between different planning steps.

T 8.94 Course: Großdiesel- und -gasmotoren für Schiffsantriebe [T-MACH-110816]

Responsible: Dr.-Ing. Heiko Kubach
Organisation:
Part of: M-MACH-102645 - Major Field: Combustion Engine Techniques

Type	Credits	Recurrence	Expansion	Version
Oral examination	4	Each summer term	1 terms	1

Events					
SS 2020	2134154	Large Diesel and Gas Engines for Ship Propulsions	2 SWS	Lecture (V)	Kubach
Exams					
SS 2020	76-T-MACH-110816	Großdiesel- und -gasmotoren für Schiffsantriebe		Prüfung (PR)	

Competence Certificate
oral exam, 20 minutes

Prerequisites
None

Below you will find excerpts from events related to this course:

V Large Diesel and Gas Engines for Ship Propulsions — Lecture (V)
2134154, SS 2020, 2 SWS, Language: German, Open in study portal

Content

- Introduction and History
- Types of Ships amd Propulsion Systems
- Thermodynamic
- Boosting
- Design
- Fuels
- Lubricants
- Injection of liquid Fuels
- Combustions Processes for liquid Fuels
- Injection of Gaseous Fuels
- Combustion Processes for Gaseous Fuels
- Emissions
- Integration of Engines in Ships
- Large Engines in other Applications

T 8.95 Course: Handling Characteristics of Motor Vehicles I [T-MACH-105152]

Responsible: Dr.-Ing. Hans-Joachim Unrau
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102818 - Major Field: Vehicle Technology

Type	Credits	Recurrence	Version
Oral examination	4	Each winter term	1

Events					
WS 19/20	2113807	Handling Characteristics of Motor Vehicles I	2 SWS	Lecture (V)	Unrau
Exams					
WS 19/20	76-T-MACH-105152	Handling Characteristics of Motor Vehicles I		Prüfung (PR)	Unrau

Competence Certificate
Verbally

Duration: 30 up to 40 minutes

Auxiliary means: none

Prerequisites
none

Below you will find excerpts from events related to this course:

V Handling Characteristics of Motor Vehicles I
2113807, WS 19/20, 2 SWS, Language: German, Open in study portal

Lecture (V)

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

Learning Objectives:

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. Consequently they are ready to analyze the most importent influencing factors on the driving behaviour and to contribute to the optimization of the handling characteristics.

Literature
1. Willumeit, H.-P.: Modelle und Modellierungsverfahren in der Fahrzeugdynamik,
B. G. Teubner Verlag, 1998

2. Mitschke, M./Wallentowitz, H.: Dynamik von Kraftfahrzeugen, Springer-Verlag, Berlin, 2004

3. Gnadler, R.; Unrau, H.-J.: Umdrucksammlung zur Vorlesung Fahreigenschaften von Kraftfahrzeugen I

T 8.96 Course: Handling Characteristics of Motor Vehicles II [T-MACH-105153]

Responsible: Dr.-Ing. Hans-Joachim Unrau
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102818 - Major Field: Vehicle Technology

Type	Credits	Recurrence	Version
Oral examination	4	Each summer term	1

Events					
SS 2020	2114838	Handling Characteristics of Motor Vehicles II	2 SWS	Lecture (V)	Unrau
Exams					
WS 19/20	76-T-MACH-105153	Handling Characteristics of Motor Vehicles II		Prüfung (PR)	Unrau

Competence Certificate
Oral Examination

Duration: 30 up to 40 minutes

Auxiliary means: none

Prerequisites
none

Below you will find excerpts from events related to this course:

V Handling Characteristics of Motor Vehicles II
2114838, SS 2020, 2 SWS, Language: German, Open in study portal

Lecture (V)

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

Learning Objectives:

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. Consequently they are ready to judge the driving behaviour of vehicles and to change it by specific vehicle modifications.

Literature
1. Zomotor, A.: Fahrwerktechnik: Fahrverhalten, Vogel Verlag, 1991

2. Mitschke, M./Wallentowitz, H.: Dynamik von Kraftfahrzeugen, Springer-Verlag, Berlin, 2004

3. Gnadler, R.; Unrau, H.-J.: Umdrucksammlung zur Vorlesung Fahreigenschaften von Kraftfahrzeugen II

T 8.97 Course: Heat and Mass Transfer [T-MACH-105292]

Responsible: Prof. Dr.-Ing. Henning Bockhorn
Prof. Dr. Ulrich Maas

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102746 - Compulsory Elective Module

Type	Credits	Recurrence	Version
Written examination	4	Each term	1

Events					
WS 19/20	2165512	Heat and mass transfer	2 SWS	Lecture (V)	Maas
SS 2020	3122512	Heat and Mass Transfer	2 SWS	Lecture (V)	Bockhorn
Exams					
WS 19/20	76-T-MACH-105292	Heat and Mass Transfer		Prüfung (PR)	Maas

Competence Certificate
Written exam, 3 h

Prerequisites
none

Below you will find excerpts from events related to this course:

V Heat and mass transfer

Lecture (V)

2165512, WS 19/20, 2 SWS, Language: German, Open in study portal

Literature

- Maas ; Vorlesungsskript "Wärme- und Stoffübertragung"
- Baehr, H.-D., Stephan, K.: "Wärme- und Stoffübertragung" , Springer Verlag, 1993
- Incropera, F., DeWitt, F.: "Fundamentals of Heat and Mass Transfer" , John Wiley & Sons, 1996
- Bird, R., Stewart, W., Lightfoot, E.: "Transport Phenomena" , John Wiley & Sons, 1960

T 8.98 Course: Human Factors Engineering I [T-MACH-105518]

Responsible: Prof. Dr.-Ing. Barbara Deml
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102589 - Major Field: Production Systems

Type	Credits	Recurrence	Version
Written examination	4	Each winter term	2

Events					
WS 19/20	2109035	Human Factors Engineering I: Ergonomics	2 SWS	Lecture (V)	Deml
Exams					
WS 19/20	76-T-MACH-105518	Human Factors Engineering I		Prüfung (PR)	Deml
SS 2020	76-T-MACH-105518	Human Factors Engineering I		Prüfung (PR)	Deml

Competence Certificate
written exam, 60 minutes

The exams are only offered in German!

Prerequisites
none

Below you will find excerpts from events related to this course:

V Human Factors Engineering I: Ergonomics

2109035, WS 19/20, 2 SWS, Language: German, Open in study portal

Lecture (V)

Content
The course "Human Factors Engineering I: Ergonomics" takes place in the first half of the semester, **until 2019/12/05**, on Wednesday and Thursday.

In the second half of the semester, **beginning with 2019/12/11**, the course "Human Factors Engineering II: Work Organisation" takes place on Wednesday and Thursday.

Content of teaching:

1. Principles of human work
2. Behavioural-science data acquisition
3. workplace design
4. work environment design
5. work management
6. labour law and advocay groups

Learning target:

The students acquire a basic knowledge in the field of ergonomics:

- They are able to consider cognitive, physiological, anthropometric, and safety technical aspects in order to design workplaces ergonomically.
- Just as well they know physical and psycho-physical fundamentals (e. g. noise, lighting, climate) in the field of work-environmental design.
- Furthermore the students are able to evaluate workplaces by knowing and being able to apply essential methods of time studies and payment systems.
- Finally, they get a first, overall insight into the German labour law as well as into the organisation of advocacy groups beyond companies.

Further on the participants get to know basic methods of behavioral-science data acquisition (e. g. eye-tracking, ECG, dual-task-paradigm).

Literature
Die Kursmaterialien stehen auf ILIAS zum Download zur Verfügung.

T 8.99 Course: Human Factors Engineering II [T-MACH-105519]

Responsible: Prof. Dr.-Ing. Barbara Deml
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102589 - Major Field: Production Systems

Type	Credits	Recurrence	Version
Written examination	4	Each winter term	2

Events					
WS 19/20	2109036	Human Factors Engineering II: Work Organisation	2 SWS	Lecture (V)	Deml
Exams					
WS 19/20	76-T-MACH-105519	Human Factors Engineering II		Prüfung (PR)	Deml
SS 2020	76-T-MACH-105519	Human Factors Engineering II		Prüfung (PR)	Deml

Competence Certificate
written exam, 60 minutes

The exams are only offered in German!

Prerequisites
none

Below you will find excerpts from events related to this course:

V Human Factors Engineering II: Work Organisation

2109036, WS 19/20, 2 SWS, Language: German, Open in study portal

Lecture (V)

Content
Content of teaching:

1. Fundamentals of work organization
2. Empirical research methods
3. Individual level
    - personnel selection
    - personnel development
    - personnel assessment
    - work satisfaction/motivation
4. Group level
    - interaction and communication
    - management of employees
    - team work
5. Organizational level
    - structural organization
    - process organization
    - production organization

Learning target:

The students gain a first insight into empirical research methods (e. g. experimental design, statistical data evaluation). Particularly, they acquire a basic knowledge in the field of work organisation:

- *Organizational level*. Within this module the students gain also a fundamental knowledge in the field of structural, process, and production organization.
- *Group level*. Besides, they get to know basic aspects of industrial teamwork and they know relevant theories in the field of interaction and communication, the management of employees as well as work satisfaction and motivation.
- *individual level*. Finally, the students get to know also methods in the field of personnel selection, development, and assessment.

Literature
Die Kursmaterialien stehen auf ILIAS zum Download zur Verfügung.

8.100 Course: Human-Machine-Interaction [T-INFO-101266]

Responsible: Prof. Dr.-Ing. Michael Beigl
Organisation: KIT Department of Informatics
Part of: M-MACH-102820 - Major Field: Mechatronics

Type	Credits	Recurrence	Version
Written examination	6	Each summer term	2

Events					
SS 2020	24659	Human-Computer-Interaction	2 SWS	Lecture (V)	Exler, Beigl
Exams					
WS 19/20	7500076	Human-Machine-Interaction		Prüfung (PR)	Beigl
SS 2020	7500048	Human-Machine-Interaction		Prüfung (PR)	Beigl

Modeled Conditions
The following conditions have to be fulfilled:

1. The course T-INFO-106257 - Human-Machine-Interaction Pass must have been passed.

T 8.101 Course: Human-Machine-Interaction Pass [T-INFO-106257]

Responsible: Prof. Dr.-Ing. Michael Beigl
Organisation: KIT Department of Informatics
Part of: M-MACH-102820 - Major Field: Mechatronics

Type	Credits	Recurrence	Version
Completed coursework	0	Each summer term	1

Events					
SS 2020	2400095	Human-Computer-Interaction	1 SWS	Practice (Ü)	Beigl, Exler
SS 2020	24659	Human-Computer-Interaction	2 SWS	Lecture (V)	Exler, Beigl
Exams					
SS 2020	7500121	Human-Machine-Interaction		Prüfung (PR)	Beigl

T 8.102 Course: Hybrid and Electric Vehicles [T-ETIT-100784]

Responsible: Dr.-Ing. Klaus-Peter Becker
Organisation: KIT Department of Electrical Engineering and Information Technology
Part of: M-MACH-102812 - Major Field: Powertrain Systems
M-MACH-102818 - Major Field: Vehicle Technology
M-MACH-102820 - Major Field: Mechatronics

Type	Credits	Recurrence	Version
Written examination	4	Each winter term	1

Events					
WS 19/20	2306321	Hybrid and Electric Vehicles	2 SWS	Lecture (V)	Doppelbauer
WS 19/20	2306323	Tutorial for 2306323 Hybrid and Electric Vehicles	1 SWS	Practice (Ü)	Doppelbauer
Exams					
WS 19/20	7306321	Hybrid and Electric Vehicles		Prüfung (PR)	Doppelbauer

Prerequisites
none

T 8.103 Course: Hydraulic Fluid Machinery [T-MACH-105326]

Responsible: Dr. Balazs Pritz
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102816 - Major Field: Fundamentals of Energy Technology
M-MACH-102838 - Major Field: Energy Converting Engines

Type	Credits	Recurrence	Version
Oral examination	8	Each summer term	1

Events					
SS 2020	2157432	Hydraulic Fluid Machinery	4 SWS	Lecture (V)	Pritz
Exams					
WS 19/20	7600010	Hydraulic Fluid Machinery		Prüfung (PR)	Pritz
SS 2020	7600004	Hydraulic Fluid Machinery		Prüfung (PR)	Pritz

Competence Certificate
oral exam, 40 min.

Prerequisites
None.

Below you will find excerpts from events related to this course:

V Hydraulic Fluid Machinery
2157432, SS 2020, 4 SWS, Language: German, Open in study portal

Lecture (V)

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

2157432 (Hydraulic Machinery) can not be combined with the event 2157451 (Wind and Hydropower)

Recommendations:

2153412 Fluid mechanics

Students get to know the basics of hydraulic fluid machinery (pumps, fans, hydroturbines, windturbines, hydrodynamic transmissions) in general. Application of the knowledge in different fields of engineering.

The lecture introduces the basics of Hydraulic Fluid Machinery. 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.

Students are able to understand the working principle of Hydraulic Fluid Machinery as well as the interaction with typical systems, in which they are integrated.

regular attendance: 56 hours
self-study: 150 hours

preparation for exam: 40 hours

Oral or written examination (see anouncement)
No tools or reference materials may be used during the exam.

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

T 8.104 Course: I4.0 Systems Platform [T-MACH-106457]

Responsible: Dipl.-Ing. Thomas Maier
Prof. Dr.-Ing. Jivka Ovtcharova

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102583 - Major Field: Information Management

Type	Credits	Recurrence	Version
Examination of another type	4	Each term	2

Events					
WS 19/20	2123900	I4.0 Systems platform	4 SWS	Prüfung (PR)	Ovtcharova, Maier
SS 2020	2123900	I4.0 Systems platform	4 SWS	Project (PRO)	Ovtcharova, Maier
Exams					
WS 19/20	76-T-MACH-106457	I4.0 Systems platform		Prüfung (PR)	Ovtcharova

Competence Certificate
Alternative exam assessment (project work)

Prerequisites
None

Annotation
Limited number of participants.

Below you will find excerpts from events related to this course:

V I4.0 Systems platform

2123900, WS 19/20, 4 SWS, Language: German, Open in study portal

Prüfung (PR)

Content
Industry 4.0, IT systems for fabrication (e.g.: CAx, PDM, CAM, ERP, MES), process modelling and execution, project work in teams, practice-relevant I4.0 problems, in automation, manufacturing industry and service.

Students can

- describe the fundamental concepts, challenges, and objectives of Industrie 4.0 and name the essential terms in context of information management
- explain the necessary information flow between the different IT systems. They get practically knowledge about using current IT systems in context of I4.0, from order to production.
- map and analyze processes in the context of Industry 4.0 with special methods of process modelling
- collaboratively grasp practical I4.0 issues using existing hardware and software and work out solutions for a continuous improvement process in a team
- prototypically implement the self-developed solution proposal with the given IT systems and the existing hardware equipment and finally present the results

Literature
Keine / None

V I4.0 Systems platform

2123900, SS 2020, 4 SWS, Language: German, Open in study portal

Project (PRO)

Content

Industry 4.0, IT systems for fabrication (e.g.: CAx, PDM, CAM, ERP, MES), process modelling and execution, project work in teams, practice-relevant I4.0 problems, in automation, manufacturing industry and service.

Students can

- describe the fundamental concepts, challenges, and objectives of Industrie 4.0 and name the essential terms in context of information management
- explain the necessary information flow between the different IT systems. They get practically knowledge about using current IT systems in context of I4.0, from order to production.
- map and analyze processes in the context of Industry 4.0 with special methods of process modelling
- collaboratively grasp practical I4.0 issues using existing hardware and software and work out solutions for a continuous improvement process in a team
- prototypically implement the self-developed solution proposal with the given IT systems and the existing hardware equipment and finally present the results

Literature

Keine / None

T 8.105 Course: Ignition Systems [T-MACH-105985]

Responsible: Dr.-Ing. Olaf Toedter
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102645 - Major Field: Combustion Engine Techniques

Type	Credits	Version
Oral examination	4	1

Events					
WS 19/20	2133125	Ignition systems	2 SWS	Lecture (V)	Toedter
Exams					
WS 19/20	76-T-MACH-105985	Ignition systems		Prüfung (PR)	Koch
SS 2020	76-T-MACH-105985	Ignition systems		Prüfung (PR)	Koch

Competence Certificate
oral exam, 20 min

Prerequisites
none

Below you will find excerpts from events related to this course:

V Ignition systems
2133125, WS 19/20, 2 SWS, Language: German, Open in study portal

Lecture (V)

Content

- Ignition Process
- Spark Ignition
- Principle of Spark Ignition Systems
- Limits of Spark Ignition
- New Develpoments of Spark Ignition Systems
- New an Alternative Ignition Systems

8.106 Course: Industrial Aerodynamics [T-MACH-105375]

Responsible: Prof. Dr.-Ing. Thomas Breitling
Prof. Dr.-Ing. Bettina Frohnapfel

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102818 - Major Field: Vehicle Technology

Type	Credits	Recurrence	Version
Oral examination	4	Each winter term	1

Events					
WS 19/20	2153425	Industrial aerodynamics	2 SWS		Breitling
Exams					
WS 19/20	76-T-MACH-105375	Industrial Aerodynamics		Prüfung (PR)	Breitling

Competence Certificate
oral exam - 30 minutes

Prerequisites
none

Below you will find excerpts from events related to this course:

V Industrial aerodynamics

2153425, WS 19/20, 2 SWS, Language: German, Open in study portal

Content
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 examplary.
An excursion to the Daimler AG wind tunnel and the research and development centers is planned.

- Industrial flow measurement techniques
- Flow simulation and control of numerical errors, turbulence modeling
- Cooling flows
- Flow mixing and combustation at direct injected Diesel engines
- Flow mixing and combustation at gasoline engine
- Vehicle aerodynamics
- HVAC-Systems and thermal comfort
- Aeroacoustics

Students can describe the different challenges of aerdynamical flow that occur in vehicles. They are qualified to analyze external flows around the vehicles, flows in the passenger compartments (thermal comfort), as well as cooling flows, charge motion, mixing and combustion processes in the engine.

Literature
Vorlesungsskript

T 8.107 Course: Information Engineering [T-MACH-102209]

Responsible: Prof. Dr.-Ing. Jivka Ovtcharova
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102583 - Major Field: Information Management

Type	Credits	Recurrence	Version
Examination of another type	3	Each term	2

Events					
SS 2020	2122014	Information Engineering	2 SWS	Seminar (S)	Ovtcharova, Mitarbeiter
Exams					
WS 19/20	76-T-MACH-102209	Information Engineering		Prüfung (PR)	Ovtcharova

Competence Certificate
Alternative exam assessment (written composition and speech)

Prerequisites
None

Below you will find excerpts from events related to this course:

V Information Engineering
2122014, SS 2020, 2 SWS, Language: German/English, Open in study portal

Seminar (S)

Content
Seminar papers on current research topics of the Institute for Information Management in Engineering. The respective topics are presented at the beginning of each semester.

Literature
Themenspezifische Literatur

T 8.108 Course: Information Processing in Sensor Networks [T-INFO-101466]

Responsible: Prof. Dr.-Ing. Uwe Hanebeck
Organisation: KIT Department of Informatics
Part of: M-MACH-102817 - Major Field: Information Technology

Type	Credits	Recurrence	Version
Oral examination	6	Irregular	1

Events					
WS 19/20	24102	Information Processing in Sensor Networks	3 SWS	Lecture (V)	Noack, Mayer, Hanebeck
Exams					
WS 19/20	7500030	Information Processing in Sensor Networks		Prüfung (PR)	Noack, Hanebeck
SS 2020	7500011	Information Processing in Sensor Networks		Prüfung (PR)	Hanebeck, Noack

T 8.109 Course: Information Systems and Supply Chain Management [T-MACH-102128]

Responsible: Dr. Christoph Kilger
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102583 - Major Field: Information Management
M-MACH-102817 - Major Field: Information Technology

Type	Credits	Recurrence	Version
Oral examination	3	Each summer term	2

Events					
SS 2020	2118094	Information Systems in Logistics and Supply Chain Management	2 SWS	Lecture (V)	Kilger
Exams					
WS 19/20	76T-MACH-102128	Information Systems and Supply Chain Management		Prüfung (PR)	Mittwollen
SS 2020	76-T-MACH-102128	Information Systems and Supply Chain Management		Prüfung (PR)	Mittwollen

Competence Certificate
The assessment consists of an oral exam (20 min.) taking place in the recess period according to § 4 paragraph 2 Nr. 2 of the examination regulation.

Prerequisites
none

Below you will find excerpts from events related to this course:

V Information Systems in Logistics and Supply Chain Management

2118094, SS 2020, 2 SWS, Language: German, Open in study portal

Lecture (V)

Literature
Stadtler, Kilger: Supply Chain Management and Advanced Planning, Springer, 4. Auflage 2008

T 8.110 Course: Integrated Information Systems for Engineers [T-MACH-102083]

Responsible: Prof. Dr.-Ing. Jivka Ovtcharova
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102583 - Major Field: Information Management
M-MACH-102589 - Major Field: Production Systems
M-MACH-102746 - Compulsory Elective Module

Type	Credits	Recurrence	Version
Oral examination	4	Each summer term	2

Events					
SS 2020	2121001	Integrated Information Systems for engineers	3 SWS	Lecture / Practice (VÜ)	Ovtcharova, Elstermann
Exams					
WS 19/20	76-T-MACH-102083	Integrated Information Systems for Engineers		Prüfung (PR)	Ovtcharova

Competence Certificate
Oral examination 20 min.

Prerequisites
None

Below you will find excerpts from events related to this course:

V Integrated Information Systems for engineers
2121001, SS 2020, 3 SWS, Language: German, Open in study portal

Lecture / Practice (VÜ)

Content

- Information systems, information management
- CAD, CAP and CAM systems
- PPS, ERP and PDM systems
- Knowledge management and ontology
- Process modeling

Students can:

- illustrate the structure and operating mode of information systems
- describe the structure of relational databases
- describe the fundamentals of knowledge management and its application in engineering and deploy ontology as knowledge representation
- describe different types of process modelling and their application and illustrate and execute simple work flows and processes with selected tools
- explain different goals of specific IT systems in product development (CAD, CAP, CAM, PPS, ERP, PDM) and assign product development processes

Literature
Vorlesungsfolien / lecture slides

T 8.111 Course: Integrated Production Planning in the Age of Industry 4.0 [T-MACH-108849]

Responsible: Prof. Dr.-Ing. Gisela Lanza
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102589 - Major Field: Production Systems

Type	Credits	Recurrence	Version
Oral examination	8	Each summer term	1

Events					
SS 2020	2150660	Integrated Production Planning in the Age of Industry 4.0	6 SWS	Lecture / Practice (VÜ)	Lanza
Exams					
WS 19/20	76-T-MACH-108849	Integrated Production Planning in the Age of Industry 4.0		Prüfung (PR)	Lanza

Competence Certificate
Oral Exam (40 min)

Prerequisites
"T-MACH-109054 - Integrierte Produktionsplanung im Zeitalter von Industrie 4.0" as well as "T-MACH-102106 Integrierte Produktionsplanung" must not be commenced.

Below you will find excerpts from events related to this course:

V Integrated Production Planning in the Age of Industry 4.0

Lecture / Practice (VÜ)

2150660, SS 2020, 6 SWS, Language: German, Open in study portal

Content
Integrated production planning in the age of industry 4.0 will be taught in the context of this engineering science lecture. In addition to a comprehensive introduction to Industry 4.0, the following topics will be addressed at the beginning of the lecture:

- Basics, history and temporal development of production
- Integrated production planning and integrated digital engineering
- Principles of integrated production systems and further development with Industry 4.0

Building on this, the phases of integrated production planning are taught in accordance with VDI Guideline 5200, whereby special features of parts production and assembly are dealt with in the context of case studies:

- Factory planning system
- Definition of objectives
- Data collection and analysis
- Concept planning (structural development, structural dimensioning and rough layout)
- Detailed planning (production planning and control, fine layout, IT systems in an industry 4.0 factory)
- Preparation and monitoring of implementation
- Start-up and series support

The lecture contents are rounded off by numerous current practical examples with a strong industry 4.0 reference. Within the exercises the lecture contents are deepened and applied to specific problems and tasks.

Learning Outcomes:

The students …

- can discuss basic questions of production technology.
- are able to apply the methods of integrated production planning they have learned about to new problems.
- are able to analyze and evaluate the suitability of the methods, procedures and techniques they have learned about for a specific problem.
- can apply the learned methods of integrated production planning to new problems.
- can use their knowledge targeted for efficient production technology.

Workload:

MACH:
regular attendance: 63 hours
self-study: 177 hours
WING:
regular attendance: 63 hours
self-study: 207 hours

Literature
Medien:
Skript zur Veranstaltung wird über (https://ilias.studium.kit.edu/) bereitgestellt.

Media:
Lecture notes will be provided in Ilias (https://ilias.studium.kit.edu/).

T 8.112 Course: Integrative Strategies in Production and Development of High Performance Cars [T-MACH-105188]

Responsible: Dr. Karl-Hubert Schlichtenmayer
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102815 - Major Field: Engineering Design
M-MACH-102818 - Major Field: Vehicle Technology

Type	Credits	Recurrence	Version
Written examination	4	Each summer term	1

Events					
SS 2020	2150601	Integrative Strategies in Production and Development of High Performance Cars	2 SWS	Lecture (V)	Schlichtenmayer
Exams					
WS 19/20	76-T-MACH-105188	Integrative Strategies in Production and Development of High Performance Cars		Prüfung (PR)	Schlichtenmayer

Competence Certificate
Written Exam (60 min)

Prerequisites
none

Below you will find excerpts from events related to this course:

V Integrative Strategies in Production and Development of High Performance Cars

Lecture (V)

2150601, SS 2020, 2 SWS, Language: German, Open in study portal

Content

The lecture deals with the technical and organizational aspects of integrated development and production of sports cars on the example of Porsche AG. The lecture begins with an introduction and discussion of social trends. The deepening of standardized development processes in the automotive practice and current development strategies follow. The management of complex development projects is a first focus of the lecture. The complex interlinkage between development, production and purchasing are a second focus. Methods of analysis of technological core competencies complement the lecture. The course is strongly oriented towards the practice and is provided with many current examples.

The main topics are:

- Introduction to social trends towards high performance cars
- Automotive Production Processes
- Integrative R&D strategies and holistic capacity management
- Management of complex projects
- Interlinkage between R&D, production and purchasing
- The modern role of manufacturing from a R&D perspective
- Global R&D and production
- Methods to identify core competencies

Learning Outcomes:

The students …

- are capable to specify the current technological and social challenges in automotive industry.
- are qualified to identify interlinkages between development processes and production systems.
- are able to explain challenges and solutions of global markets and global production of premium products.
- are able to explain modern methods to identify key competences of producing companies.

Workload:

regular attendance: 21 hours
self-study: 99 hours

Literature
Medien:
Skript zur Veranstaltung wird über (https://ilias.studium.kit.edu/) bereitgestellt.

Media:
Lecture notes will be provided in Ilias (https://ilias.studium.kit.edu/).

T 8.113 Course: Intellectual Property Rights and Strategies in Industrial Companies [T-MACH-105442]

Responsible: Prof. Dr.-Ing. Albert Albers
Prof. Dr.-Ing. Sven Matthiesen
Frank Zacharias

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102583 - Major Field: Information Management
M-MACH-102812 - Major Field: Powertrain Systems
M-MACH-102818 - Major Field: Vehicle Technology
M-MACH-102820 - Major Field: Mechatronics

Type	Credits	Recurrence	Version
Oral examination	4	Each term	1

Events					
WS 19/20	2147161	Intellectual Property Rights and Strategies in Industrial Companies	2 SWS	Lecture (V)	Zacharias
SS 2020	2147160	Patents and Patentstrategies in innovative companies	2 SWS		Zacharias
Exams					
WS 19/20	7600012	Intellectual Property Rights and Strategies in Industrial Companies		Prüfung (PR)	Zacharias

Competence Certificate
oral exam (20 min)

Prerequisites
none

Recommendation
None

Below you will find excerpts from events related to this course:

V Intellectual Property Rights and Strategies in Industrial Companies

Lecture (V)

2147161, WS 19/20, 2 SWS, Language: German, Open in study portal

V Patents and Patentstrategies in innovative companies

2147160, SS 2020, 2 SWS, Language: German, Open in study portal

Content

Attendance at lectures (5 L): 24h

Personal preparation and follow-up of lecture and exercise: 5h

Preparation exam: 31h

The students understand and are able to describe the basics of intellectual property, particularly with regard to the filing and obtaining of property rights. They can name the criteria of project-integrated intellectual property management and strategic patenting in innovative companies. Students are also able to describe the key regulations of the law regarding employee invention and to illustrate the challenges of intellectual properties with reference to examples.

The lecture will describe the requirements to be fulfilled and how protection is obtained for patents, design rights and trademarks, with a particular focus on Germany, Europe and the EU. Active, project-integrated intellectual property management and the use of strategic patenting by technologically oriented companies will also be discussed. Furthermore, the significance of innovations and intellectual property for both business and industry will be demonstrated using practical examples, before going on to consider the international challenges posed by intellectual

property and current trends in the sector. Within the context of licensing and infringement, insight will be provided as to the relevance of communication, professional negotiations and dispute resolution procedures, such as mediation for example. The final item on the agenda will cover those aspects of corporate law that are relevant to intellectual property.

Lecture overview:

1. Introduction to intellectual property
2. The profession of the patent attorney
3. Filing and obtaining intellectual property rights
4. Patent literature as a source of knowledge and information
5. The law regarding employee inventions
6. Active, project-integrated intellectual property management
7. Strategic patenting
8. The significance of intellectual property
9. International challenges and trends
10. Professional negotiations and dispute resolution procedures
11. Aspects of corporate law

T 8.114 Course: Introduction into Mechatronics [T-MACH-100535]

Responsible: Moritz Böhland
Dr.-Ing. Maik Lorch
PD Dr.-Ing. Markus Reischl

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102746 - Compulsory Elective Module
M-MACH-102820 - Major Field: Mechatronics

Type	Credits	Recurrence	Version
Written examination	6	Each winter term	2

Events					
WS 19/20	2105011	Introduction into Mechatronics	3 SWS	Lecture (V)	Reischl, Lorch, Böhland
Exams					
WS 19/20	76-T-MACH-100535	Introduction into Mechatronics		Prüfung (PR)	Reischl

Competence Certificate
Oral exam (Duration: 2h)

Prerequisites
none

Below you will find excerpts from events related to this course:

V Introduction into Mechatronics

2105011, WS 19/20, 3 SWS, Language: German, Open in study portal

Lecture (V)

Content
Content:

- Introduction
- Structure of mechatronic systems
- Mathematical treatment of mechatronic systems
- Sensors and actuators
- Measurements: acquisition and interpretation
- Modelling of mechatronic systems
- Control and feedback control systems
- Information processing

Learning objectives:

The student has knowledge about the specific challenge of interdisciplinary collaboration within the framework of mechatronics. He is able to explain the origin, necessity and methodic implementation of interdisciplinary collaboration, to name the main difficulties as well as the special features within the development of mechatronic products from the point of view of development methodic.

The student has fundamental knowledge of modeling mechanical, hydraulically and electrically part systems and about suitable optimization methods.

The student knows the difference in use of the term "system" in mechatronic and mechanical use.

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

T 8.115 Course: Introduction into the Multi-Body Dynamics [T-MACH-105209]

Responsible: Prof. Dr.-Ing. Wolfgang Seemann
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102746 - Compulsory Elective Module
M-MACH-102812 - Major Field: Powertrain Systems
M-MACH-102820 - Major Field: Mechatronics
M-MACH-104430 - Major Field: Modeling and Simulation in Dynamics

Type	Credits	Recurrence	Version
Written examination	5	Each summer term	2

Events					
SS 2020	2162235	Introduction into the multi-body dynamics	3 SWS	Lecture (V)	Seemann
Exams					
WS 19/20	76-T-MACH-105209	Introduction into the Multi-Body Dynamics		Prüfung (PR)	Seemann
SS 2020	76-T-MACH-105209	Introduction into the Multi-Body Dynamics		Prüfung (PR)	Seemann

Competence Certificate
Written examination, 180 min.

Prerequisites
none

Recommendation
Engineering Mechanics III/IV

Below you will find excerpts from events related to this course:

V Introduction into the multi-body dynamics

2162235, SS 2020, 3 SWS, Language: German, Open in study portal

Lecture (V)

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 Systems.
Kane, T.: Dynamics of rigid bodies.

T 8.116 Course: Introduction to Ceramics [T-MACH-100287]

Responsible: Prof. Dr. Michael Hoffmann
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102819 - Major Field: Materials Science and Engineering

Type	Credits	Recurrence	Version
Oral examination	6	Each winter term	1

Events					
WS 19/20	2125757	Introduction to Ceramics	3 SWS	Lecture (V)	Hoffmann
Exams					
WS 19/20	76-T-MACH-100287	Introduction to Ceramics		Prüfung (PR)	Hoffmann, Schell, Wagner

Competence Certificate
The assessment consists of an oral exam (30 min) taking place at a specific date.

The re-examination is offered at a specific date.

Prerequisites
None

Below you will find excerpts from events related to this course:

V Introduction to Ceramics

2125757, WS 19/20, 3 SWS, Language: German, Open in study portal

Lecture (V)

Literature

- H. Salmang, H. Scholze, "Keramik", Springer
- Kingery, Bowen, Uhlmann, "Introduction To Ceramics", Wiley
- Y.-M. Chiang, D. Birnie III and W.D. Kingery, "Physical Ceramics", Wiley
- S.J.L. Kang, "Sintering, Densification, Grain Growth & Microstructure", Elsevier

T 8.117 Course: Introduction to Computational Fluid Dynamics [T-MACH-110362]

Responsible: Prof. Dr.-Ing. Bettina Frohnapfel
Dr.-Ing. Alexander Stroh

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102582 - Major Field: Continuum Mechanics

Type	Credits	Version
Written examination	4	2

Events					
SS 2020	2154533	Introduction to Computational Fluid Dynamics	2 SWS	Lecture (V)	Stroh, Frohnapfel
SS 2020	2154534	Tutorial Introduction to Computational Fluid Dynamics	2 SWS	Practice (Ü)	Stroh, Frohnapfel
Exams					
SS 2020	76-T-MACH-110362	Introduction to Computational Fluid Dynamics		Prüfung (PR)	Frohnapfel

Competence Certificate
written 90min

Annotation
The content of the lecture "continuum mechanics of solids and fluids" is expected to be known.

Below you will find excerpts from events related to this course:

V Introduction to Computational Fluid Dynamics

2154533, SS 2020, 2 SWS, Language: German, Open in study portal

Lecture (V)

Content

- Introduction and Motivation, Fundamental Equations and Dimensionless Numbers
- Turblence and Modelling (DNS, LES, RANS);
- Numerical Solution of the Navier Stokes Equations:
  Discretization and Solution Approaches (FDM, FVM), boundary and initial conditions, stability, mistakes in numerics and modelling
- Set-up of a numerical simulation: pre- and postprocessing, validation, result evaluation, discussion of results
- Introduction to open-source toolbox OpenFOAM:
  set-up of simulation, generation of numerical grid with different tools, data evaluation within OpenFOAM and with python;
- Introduction to a research oriented toolbox for turbulent flows (DNS based o Incompact3d): set-up of simulation, statistical evaluation and analysis with MATLAB und python;
- visualisization of simulation results in ParaView

This course includes a lecture and a computer course. The limited places in the computer course will be distributed by the institute.

Literature
Wird in der Vorlesung bekannt gegeben.

V Tutorial Introduction to Computational Fluid Dynamics

2154534, SS 2020, 2 SWS, Open in study portal

Practice (Ü)

Content

- Introduction and Motivation, Fundamental Equations and Dimensionless Numbers
- Turblence and Modelling (DNS, LES, RANS);
- Numerical Solution of the Navier Stokes Equations:
  Discretization and Solution Approaches (FDM, FVM), boundary and initial conditions, stability, mistakes in numerics and modelling
- Set-up of a numerical simulation: pre- and postprocessing, validation, result evaluation, discussion of results
- Introduction to open-source toolbox OpenFOAM:
  set-up of simulation, generation of numerical grid with different tools, data evaluation within OpenFOAM and with python;
- Introduction to a research oriented toolbox for turbulent flows (DNS based o Incompact3d): set-up of simulation, statistical evaluation and analysis with MATLAB und python;
- visualisization of simulation results in ParaView

This course includes a lecture and a computer course. The limited places in the computer course will be distributed by the institute.

T 8.118 Course: Introduction to Nonlinear Vibrations [T-MACH-105439]

Responsible: Prof. Dr.-Ing. Alexander Fidlin
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-104442 - Major Field: Vibration Theory

Type	Credits	Recurrence	Version
Oral examination	7	Each winter term	1

Events					
WS 19/20	2162247	Introduction to Nonlinear Vibrations	2 SWS	Lecture (V)	Fidlin
WS 19/20	2162248	Introduction into the nonlinear vibrations (Tutorial)	2 SWS	Practice (Ü)	Fidlin, Schröders
Exams					
WS 19/20	76-T-MACH-105439	Introduction to Nonlinear Vibrations		Prüfung (PR)	Fidlin
SS 2020	76-T-MACH-105439	Introduction to Nonlinear Vibrations		Prüfung (PR)	Fidlin

Competence Certificate
oral exam, 30 min.

Prerequisites
none

Recommendation
Vibration theory, Mathematical Methods of Vibration Theory, Dynamic Stability

Below you will find excerpts from events related to this course:

V Introduction to Nonlinear Vibrations

2162247, WS 19/20, 2 SWS, Language: German, Open in study portal

Lecture (V)

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.

V **Introduction into the nonlinear vibrations (Tutorial)** **Practice (Ü)**
2162248, WS 19/20, 2 SWS, Language: German, Open in study portal

Content
Exercises related to the lecture

T 8.119 Course: Introduction to Nuclear Energy [T-MACH-105525]

Responsible: Prof. Dr.-Ing. Xu Cheng
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102816 - Major Field: Fundamentals of Energy Technology

Type	Credits	Recurrence	Version
Oral examination	4	Each winter term	1

Events					
WS 19/20	2189903	Introduction to Nuclear Energy	2 SWS	Lecture (V)	Cheng
Exams					
WS 19/20	76-T-MACH-105525	Introduction to Nuclear Energy		Prüfung (PR)	Cheng

Competence Certificate
oral exam, 30 min

Prerequisites
none

Below you will find excerpts from events related to this course:

V Introduction to Nuclear Energy

2189903, WS 19/20, 2 SWS, Language: German, Open in study portal

Lecture (V)

Content
This lecture is dedicated to students of mechanical engineering and other engineering Bachelor or Master degree courses. Goal of the lecture is the fundamental knowledge of nuclear energy and nuclear reactors. After the lecture the students understand the principle of the usage of nuclear energy, the structure and operation of nuclear power plants and nuclear safety measures. Furthermore, the students are capable of giving technical assessment of the usage of nuclear energy with respect to its safety and sustainability.

T 8.120 Course: Introduction to Numerical Fluid Dynamics [T-MACH-105515]

Responsible: Dr. Balazs Pritz
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102838 - Major Field: Energy Converting Engines

Type	Credits	Recurrence	Version
Completed coursework	4	Each winter term	1

Events					
WS 19/20	2157444	Introduction to numerical fluid dynamics	2 SWS	Practical course (P)	Pritz
Exams					
WS 19/20	7600009	Introduction to Numerical Fluid Dynamics		Prüfung (PR)	Pritz

Competence Certificate
Certificate of participation

Prerequisites
none

Below you will find excerpts from events related to this course:

V Introduction to numerical fluid dynamics

2157444, WS 19/20, 2 SWS, Language: German, Open in study portal

Practical course (P)

Literature
Praktikumsskript

T 8.121 Course: Introduction to the Finite Element Method [T-MACH-110837]

Responsible: Prof. Dr.-Ing. Thomas Böhlke
Dr.-Ing. Tom-Alexander Langhoff

Organisation:

Part of: M-MACH-102582 - Major Field: Continuum Mechanics

Type	Credits	Recurrence	Version
Written examination	4	Each summer term	1

Competence Certificate
Written exam.

T 8.122 Course: IT-Fundamentals of Logistics [T-MACH-105187]

Responsible: Prof. Dr.-Ing. Frank Thomas
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102583 - Major Field: Information Management
M-MACH-102812 - Major Field: Powertrain Systems
M-MACH-102817 - Major Field: Information Technology
M-MACH-102820 - Major Field: Mechatronics
M-MACH-102821 - Major Field: Technical Logistics

Type	Credits	Recurrence	Version
Oral examination	3	Each summer term	2

Events					
SS 2020	2118184	IT-Fundamentals of Logistics: Opportunities for Digital Transformation	2 SWS	Lecture (V)	Thomas
Exams					
WS 19/20	76-T-MACH-105187	IT-Fundamentals of Logistics		Prüfung (PR)	Furmans, Mittwollen

Competence Certificate
The assessment consists of an oral exam (30min) taking place in the recess period according to § 4 paragraph 2 Nr. 2 of the examination regulation.

Prerequisites
none

Annotation
1) Detailed script can be downloaded online (www.tup.com), updated and enhanced annually.

2) CD-ROM with chapters and exercises at the end of the semester available from the lecturer, also updated and enhanced annually.

Below you will find excerpts from events related to this course:

V IT-Fundamentals of Logistics: Opportunities for Digital Transformation — Lecture (V)

2118184, SS 2020, 2 SWS, Language: German, Open in study portal

T 8.123 Course: Lab Computer-Aided Methods for Measurement and Control [T-MACH-105341]

Responsible: Prof. Dr.-Ing. Christoph Stiller
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102817 - Major Field: Information Technology

Type	Credits	Recurrence	Version
Completed coursework	4	Each winter term	1

Events					
WS 19/20	2137306	Lab Computer-aided methods for measurement and control	3 SWS	Practical course (P)	Stiller, Richter
Exams					
WS 19/20	76-T-MACH-105341	Lab Computer-Aided Methods for Measurement and Control		Prüfung (PR)	Stiller

Competence Certificate
Colloquia

Prerequisites
none

Below you will find excerpts from events related to this course:

V Lab Computer-aided methods for measurement and control

2137306, WS 19/20, 3 SWS, Language: German, Open in study portal

Practical course (P)

Content
Lerninhalt (EN):

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 lab comprises 9 experiments.

Voraussetzungen: Recommendations:

Basic studies and preliminary examination; basic lectures in automatic control

Arbeitsaufwand (EN): 120 hours

Lernziele (EN):

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.

Nachweis (EN):

Colloquia

Literature
Übungsanleitungen sind auf der Institutshomepage erhältlich.

Instructions to the experiments are available on the institute's website

T 8.124 Course: Laboratory Exercise in Energy Technology [T-MACH-105331]

Responsible: Prof. Dr.-Ing. Hans-Jörg Bauer
Prof. Dr. Ulrich Maas
Heiner Wirbser

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102816 - Major Field: Fundamentals of Energy Technology

Type	Credits	Recurrence	Version
Completed coursework	4	Each term	1

Events					
WS 19/20	2171487	Laboratory Exercise in Energy Technology	3 SWS	Practical course (P)	Bauer, Maas, Bykov
SS 2020	2171487	Laboratory Exercise in Energy Technology	3 SWS	Practical course (P)	Bauer, Maas, Bykov
Exams					
WS 19/20	76-T-MACH-105331	Laboratory Exercise in Energy Technology		Prüfung (PR)	Bauer, Maas, Wirbser
SS 2020	76-T-MACH-105331	Laboratory Exercise in Energy Technology		Prüfung (PR)	Bauer, Maas, Wirbser

Competence Certificate
1 report, approx. 12 pages

Discussion of the documented results with the assistents

Prerequisites
none

Below you will find excerpts from events related to this course:

V Laboratory Exercise in Energy Technology

2171487, WS 19/20, 3 SWS, Language: German, Open in study portal

Practical course (P)

Content
Online registration within the first two weeks of the lecture periode at: http://www.its.kit.edu

- 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 nozzles
- Investigation of pollutant and noise emission as well as reliability and material deterioration
- Exhaust gas treatment
- Exhaust gas turbocharger
- Cooling Tower
- Heatpump
- Plant oil stove
- Heat capacity
- Wood combustion

regular attendance: 42h
self-study: 78h

Attending this course enables the students to:

- accomplish experimental and design related as well as theoretical tasks in a scientific background
- perform a correct evaluation of the obtained results
- adequately document and present their results in a scientific framework

1 report, approx. 12 pages

Discussion of the documented results with the assistents

Duration: 30 minutes

no tools or reference materials may be used

V **Laboratory Exercise in Energy Technology** **Practical course (P)**
2171487, SS 2020, 3 SWS, Language: German, Open in study portal

Content
Online registration within the first two weeks of the lecture periode at: http://www.its.kit.edu

- 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 nozzles
- Investigation of pollutant and noise emission as well as reliability and material deterioration
- Exhaust gas treatment
- Exhaust gas turbocharger
- Cooling Tower
- Heatpump
- Plant oil stove
- Heat capacity
- Wood combustion

regular attendance: 42h
self-study: 78h

Attending this course enables the students to:

- accomplish experimental and design related as well as theoretical tasks in a scientific background
- perform a correct evaluation of the obtained results
- adequately document and present their results in a scientific framework

1 report, approx. 12 pages

Discussion of the documented results with the assistents

Duration: 30 minutes

no tools or reference materials may be used

T 8.125 Course: Laboratory Laser Materials Processing [T-MACH-102154]

Responsible: Dr.-Ing. Johannes Schneider
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102819 - Major Field: Materials Science and Engineering

Type	Credits	Recurrence	Version
Completed coursework	4	Each term	2

Events					
WS 19/20	2183640	Laboratory "Laser Materials Processing"	3 SWS	Practical course (P)	Schneider, Pfleging
SS 2020	2183640	Laboratory "Laser Materials Processing"	3 SWS	Practical course (P)	Schneider, Pfleging
Exams					
WS 19/20	76-T-MACH-102154	Laboratory Laser Materials Processing		Prüfung (PR)	Schneider
SS 2020	76-T-MACH-102154	Laboratory Laser Materials Processing		Prüfung (PR)	Schneider

Competence Certificate
The assessment consists of a colloquium for every single experiment and an overall final colloquium incl. an oral presentation of 20 min.

Prerequisites
None

Recommendation
Basic knowledge of physics, chemistry and material science is assumed.

Below you will find excerpts from events related to this course:

V Laboratory "Laser Materials Processing"

2183640, WS 19/20, 3 SWS, Language: German, Open in study portal

Practical course (P)

Content
The laboratory compromises 8 half-day experiments, which address the following laser processing topics of metals, ceramics and polymers:

• safety aspects

• surface hardening and remelting

• melt and reactive cutting

• surface modification by dispersing or alloying

• welding

• surface texturing

• metrology

There are used CO2-, excimer-, Nd:YAG- and high power diode-laser sources within the laboratory.

The student

- can describe the influence of laser, material and process parameters and can choose suitable parameters for the most important methods of laser-based processing in automotive engineering.
- can explain the requirements for safe handling of laser radiation and for the design of safe laser systems.

Basic knowledge of physics, chemistry and material science is assumed.

The attendance to one of the courses Physical Basics of Laser Technology (2181612) or Laser Application in Automotive Engineering (2182642) is strongly recommended.

regular attendance: 34 hours
self-study: 86 hours

The assessment consists of a colloquium for every single experiment and an overall final colloquium incl. an oral presentation of 20 min.

Literature
F. K. Kneubühl, M. W. Sigrist: Laser, 2008, Vieweg+Teubner

T. Graf: Laser - Grundlagen der Laserstrahlquellen, 2009, Vieweg-Teubner Verlag

R. Poprawe: Lasertechnik für die Fertigung, 2005, Springer

H. Hügel, T. Graf: Laser in der Fertigung, 2009, Vieweg+Teubner

J. Eichler, H.-J. Eichler: Laser - Bauformen, Strahlführung, Anwendungen, 2006, Springer

V **Laboratory "Laser Materials Processing"** **Practical course (P)**
2183640, SS 2020, 3 SWS, Language: German, Open in study portal

Content
The laboratory compromises 8 half-day experiments, which address the following laser processing topics of metals, ceramics and polymers:

• safety aspects

• surface hardening and remelting

• melt and reactive cutting

• surface modification by dispersing or alloying

• welding

• surface texturing

• metrology

There are used CO2-, excimer-, Nd:YAG- and high power diode-laser sources within the laboratory.

The student

- can describe the influence of laser, material and process parameters and can choose suitable parameters for the most important methods of laser-based processing in automotive engineering.
- can explain the requirements for safe handling of laser radiation and for the design of safe laser systems.

Basic knowledge of physics, chemistry and material science is assumed.

The attendance to one of the courses Physical Basics of Laser Technology (2181612) or Laser Application in Automotive Engineering (2182642) is strongly recommended.

regular attendance: 34 hours
self-study: 86 hours

The assessment consists of a colloquium for every single experiment and an overall final colloquium incl. an oral presentation of 20 min.

Literature
F. K. Kneubühl, M. W. Sigrist: Laser, 2008, Vieweg+Teubner

T. Graf: Laser - Grundlagen der Laserstrahlquellen, 2009, Vieweg-Teubner Verlag

R. Poprawe: Lasertechnik für die Fertigung, 2005, Springer

H. Hügel, T. Graf: Laser in der Fertigung, 2009, Vieweg+Teubner

J. Eichler, H.-J. Eichler: Laser - Bauformen, Strahlführung, Anwendungen, 2006, Springer

W.T. Silfvast: Laser Fundamentals, 2008, Cambrigde University Press

W.M. Steen: Laser Materials Processing, 2010, Springer

T 8.126 Course: Laboratory Mechatronics [T-MACH-105370]

Responsible: Dr.-Ing. Maik Lorch
Prof. Dr.-Ing. Wolfgang Seemann
Prof. Dr.-Ing. Christoph Stiller

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102815 - Major Field: Engineering Design
M-MACH-102817 - Major Field: Information Technology
M-MACH-102820 - Major Field: Mechatronics

Type	Credits	Recurrence	Version
Completed coursework	4	Each winter term	4

Events					
WS 19/20	2105014	Laboratory mechatronics	3 SWS	Practical course (P)	Seemann, Stiller, Lorch, Böhland, Burgert, Bitner

Competence Certificate
certificate of successful attendance

Prerequisites
None

Below you will find excerpts from events related to this course:

V Laboratory mechatronics

2105014, WS 19/20, 3 SWS, Language: German, Open in study portal

Practical course (P)

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

Learning objectives:

The student is able to ...

- use his knowledge about mechatronics and microsystems technology to solve a practical problem. The laboratory course comprises simulation, bus communication, measurement instrumentation, control engineering and programming.
- integrate the different subsystems from a manipulator to a working compound system in teamwork.

Nachweis (EN): certificate of successful attendance

Voraussetzung (EN): none

Arbeitsaufwand (EN):

regular attendance: 33.5 h

self-study: 88.5 h

Literature
Materialien zum Mechatronik-Praktikum

Manuals for the laboratory course on Mechatronics

T 8.127 Course: Laboratory Production Metrology [T-MACH-108878]

Responsible: Dr.-Ing. Benjamin Häfner
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102589 - Major Field: Production Systems
M-MACH-102820 - Major Field: Mechatronics

Type	Credits	Recurrence	Version
Examination of another type	4	Each summer term	1

Events					
SS 2020	2150550	Laboratory Production Metrology	3 SWS	Practical course (P)	Häfner
Exams					
WS 19/20	76-T-MACH-108878	Laboratory Production Metrology		Prüfung (PR)	Häfner

Competence Certificate
Alternative Test Achievement: Group presentation of 15 min at the beginning of each experiment and evaluation of the participation during the experiments

and

Oral Exam (15 min)

Prerequisites
none

Annotation
For organizational reasons the number of participants for the course is limited. Hence al selection process will take place. Applications are made via the homepage of wbk (http://www.wbk.kit.edu/studium-und-lehre.php).

Below you will find excerpts from events related to this course:

V Laboratory Production Metrology

2150550, SS 2020, 3 SWS, Language: German, Open in study portal

Practical course (P)

Content
During this course, students get to know measurement systems that are used in a production system. In the age of Industry 4.0, sensors are becoming more important. Therefore, the application of in-line measurement technology such as machine vision and non-destructive testing is focussed. Additionally, laboratory based measurement technologies such as computed tomography are addressed. The students learn the theoretical background as well as practical applications for industrial examples. The students use sensors by themselves during the course. Additionally, they are trained on how to integrate sensors in production processes and how to analyze measurement data with suitable software.

The following topics are addressed:

- Classification and examples for different measurement technologies in a production environment
- Machine vision with optical sensors
- Information fusion based on optical measurements
- Robot-based optical measurements
- Non-destructive testing by means of acoustic measurements
- Coodinate measurement technology
- Industrial computed tomography
- Measurement uncertainty evaluation
- Analysis of production data by means of data mining

Learning Outcomes:

The students …

- are able to name, describe and mark out different measurement technologies that are relevant in a production environment.
- are able to conduct measurements with the presented in-line and laboratory based measurement systems.
- are able to analyze measurement results and asses the measurement uncertainty of these.
- are able to deduce whether a work piece fulfills quality relevant specifications by analysing measurement results.
- are able to use the presented measurement technologies for a new task.

Workload:

regular attendance: 31,5 hours
self-study: 88,5 hours

Literature
Skript zur Veranstaltung wird über (https://ilias.studium.kit.edu/) bereitgestellt. Ebenso wird auf gängie Fachliteratur verwiesen.

Lecture notes will be provided in Ilias (https://ilias.studium.kit.edu/). Additional reference to literature will be provided, as well.

T 8.128 Course: Laser in Automotive Engineering [T-MACH-105164]

Responsible: Dr.-Ing. Johannes Schneider
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102818 - Major Field: Vehicle Technology
M-MACH-102819 - Major Field: Materials Science and Engineering

Type	Credits	Recurrence	Version
Oral examination	4	Each summer term	2

Events					
SS 2020	2182642	Laser in automotive engineering	2 SWS	Lecture (V)	Schneider
Exams					
WS 19/20	76-T-MACH-105164	Laser in Automotive Engineering		Prüfung (PR)	Schneider
SS 2020	76-T-MACH-105164	Laser in Automotive Engineering		Prüfung (PR)	Schneider

Competence Certificate
oral examination (30 min)

no tools or reference materials

Prerequisites
It is not possible, to combine this brick with brick Physical Basics of Laser Technology [T-MACH-109084] and brick Physical Basics of Laser Technology [T-MACH-102102]

Modeled Conditions
The following conditions have to be fulfilled:

1. The course T-MACH-102102 - Physical Basics of Laser Technology must not have been started.

Recommendation
preliminary knowlegde in mathematics, physics and materials science

Below you will find excerpts from events related to this course:

V Laser in automotive engineering
2182642, SS 2020, 2 SWS, Language: German, Open in study portal

Lecture (V)

Content
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. Furthermore the application of laser light in metrology and safety aspects will be addressed.

- physical basics of laser technology
- laser beam sources (Nd:YAG-, CO2-, high power diode-laser)
- beam properties, guiding and shaping
- basics of materials processing with lasers
- laser applications in automotive engineering
- economical aspects
- savety aspects

The student

- can explain the principles of light generation, the conditions for light amplification as well as the basic structure and function of Nd:YAG-, CO2- and high power diode-laser sources.
- can describe the most important methods of laser-based processing in automotive engineering and illustrate the influence of laser, material and process parameters
- can analyse manufacturing problems and is able to choose a suitable laser source and process parameters.
- can explain the requirements for safe handling of laser radiation and for the design of safe laser systems.

Basic knowledge of physics, chemistry and material science is assumed.

It is not possible, to combine this lecture with the lecture *Physical basics of laser technology* [2181612].

regular attendance: 22,5 hours
self-study: 97,5 hours

oral examination (ca. 30 min)

no tools or reference materials

Literature
F. K. Kneubühl, M. W. Sigrist: Laser, 2008, Vieweg+Teubner

H. Hügel, T. Graf: Laser in der Fertigung, 2009, Vieweg+Teubner

T. Graf: Laser - Grundlagen der Laserstrahlquellen, 2009, Vieweg-Teubner Verlag

R. Poprawe: Lasertechnik für die Fertigung, 2005, Springer

J. Eichler, H.-J. Eichler: Laser - Bauformen, Strahlführung, Anwendungen, 2006, Springer

T 8.129 Course: Leadership and Conflict Management [T-MACH-105440]

Responsible: Hans Hatzl
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102815 - Major Field: Engineering Design

Type	Credits	Recurrence	Version
Oral examination	4	Each summer term	1

Events					
SS 2020	2110017	Leadership and Conflict Management (in German)	2 SWS	Lecture (V)	Hatzl
Exams					
SS 2020	76-T-MACH-105440	Leadership and Conflict Management		Prüfung (PR)	Deml, Hatzl

Competence Certificate
oral exam (approx. 30 min)

Prerequisites
none

Below you will find excerpts from events related to this course:

V Leadership and Conflict Management (in German)

2110017, SS 2020, 2 SWS, Language: German, Open in study portal

Lecture (V)

Content
In this compact event, management and leadership techniques are taught which are among the key qualifications for management tasks. Furthermore, you will be prepared for management and leadership tasks.

The course consists of the following course contents:

1. Introduction to the topic
   Goal setting and goal achievement
   Management techniques in planning
   Communication and information
   Decision Theory
   Leadership and cooperation
   Self Management
   Conflict management and strategy
   Case studies

It passes:

- Obligatory attendance

recommendations:

- Knowledge of work and economic science is advantageous

Literature
Das Skript und Literaturhinweise stehen auf ILIAS zum Download zur Verfügung.

T 8.130 Course: Leadership and Management Development [T-MACH-105231]

Responsible: Prof. Dr.-Ing. Albert Albers
Prof. Dr.-Ing. Sven Matthiesen
Andreas Ploch

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102812 - Major Field: Powertrain Systems
M-MACH-102815 - Major Field: Engineering Design

Type	Credits	Recurrence	Version
Oral examination	4	Each winter term	1

Events					
WS 19/20	2145184	Leadership and Product Development	2 SWS	Lecture (V)	Ploch
Exams					
WS 19/20	76-T-MACH-105231	Leadership and Management Development		Prüfung (PR)	Ploch, Albers

Competence Certificate
oral exam (20 min)

Prerequisites
none

Below you will find excerpts from events related to this course:

V Leadership and Product Development

2145184, WS 19/20, 2 SWS, Language: German, Open in study portal

Lecture (V)

Content
Leadership heories

Management tools

Communication as a management tool

Change management

Management development and MD programs

Assessment center and management audits

Teamwork, team development and team roles

Intercultural Competence

Leadership and ethics, corporate governance

Executive coaching

Presentations Practice

Literature
Vorlesungsumdruck

T 8.131 Course: Lightweight Engineering Design [T-MACH-105221]

Responsible: Prof. Dr.-Ing. Albert Albers
Norbert Burkardt

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102815 - Major Field: Engineering Design
M-MACH-102818 - Major Field: Vehicle Technology

Type	Credits	Recurrence	Version
Written examination	4	Each summer term	2

Events					
SS 2020	2146190	Lightweight Engineering Design	2 SWS	Lecture (V)	Albers, Burkardt
Exams					
WS 19/20	76-T-MACH-105221	Lightweight Engineering Design		Prüfung (PR)	Albers, Burkardt

Competence Certificate
Written examination (90 min)

Prerequisites
None

Below you will find excerpts from events related to this course:

V Lightweight Engineering Design

2146190, SS 2020, 2 SWS, Language: German, Open in study portal

Lecture (V)

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

Additionally, guest speakers from industry will present lightweight design from an practical point of view.

The students are able to ...

- evaluate the potential of central lightweight strategies and their application in design processes.
- apply different stiffing methods qualitatively and to evaluate their effectiveness.
- evaluate the potential of computer-aided engineering as well as the related limits and influences on manufacturing.
- reflect the basics of lightweight construction from a system view in the context of the product engineering process.

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

T 8.132 Course: Machine Dynamics [T-MACH-105210]

Responsible: Prof. Dr.-Ing. Carsten Proppe
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102746 - Compulsory Elective Module
M-MACH-102812 - Major Field: Powertrain Systems
M-MACH-102820 - Major Field: Mechatronics
M-MACH-104430 - Major Field: Modeling and Simulation in Dynamics
M-MACH-104442 - Major Field: Vibration Theory

Type	Credits	Recurrence	Version
Written examination	5	Each summer term	1

Events					
SS 2020	2161224	Machine Dynamics	2 SWS	Lecture (V)	Proppe
SS 2020	2161225	Machine Dynamics (Tutorial)	1 SWS	Practice (Ü)	Proppe, Fischer
Exams					
WS 19/20	76-T-MACH-105210	Machine Dynamics		Prüfung (PR)	Proppe
SS 2020	76-T-MACH-105210	Machine Dynamics		Prüfung (PR)	Proppe

Competence Certificate
written exam, 180 min.

Prerequisites
none

Below you will find excerpts from events related to this course:

V Machine Dynamics
2161224, SS 2020, 2 SWS, Language: English, Open in study portal

Lecture (V)

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. Aufl., 1953

Holzweißig, Dresig: Lehrbuch der Maschinendynamik, 1979

Dresig, Vulfson: Dynamik der Mechanismen, 1989

V Machine Dynamics (Tutorial)
2161225, SS 2020, 1 SWS, Language: English, Open in study portal

Practice (Ü)

Content
Exercises related to the lecture

T 8.133 Course: Machine Dynamics II [T-MACH-105224]

Responsible: Prof. Dr.-Ing. Carsten Proppe
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102812 - Major Field: Powertrain Systems
M-MACH-102820 - Major Field: Mechatronics
M-MACH-104430 - Major Field: Modeling and Simulation in Dynamics
M-MACH-104442 - Major Field: Vibration Theory

Type	Credits	Recurrence	Version
Oral examination	4	Each winter term	1

Events					
WS 19/20	2162220	Machine Dynamics II	2 SWS	Lecture (V)	Proppe
Exams					
WS 19/20	76-T-MACH-105224	Machine Dynamics II		Prüfung (PR)	Proppe
SS 2020	76-T-MACH-105224	Machine Dynamics II		Prüfung (PR)	Proppe

Competence Certificate
oral exam, 30 min.

Prerequisites
none

Recommendation
Machine Dynamics

Below you will find excerpts from events related to this course:

V Machine Dynamics II
2162220, WS 19/20, 2 SWS, Language: English, Open in study portal

Lecture (V)

Content
hydrodynamic bearings

- rotating shafts in hydrodynamic bearings
- belt drives
- virbation of turbine blades

Literature
R. Gasch, R. Nordmann, H. Pfützner: Rotordynamik, Springer, 2006

T 8.134 Course: Machine Tools and Industrial Handling [T-MACH-109055]

Responsible: Prof. Dr.-Ing. Jürgen Fleischer
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102589 - Major Field: Production Systems
M-MACH-102815 - Major Field: Engineering Design

Type	Credits	Recurrence	Version
Oral examination	8	Each winter term	1

Events					
WS 19/20	2149902	Machine Tools and Industrial Handling	6 SWS	Lecture / Practice (VÜ)	Fleischer
Exams					
WS 19/20	76-T-MACH-109055	Machine Tools and Industrial Handling		Prüfung (PR)	Fleischer

Competence Certificate
Oral exam (40 minutes)

Prerequisites
"T-MACH-102158 - Werkzeugmaschinen und Handhabungstechnik" must not be commenced.

Below you will find excerpts from events related to this course:

V Machine Tools and Industrial Handling — **Lecture / Practice (VÜ)**
2149902, WS 19/20, 6 SWS, Language: German, Open in study portal

Content
The lecture gives an overview of the construction, use and application of machine tools and industrial handling equipment. In the course of the lecture a well-founded and practice-oriented knowledge for the selection, design and evaluation of machine tools is conveyed. First, the main components of the machine tools are systematically explained and their design principles as well as the integral machine tool design are discussed. Subsequently, the use and application of machine tools will be demonstrated using typical machine examples. Based on examples from current research and industrial applications, the latest developments are discussed, especially concerning the implementation of Industry 4.0.

The individual topics are:

- Frames and frame components
- Feed axes
- Spindles
- Peripheral equipment
- Control unit
- Metrological evaluation and machine testing
- Process monitoring
- Maintenance of machine tools
- Safety assessment of machine tools
- Machine examples

Learning Outcomes:

The students …

- are able to assess the use and application of machine tools and handling equipment and to differentiate between them in terms of their characteristics and design.
- can describe and discuss the essential elements of the machine tool (frame, main spindle, feed axes, peripheral equipment, control unit).
- are able to select and dimension the essential components of a machine tool.
- are capable of selecting and evaluating machine tools according to technical and economic criteria.

Workload:

MACH:
regular attendance: 63 hours
self-study: 177 hours
WING:
regular attendance: 63 hours
self-study: 207 hours

Literature
Medien:
Skript zur Veranstaltung wird über Ilias (https://ilias.studium.kit.edu/) bereitgestellt.

Media:
Lecture notes will be provided in Ilias (https://ilias.studium.kit.edu/).

T 8.135 Course: Machine Vision [T-MACH-105223]

Responsible: Dr. Martin Lauer
Prof. Dr.-Ing. Christoph Stiller

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102817 - Major Field: Information Technology

Type	Credits	Recurrence	Version
Written examination	8	Each winter term	2

Events					
WS 19/20	2137308	Machine Vision	4 SWS	Lecture / Practice (VÜ)	Lauer, Quehl
Exams					
WS 19/20	76-T-MACH-105223	Machine Vision		Prüfung (PR)	Stiller, Lauer

Competence Certificate
Type of Examination: written exam

Duration of Examination: 60 minutes

Prerequisites
None

Below you will find excerpts from events related to this course:

V Machine Vision

2137308, WS 19/20, 4 SWS, Language: English, Open in study portal

Lecture / Practice (VÜ)

Content
Lernziele (EN):

Machine vision (or *computer vision*) describes all kind of techniques that can be used to extract information from camera images in an automated way. Considerable improvements of machine vision techniques throughout recent years, e.g. by the advent of deep learning, have caused growing interest in these techniques and enabled applications in various domains, e.g. robotics, autonomous driving, gaming, production control, visual inspection, medicine, surveillance systems, and augmented reality.

The participants should gain an overview over the basic techniques in machine vision and obtain hands-on experience.

Nachweis: written exam, 60 min.

Arbeitsaufwand: 240 hours

Voraussetzungen: none

Literature
Foliensatz zur Veranstaltung wird als kostenlose pdf-Datei bereitgestellt.Weitere Empfehlungen werden in der Vorlesung bekannt gegeben.

T 8.136 Course: Machines and Processes [T-MACH-105208]

Responsible: Prof. Dr.-Ing. Hans-Jörg Bauer
Dr.-Ing. Heiko Kubach
Prof. Dr. Ulrich Maas
Dr. Balazs Pritz

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102566 - Machines and Processes

Type	Credits	Recurrence	Version
Written examination	7	Each term	2

Events					
WS 19/20	2185000	Machines and Processes	4 SWS	Lecture / Practice (VÜ)	Bauer, Kubach, Maas, Pritz
SS 2020	3134140	Machines and Processes	4 SWS	Lecture / Practice (VÜ)	Bauer, Maas, Kubach, Pritz
Exams					
WS 19/20	76-T-MACH-105208	Machines and Processes		Prüfung (PR)	Kubach, Maas, Bauer
WS 19/20	76-T-MACH-105208e	Machines and Processes		Prüfung (PR)	Kubach, Maas, Bauer
SS 2020	76-T-MACH-105208	Machines and Processes, Prerequisite		Prüfung (PR)	Kubach, Gabi, Bauer, Maas

Competence Certificate
written exam (duration: 120 min)

Prerequisites
Taking part at the exam is possible only when lab course has been successfully completed

Modeled Conditions
The following conditions have to be fulfilled:

1. The course T-MACH-105232 - Machines and Processes, Prerequisite must have been passed.

Below you will find excerpts from events related to this course:

V Machines and Processes

2185000, WS 19/20, 4 SWS, Open in study portal

Lecture / Practice (VÜ)

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
- emissions

T 8.137 Course: Machines and Processes, Prerequisite [T-MACH-105232]

Responsible: Prof. Dr.-Ing. Hans-Jörg Bauer
Dr.-Ing. Heiko Kubach
Prof. Dr. Ulrich Maas
Dr. Balazs Pritz

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102566 - Machines and Processes

Type	Credits	Recurrence	Version
Completed coursework	0	Each term	1

Events					
WS 19/20	2187000	Machines and Processes	1 SWS	Practical course (P)	Bauer, Kubach, Maas, Pritz, Schmidt
SS 2020	2187000	Machinery and Processes	1 SWS	Practical course (P)	Bauer, Kubach, Maas, Pritz
Exams					
WS 19/20	76-T-MACH-105232	Machines and Processes, Prerequisite		Prüfung (PR)	Kubach, Maas, Bauer, Gabi
SS 2020	76-T-MACH-105232	Machines and Processes, Prerequisite		Prüfung (PR)	Kubach, Gabi, Bauer, Maas

Competence Certificate
successful completed training course

Prerequisites
none

Below you will find excerpts from events related to this course:

V Machines and Processes
2187000, WS 19/20, 1 SWS, Open in study portal

Practical course (P)

Content
Lab Course Experiment

V Machinery and Processes
2187000, SS 2020, 1 SWS, Open in study portal

Practical course (P)

Content
successful lab course and written exam (2 h)

Taking part at the exam is possible only when lab course has been successfully completed

Lab course and lecture take place in summer and winter semester.

In the SS the lecture is held in English. The lab course is always bilingual.

Media:

slides to download

Documentation of the labcourse

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
- emissions

regular attendance: 48 h, self-study: 160 h

The students can name and describe basic energy conversion processes and energy converting machines. They can explain the application of these energy conversion processes in various machines. They can analyze and evaluate the processes and machines in terms of functionality and efficiency and they are able to solve basic technical problems in terms of operating the machines.

T 8.138 Course: Manufacturing Technology [T-MACH-102105]

Responsible: Prof. Dr.-Ing. Volker Schulze
Dr.-Ing. Frederik Zanger

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102589 - Major Field: Production Systems
M-MACH-102815 - Major Field: Engineering Design

Type	Credits	Recurrence	Version
Written examination	8	Each winter term	3

Events					
WS 19/20	2149657	Manufacturing Technology	6 SWS	Lecture / Practice (VÜ)	Schulze, Zanger
Exams					
WS 19/20	76-T-MACH-102105	Manufacturing Technology		Prüfung (PR)	Schulze

Competence Certificate
Written Exam (180 min)

Prerequisites
none

Below you will find excerpts from events related to this course:

V Manufacturing Technology

Lecture / Practice (VÜ)

2149657, WS 19/20, 6 SWS, Language: German, Open in study portal

Content

The objective of the lecture is to look at manufacturing technology within the wider context of production engineering, to provide an overview of the different manufacturing processes and to impart detailed process knowledge of the common processes. The lecture covers the basic principles of manufacturing technology and deals with the manufacturing processes according to their classification into main groups regarding technical and economic aspects. The lecture is completed with topics such as process chains in manufacturing.

The following topics will be covered:

- Quality control
- Primary processing (casting, plastics engineering, sintering, additive 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

This lucture provides an excursion to an industry company.

Learning Outcomes:

The students ...

- are capable to specify the different manufacturing processes and to explain their functions.
- are able to classify the manufacturing processes by their general structure and functionality according to the specific main groups.
- have the ability to perform a process selection based on their specific characteristics.
- are enabled to identify correlations between different processes and to select a process regarding possible applications.
- are qualified to evaluate different processes regarding specific applications based on technical and economic aspects.
- are experienced to classify manufacturing processes in a process chain and to evaluate their specific influence on surface integrity of workpieces regarding the entire process chain.

Workload:

regular attendance: 63 hours
self-study: 177 hours

Literature
Medien:
Skript zur Veranstaltung wird über ilias (https://ilias.studium.kit.edu/) bereitgestellt.

Media:
Lecture notes will be provided in ilias (https://ilias.studium.kit.edu/).

T 8.139 Course: Material Flow in Logistic Systems [T-MACH-102151]

Responsible: Prof. Dr.-Ing. Kai Furmans
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102589 - Major Field: Production Systems

Type	Credits	Recurrence	Version
Examination of another type	9	Each winter term	3

Events					
WS 19/20	2117051	Material flow in logistic systems	6 SWS	Others (sonst.)	Furmans
Exams					
WS 19/20	76-T-MACH-102151	Material Flow in Logistic Systems		Prüfung (PR)	Furmans

Competence Certificate
The assessment (Prüfungsleistung anderer Art) consists of the following assignments:

- 40% assessment of the final case study as individual performance,
- 60% semester evaluation which includes working on 5 case studies and defending those (For both assessment types, the best 4 of 5 tries count for the final grade.):
  - 40% assessment of the result of the case studies as group work,
  - 20% assessment of the oral examination during the case study colloquiums as individual performance.

A detailed description of the learning control can be found under Annotations.

Prerequisites
none

Recommendation
Recommended elective subject: Probability Theory and Statistics

Annotation
Students are divided into groups for this course. Five case studies are carried out in these groups. The results of the group work during the lecture period are presented and evaluated in writing. In the oral examination during the case study colloquiums, the understanding of the result of the group work and the models dealt with in the course is tested. The participation in the oral defenses is compulsory and will be controlled. For the written submission the group receives a common grade, in the oral defense each group member is evaluated individually.

After the lecture period, there is the final case study. This case study contains the curriculum of the whole semester. The students work individually on this case study which takes place at a predefined place and time (duration: 4h).

Below you will find excerpts from events related to this course:

V Material flow in logistic systems

2117051, WS 19/20, 6 SWS, Language: German, Open in study portal

Others (sonst.)

Content
Learning 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
- Shuttle systems
- Sorting systems
- Simulation
- Calculation of availability and reliability
- Value stream analysis

After successful completion of the course, you are able (alone and in a team) to:

- Accurately describe a material handling system in a conversation with an expert.
- Model and parameterize the system load and the typical design elements of a material handling system.
- Design a material handling system for a task.
- Assess the performance of a material handling system in terms of the requirements.
- Change the main lever for influencing the performance.
- Expand the boundaries of today's methods and system components conceptually if necessary.

Literature:

Arnold, Dieter; Furmans, Kai: Materialfluss in Logistiksystemen; Springer-Verlag Berlin Heidelberg, 2009

Description:

Students are divided into groups for this course. Five case studies are carried out in these groups. The results of the group work during the lecture period are presented and evaluated in writing. During the colloquiums, the result of the case study is presented and the understanding of the group work and the models dealt with in the course are tested in an oral defense. The participation in the colloquiums is compulsory and will be controlled. For the written submission and the presentation the group receives a common grade, in the oral defense each group member is evaluated individually.

After the lecture period, there is the final case study. This case study contains the curriculum of the whole semester. The students work individually on this case study which takes place at a predefined place and time (duration: 4h).

We strongly recommend to attend the introductory session at 16.10.2019. In this session, the teaching concept of "Materialfluss in Logistiksysteme" is explained and outstanding issues are clarified.

Workload:

- Regular attendance: 35 h
- Self-study: 135 h
- Group work: 100 h

Competence Certificate:

The assessment (Prüfungsleistung anderer Art) consists of the following assignments:

- 40% assessment of the final case study as individual performance,
- 60% semester evaluation which includes working on 5 case studies and defending those (For both assessment types, the best 4 of 5 tries count for the final grade.):
    - 40% assessment of the result and the presentation of the case studies as group work,
    - 20% assessment of the oral examination during the colloquiums as individual performance.

T 8.140 Course: Materials Characterization [T-MACH-107684]

Responsible: Dr.-Ing. Jens Gibmeier
Organisation: KIT Department of Mechanical Engineering
Part of: M-MACH-102819 - Major Field: Materials Science and Engineering

Type	Credits	Recurrence	Version
Oral examination	4	Each winter term	3

Events					
WS 19/20	2174586	materials characterization	2 SWS	Lecture (V)	Schneider, Gibmeier
Exams					
WS 19/20	76-T-MACH-107684	Materials Characterization		Prüfung (PR)	Heilmaier, Gibmeier
SS 2020	76-T-MACH-107684	Materials Characterization		Prüfung (PR)	Heilmaier, Gibmeier

Competence Certificate
Oral exam, about 25 minutes

Prerequisites
Successful participation in Exercises for Materials Characterization is the condition for the admittance to the oral exam in Materials Characterization.

Modeled Conditions
The following conditions have to be fulfilled:

1. The course T-MACH-107685 - Exercises for Materials Characterization must have been passed.

Below you will find excerpts from events related to this course:

V materials characterization
2174586, WS 19/20, 2 SWS, Language: German, Open in study portal

Lecture (V)

Content
The following methods will be introduced within this lecture:

- microscopic methods: optical microscopy, electron microscopy (SEM/TEM), atomic force microscopy
- material and microstructure analyses by means of X-ray, neutron and electron beams
- analysis methods at SEM/TEM (e.g. EELS)
- spectroscopic methods (e.g. EDS / WDS)

learning objectives:
The students have fundamental knowledge about methods of material analysis. They have a basic understanding to transfer this fundamental knowledge on problems in engineering science. Furthermore, the students have the ability to describe technical material by its microscopic and submicroscopic structure.
requirements:
none
workload:

The workload for the module “Materials Characterization” is 180 h per semester and consists of the presence during the lectures (21 h) and tutorials (12 h) as well as self-study for the lecture (99 h) and for the tutorials (48 h).

Literature
Vorlesungsskript (wird zu Beginn der Veranstaltung ausgegeben).

Literatur wird zu Beginn der Veranstaltung bekanntgegeben.

T 8.141 Course: Materials of Lightweight Construction [T-MACH-105211]

Responsible: Prof. Dr.-Ing. Peter Elsner
Dr.-Ing. Wilfried Liebig

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102819 - Major Field: Materials Science and Engineering

Type	Credits	Recurrence	Version
Oral examination	4	Each summer term	1

Events					
SS 2020	2174574	Materials for Lightweight Construction	2 SWS	Lecture (V)	Liebig, Elsner
Exams					
WS 19/20	76-T-MACH-105211	Materials of Lightweight Construction		Prüfung (PR)	Liebig, Weidenmann
SS 2020	76-T-MACH-105211	Materials of Lightweight Construction		Prüfung (PR)	Liebig

Competence Certificate
Oral exam, about 25 minutes

Prerequisites
none

Recommendation
Materials Science I/II

Below you will find excerpts from events related to this course:

V Materials for Lightweight Construction

2174574, SS 2020, 2 SWS, Language: German, Open in study portal

Lecture (V)

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 steels, press-hardening and hardenable steels

Composites - mainly PMC

Matrices

Reinforcements

Basic mechanical principles of composites

Hybrid composites

Special materials for lightweight design

Beryllium alloys

Metallic Glasses

Applications

learning objectives:

The students are capable to name different lightweight materials and can describe their composition, properties and fields of application. They can describe the hardening mechanisms of lightweight materials and can transfer this knowledge to applied problems.

The students can apply basic mechanical models of composites and can depict differences in the mechanical properties depending on composition and structure. The students can describe the basic principle of hybrid material concepts and can judge their advantages in comparison to bulk materials. The students can name special materials for lightweight design and depict differences to conventional materials. The students have the ability to present applications for different lightweight materials and can balance reasons for their use.

requirements:

Werkstoffkunde I/II (recommended)

workload:

The workload for the lecture “Materials for Lightweight Construction” is 120 h per semester and consists of the presence during the lectures (24 h), preparation and rework time at home (48 h) and preparation time for the oral exam (48 h).

Literature

Literaturhinweise, Unterlagen und Teilmanuskript in der Vorlesung

T 8.142 Course: Materials Science and Engineering III [T-MACH-105301]

Responsible: Prof. Dr.-Ing. Martin Heilmaier
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102819 - Major Field: Materials Science and Engineering

Type	Credits	Recurrence	Version
Oral examination	8	Each winter term	2

Events					
WS 19/20	2173553	Materials Science and Engineering III	4 SWS	Lecture (V)	Heilmaier, Lang
WS 19/20	2173554	Übungen zu Werkstoffkunde III	1 SWS	Practice (Ü)	Heilmaier, Kauffmann
Exams					
WS 19/20	76-T-MACH-105301	Materials Science III		Prüfung (PR)	Heilmaier, Lang
SS 2020	76-T-MACH-105301	Materials Science III		Prüfung (PR)	Heilmaier, Lang

Competence Certificate
Oral exam, about 35 minutes

Prerequisites
none

Below you will find excerpts from events related to this course:

V Materials Science and Engineering III

2173553, WS 19/20, 4 SWS, Language: German, Open in study portal

Lecture (V)

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.

learning objectives:
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 and can apply them to metallic materials. 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.

requirements:
Basic knowledge in materials science and engineering (Werkstoffkunde I/II)

workload:

regular attendance: 53 hours
self-study: 187 hours

Literature
Vorlesungsskript; Übungsaufgaben; Bhadeshia, H.K.D.H. & Honeycombe, R.W.K.
Steels – Microstructure and Properties
CIMA Publishing, 3. Auflage, 2006

T 8.143 Course: Materials Science I & II [T-MACH-105145]

Responsible: Dr.-Ing. Jens Gibmeier
Prof. Dr.-Ing. Martin Heilmaier
Prof. Dr. Astrid Pundt

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102562 - Materials Science

Type	Credits	Recurrence	Version
Oral examination	11	Each winter term	2

Events					
WS 19/20	2173550	Materials Science and Engineering I for mach, phys	4 SWS	Lecture (V)	Pundt, Heilmaier
WS 19/20	3173008	Materials Science and Engineering I (Lecture)	4 SWS	Lecture (V)	Gibmeier
WS 19/20	3173009	Materials Science and Engineering I (Tutorial)	1 SWS	Practice (Ü)	Gibmeier
SS 2020	2174560	Materials Science and Engineering II for mach, phys	3 SWS	Lecture (V)	Heilmaier, Pundt
SS 2020	3174015	Materials Science and Engineering II (Lecture)	3 SWS	Lecture (V)	Gibmeier
SS 2020	3174026	Materials Science and Engineering II (Tutorials)	1 SWS	Practice (Ü)	Gibmeier, Mitarbeiter
Exams					
WS 19/20	76-T-MACH-105145	Materials Science I, II		Prüfung (PR)	Heilmaier

Competence Certificate
oral exam, about 25 minutes

Prerequisites
Lab course must be finished successfully prior to the registration for the oral exam.

Modeled Conditions
The following conditions have to be fulfilled:

1. The course T-MACH-105146 - Materials Science Lab Course must have been passed.

Annotation
The workload for the lecture Materials Science I & II is 165 h per semester and consists of the presence during the lectures (WS: 4 SWS, SS: 2SWS) and the exercises (1 SWS per WS and 1 SWS per SS) as well as preparation and rework time at home.

Below you will find excerpts from events related to this course:

V Materials Science and Engineering I for mach, phys

Lecture (V)

2173550, WS 19/20, 4 SWS, Language: German, Open in study portal

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

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

The students can describe the typical property profies and can name applications for the most important engineering materials.

The students are able to describe standard materials characterization methods and can explain the evaluation of these methods. They can judge materials on base of the data obtained by these methods.

requirements:

None, **Recommendations:** None.

workload:

regular attendance: 53 hours
self-study: 157 hours

Literature
Vorlesungsskript; Übungsaufgabenblätter;

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

V **Materials Science and Engineering II for mach, phys** **Lecture (V)**
2174560, SS 2020, 3 SWS, Language: German, Open in study portal

Content
Ferrous materials

Non-ferrous metals and alloys

Engineering ceramics

Glasses

Polymers

Composites

learning objectives:

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

The students can name representative materials for different material classes and can describe the differences.

The students are able to describe the basic mechanisms of hardening for ferrous and non-ferrous materials and reflect these mechanisms using phase and TTT diagrams.

The students can interpret given phase, TTT or other diagrams relevant for materials science, gather information from them and can correlate them regarding the microstructure evolution.

The students can describe the phenomena correlated with materials science in polymers, metals and ceramics and depict differences.

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

requirements:
Materials Science and Engineering I
workload:

regular attendance: 42 hours
self-study: 108 hours

examination:

Combined with 'Materials Science and Engineering I'; oral; about 30 minutes

The successful partcipation in the lab course is obligatory for the admission to the examination.

Literature
Vorlesungsskript; Übungsaufgabenblätter;

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

V	**Materials Science and Engineering II (Lecture)** 3174015, SS 2020, 3 SWS, Language: English, Open in study portal	**Lecture (V)**

Content

Ferrous materials

Non-ferrous metals and alloys

Engineering ceramics

Glasses

Polymers

Composites

learning objectives:

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

The students can name representative materials for different material classes and can describe the differences.

The students are able to describe the basic mechanisms of hardening for ferrous and non-ferrous materials and reflect these mechanisms using phase and TTT diagrams.

The students can interpret given phase, TTT or other diagrams relevant for materials science, gather information from them and can correlate them regarding the microstructure evolution.

The students can describe the phenomena correlated with materials science in polymers, metals and ceramics and depict differences.

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

requirements:
Materials Science and Engineering I
workload:

regular attendance: 42 hours
self-study: 108 hours

examination:

Combined with 'Materials Science and Engineering I'; oral; about 30 minutes

The successful partcipation in the lab course is obligatory for the admission to the examination.

Literature
Vorlesungsskript; Übungsaufgabenblätter;

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

V **Materials Science and Engineering II (Tutorials)** **Practice (Ü)**
3174026, SS 2020, 1 SWS, Language: English, Open in study portal

Content
Examplary calculations

learning objectives:

The students can apply the knowledge gained through the lacture as well as self-studies and transfer this knowledge to problems given.

They can carry out calculations independantly dealing with different subjects of materials science. Therefore, they are able to decide which formulas allow the calculation based on the question given.

Theyare able to discuss aspects of materials science both quantitatively and qualitatively and can present these results oraly.

requirements:
Lecture Materials Science and Engineering II
workload:

Literature
see lecture notes

T 8.144 Course: Materials Science Lab Course [T-MACH-105146]

Responsible: Dr.-Ing. Jens Gibmeier
Prof. Dr.-Ing. Martin Heilmaier
Prof. Dr. Astrid Pundt

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102562 - Materials Science

Type	Credits	Recurrence	Version
Completed coursework (practical)	3	Each summer term	1

Events					
SS 2020	2174597	Experimental Lab Course in Material Science	3 SWS	Practical course (P)	Heilmaier, Pundt, Dietrich, Gibmeier, Guth, Lang
SS 2020	3174016	Materials Science and Engineering Lab Course	3 SWS	Practical course (P)	Gibmeier, Heilmaier, Pundt, Dietrich, Lang

Competence Certificate
Oral colloquium at the beginning of each topic; certificate of successful attendance.

Prerequisites
none

Annotation
The workload for the lab course Materials Science is 90 h in total and consists of the presence during the 10 experiments (one week half-time, 4 hours per day) as well as preparation and rework time at home.

Below you will find excerpts from events related to this course:

V Experimental Lab Course in Material Science

Practical course (P)

2174597, SS 2020, 3 SWS, Language: German, Open in study portal

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

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

learning objectives:

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

The students can name standard materials characterization methods and can describe the execution of the tests as well as the evaluation of the results. The students are able to asses materials on base of the data obtained by these methods.

The students are capable to select appropriate experiments to clarify probelms regarding the materials behaviour. They can describe the experimental procedures and can carry out experiments. They can derive material properties from data gained in experiments. They can interpret these properties regarding microstructure-propety-relations.

requirements:
Materials Science and Engineering I & II

workload:

regular attendance: 22 hours
self-study: 68 hours

Literature
Praktikumsskriptum

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

V Materials Science and Engineering Lab Course

3174016, SS 2020, 3 SWS, Language: English, Open in study portal

Practical course (P)

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

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

learning objectives:

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

The students can name standard materials characterization methods and can describe the execution of the tests as well as the evaluation of the results. The students are able to asses materials on base of the data obtained by these methods.

The students are capable to select appropriate experiments to clarify probelms regarding the materials behaviour. They can describe the experimental procedures and can carry out experiments. They can derive material properties from data gained in experiments. They can interpret these properties regarding microstructure-propety-relations.

requirements:
Materials Science and Engineering I & II
workload:

regular attendance: 22 hours
self-study: 68 hours

Literature
Praktikumsskriptum

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

T 8.145 Course: Mathematical Methods in Continuum Mechanics [T-MACH-110375]

Responsible: Prof. Dr.-Ing. Thomas Böhlke
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102746 - Compulsory Elective Module

Type	Credits	Recurrence	Expansion	Version
Written examination	4	Each winter term	1 terms	1

Events					
WS 19/20	2161254	Mathematical Methods in Continuum Mechanics	2 SWS	Lecture (V)	Böhlke
Exams					
WS 19/20	76-T-MACH-110375	Mathematical Methods in Continuum Mechanics		Prüfung (PR)	Böhlke

Competence Certificate
written exam (90 min). Additives as announced.

Prerequisites
Passing the Tutorial to Mathematical Methods of Continuum Mechanics (T-MACH-110376)

Modeled Conditions
The following conditions have to be fulfilled:

1. The course T-MACH-110376 - Tutorial Mathematical Methods in Continuum Mechanics must have been passed.

Below you will find excerpts from events related to this course:

V Mathematical Methods in Continuum Mechanics
2161254, WS 19/20, 2 SWS, Language: German, Open in study portal

Lecture (V)

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
- constitutive equations for solids and fluids
- Formulation of initial-boundary-value problems

Literature
Vorlesungsskript
Liu, I-S.: Continuum Mechanics. Springer, 2002.
Greve, R.: Kontinuumsmechanik, Springer 2003
Schade, H.: Tensoranalysis.Walter de Gruyter, New York, 1997.
Schade, H: Strömungslehre, de Gruyter 2013

T 8.146 Course: Mathematical Methods in Continuum Mechanics [T-MACH-110836]

Responsible: Prof. Dr.-Ing. Thomas Böhlke
Organisation:
Part of: M-MACH-102582 - Major Field: Continuum Mechanics

Type	Credits	Recurrence	Expansion	Version
Written examination	4	Each winter term	1 terms	1

Events					
WS 19/20	2161254	Mathematical Methods in Continuum Mechanics	2 SWS	Lecture (V)	Böhlke

Competence Certificate
written exam (90 min). Additives as announced.

There are no prerequisites within the Major Field 13 (Continuum Mechanics)

Annotation
This brick can only be chosen within Major Field 13 of Bachelor studies Mechanical Engineering. There are no prerequisites for the exam.

Below you will find excerpts from events related to this course:

V Mathematical Methods in Continuum Mechanics

2161254, WS 19/20, 2 SWS, Language: German, Open in study portal

Lecture (V)

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
- constitutive equations for solids and fluids
- Formulation of initial-boundary-value problems

Literature
Vorlesungsskript
Liu, I-S.: Continuum Mechanics. Springer, 2002.
Greve, R.: Kontinuumsmechanik, Springer 2003
Schade, H.: Tensoranalysis.Walter de Gruyter, New York, 1997.
Schade, H: Strömungslehre, de Gruyter 2013

T 8.147 Course: Mathematical Methods in Dynamics [T-MACH-105293]

Responsible: Prof. Dr.-Ing. Carsten Proppe
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102746 - Compulsory Elective Module
M-MACH-104430 - Major Field: Modeling and Simulation in Dynamics

Type	Credits	Recurrence	Version
Written examination	6	Each winter term	2

Events					
WS 19/20	2161206	Mathematical Methods in Dynamics	2 SWS	Lecture (V)	Proppe
WS 19/20	2161207	Übungen zu Mathematische Methoden der Dynamik	1 SWS	Practice (Ü)	Proppe, Oestringer
Exams					
WS 19/20	76-T-MACH-105293	Mathematical Methods in Dynamics		Prüfung (PR)	Proppe
SS 2020	76-T-MACH-105293	Mathematical Methods in Dynamics		Prüfung (PR)	Proppe

Competence Certificate
written examination, 180 min.

Prerequisites
none

Below you will find excerpts from events related to this course:

V Mathematical Methods in Dynamics

2161206, WS 19/20, 2 SWS, Language: German, Open in study portal

Lecture (V)

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
Vorlesungsskript (erhältlich im Internet)

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

V

Übungen zu Mathematische Methoden der Dynamik

2161207, WS 19/20, 1 SWS, Language: German, Open in study portal

Practice (Ü)

Content

Excercises related to the lecture

T 8.148 Course: Mathematical Methods in Fluid Mechanics [T-MACH-105295]

Responsible: Prof. Dr.-Ing. Bettina Frohnapfel
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102746 - Compulsory Elective Module

Type	Credits	Recurrence	Version
Written examination	6	Each summer term	1

Events					
SS 2020	2154432	Mathematical Methods in Fluid Mechanics	2 SWS	Lecture (V)	Frohnapfel, Gatti
SS 2020	2154433	Tutorial in Mathematical Methods of Fluid Mechanics	1 SWS	Practice (Ü)	Frohnapfel, Gatti, Magagnato
SS 2020	2154540	Mathematical Methods in Fluid Mechanics	SWS	Lecture (V)	Magagnato
Exams					
WS 19/20	76-T-MACH-105295	Mathematical Methods in Fluid Mechanics		Prüfung (PR)	Frohnapfel

Competence Certificate
written examination - 3 hours

Prerequisites
none

Recommendation
Basic Knowledge about Fluid Mechanics

Below you will find excerpts from events related to this course:

V Mathematical Methods in Fluid Mechanics — Lecture (V)
2154432, SS 2020, 2 SWS, Language: German/English, Open in study portal

Content
The students can to simplify the Navier-Stokes equations for specific flow problems. They are able to employ mathematical method in fluid mechanics effectively in order to solve the resulting conservation equations analytically, if possible, or to enable simpler numerical access to the problem. They can describe the limits of applicability of the assumptions made to model the flow behavior.

The lecture will cover a selection of the following topics:

- Potential flow theory
- Creeping flows
- Lubrication theory
- Boundary-layer theory
- Laminar-turbulent transition (linear stability theory)
- Turbulent flows
- Numerical solution of the governing equation (finite difference methods)

The students can to simplify the Navier-Stokes equations for specific flow problems. They are able to employ mathematical method in fluid mechanics effectively in order to solve the resulting conservation equations analytically, if possible, or to enable simpler numerical access to the problem. They can describe the limits of applicability of the assumptions made to model the flow behavior.

Literature

Kundu, P.K., Cohen, K.M.: Fluid Mechanics, Elsevier, 4th Edition, 2008

Kuhlmann, H.: Strömungsmechanik, Pearson, 2007

Spurk, J. H.: Strömungslehre, Springer, 2006

Zierep, J., Bühler, K.: Strömungsmechanik, Springer, 1991

Schlichting H., Gersten K., Grenzschichttheorie, Springer, 2006

Kundu, P.K., Cohen, K.M.: Fluid Mechanics, Elsevier, 4th Edition, 2008

Batchelor, G.K.: An Introduction to Fluid Dynamics, Cambridge Mathematical Library, 2000

Pope, S. B.: Turbulent Flows, Cambridge University Press, 2000

Ferziger, H., Peric, M.: Computational Methods for Fluid Dynamics, Springer, 2008

V

Tutorial in Mathematical Methods of Fluid Mechanics

2154433, SS 2020, 1 SWS, Language: German, Open in study portal

Practice (Ü)

Content

The exercises will practise the lecture topics:

- Curvilinear coordinates and tensor calculus
- Potential flow theory
- Boundary-layer theory
- Laminar-turbulent transition (linear stability theory)
- Turbulent flows
- Numerical solution of the governing equation (finite difference methods)

Literature

Kuhlmann, H.: Strömungsmechanik, Pearson, 2007

Spurk, J. H.: Strömungslehre, Springer, 2006

Zierep, J., Bühler, K.: Strömungsmechanik, Springer, 1991

Schlichting H., Gersten K., Grenzschichttheorie, Springer, 2006

Oertel,H., Laurien, E.: Numerische Strömungsmechanik, Vieweg Verlag 2003

V

Mathematical Methods in Fluid Mechanics

2154540, SS 2020, SWS, Language: English, Open in study portal

Lecture (V)

Content

The students can to simplify the Navier-Stokes equations for specific flow problems. They are able to employ mathematical method in fluid mechanics effectively in order to solve the resulting conservation equations analytically, if possible, or to enable simpler numerical access to the problem. They can describe the limits of applicability of the assumptions made to model the flow behavior.

The lecture will cover a selection of the following topics:

- Potential flow theory
- Creeping flows
- Lubrication theory
- Boundary-layer theory
- Laminar-turbulent transition (linear stability theory)
- Turbulent flows
- Numerical solution of the governing equation (finite difference methods)

The students can to simplify the Navier-Stokes equations for specific flow problems. They are able to employ mathematical method in fluid mechanics effectively in order to solve the resulting conservation equations analytically, if possible, or to enable simpler numerical access to the problem. They can describe the limits of applicability of the assumptions made to model the flow behavior.

T 8.149 Course: Mathematical Methods of Vibration Theory [T-MACH-105294]

Responsible: Prof. Dr.-Ing. Wolfgang Seemann
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102746 - Compulsory Elective Module
M-MACH-102820 - Major Field: Mechatronics
M-MACH-104430 - Major Field: Modeling and Simulation in Dynamics
M-MACH-104442 - Major Field: Vibration Theory

Type	Credits	Recurrence	Version
Written examination	6	Each summer term	2

Events					
SS 2020	2162241	Mathematical methods of vibration theory	2 SWS	Lecture (V)	Seemann
SS 2020	2162242	Mathematical methods of vibration theory (Tutorial)	2 SWS	Practice (Ü)	Seemann, Burgert
Exams					
WS 19/20	76-T-MACH-105294	Mathematical Methods of Vibration Theory		Prüfung (PR)	Seemann
SS 2020	76-T-MACH-105294	Mathematical Methods of Vibration Theory		Prüfung (PR)	Seemann

Competence Certificate
written examination, 180 min.

Prerequisites
none

Recommendation
Engineering Mechanics III/IV

Below you will find excerpts from events related to this course:

V Mathematical methods of vibration theory

Lecture (V)

2162241, SS 2020, 2 SWS, Language: German, Open in study portal

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

V Mathematical methods of vibration theory (Tutorial)

Practice (Ü)

2162242, SS 2020, 2 SWS, Language: German, Open in study portal

Content
Seven tutorials with examples of the contents of the course

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

T 8.150 Course: Mathématiques appliquées aux sciences de l'ingénieur [T-MACH-105452]

Responsible: Prof. Dr. Jean-Yves Dantan
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102746 - Compulsory Elective Module

Type	Credits	Recurrence	Version
Oral examination	5	Each term	1

Events					
WS 19/20	2161230	Mathématiques appliquées aux sciences de l'ingénieur	4 SWS	Lecture / Practice (VÜ)	Dantan
SS 2020	2161230	Mathématiques appliquées aux sciences de l'ingénieur	4 SWS	Lecture / Practice (VÜ)	Dantan

Competence Certificate
oral exam, 30 min.

Prerequisites
none

Below you will find excerpts from events related to this course:

V Mathématiques appliquées aux sciences de l'ingénieur

Lecture / Practice (VÜ)

2161230, WS 19/20, 4 SWS, Language: French, Open in study portal

Content
Courses are taught in French.

First block course at the KIT:
Basics of probability theory and Laplace transformation

Second block course at the Arts et Métiers ParisTech, centre Metz, France
Application of mathematics in the fields of functional safety of structural components, reliability of components and systems, vibrations and control systems.
A visit to an industry partner in the vicinity of Metz will be planned.

V Mathématiques appliquées aux sciences de l'ingénieur

Lecture / Practice (VÜ)

2161230, SS 2020, 4 SWS, Language: French, Open in study portal

Content
Courses are taught in French.

First block course at the KIT:
Basics of probability theory and Laplace transformation

Second block course at the Arts et Métiers ParisTech, centre Metz, France
Application of mathematics in the fields of functional safety of structural components, reliability of components and systems, vibrations and control systems.
A visit to an industry partner in the vicinity of Metz will be planned.

T 8.151 Course: Measurement II [T-MACH-105335]

Responsible: Prof. Dr.-Ing. Christoph Stiller
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102817 - Major Field: Information Technology
M-MACH-102820 - Major Field: Mechatronics

Type	Credits	Recurrence	Version
Written examination	4	Each summer term	1

Events					
SS 2020	2138326	Measurement II	2 SWS	Lecture (V)	Stiller, Wirth
Exams					
WS 19/20	76-T-MACH-105335	Measurement II		Prüfung (PR)	Stiller

Competence Certificate
written exam

60 min.

2 DIN A4 Self-created formular sheets allowed

Prerequisites
none

Below you will find excerpts from events related to this course:

V Measurement II

2138326, SS 2020, 2 SWS, Language: German, Open in study portal

Lecture (V)

Content
Lerninhalt (EN)

1. Amplifiers
2. Digital technology
3. Stochastic modeling for measurement applications
4. Estimation
5. Kalman Filter
6. Environmental perception

Lernziele (EN):

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.

Nachweis:

Written exam

60 minutes

Individual sheet of formulas

Arbeitsaufwand:

120 hours

Literature
Skript und Foliensatz zur Veranstaltung werden als kostenlose pdf-Dateien bereitgestellt. Weitere
Empfehlungen werden in der Vorlesung bekannt gegeben.

Idealerweise haben Sie zuvor 'Grundlagen der Mess- und Regelungstechnik' gehört oder verfügen aus einer Vorlesung anderer Fakultäten über grundlegende Kenntnisse der Mess- und Regelungstechnik und der Systemtheorie.

T 8.152 Course: Mechanical Design I & II [T-MACH-105286]

Responsible: Prof. Dr.-Ing. Albert Albers
Norbert Burkardt
Prof. Dr.-Ing. Sven Matthiesen

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102573 - Mechanical Design

Type	Credits	Recurrence	Version
Written examination	5	Each winter term	2

Events					
WS 19/20	2145178	Mechanical Design I	2 SWS	Lecture (V)	Albers, Matthiesen, Behrendt
WS 19/20	3145186	Mechanical Design I (Lecture)	2 SWS	Lecture (V)	Albers, Burkardt
SS 2020	2146178	Mechanical Design II	2 SWS	Lecture (V)	Albers, Matthiesen, Behrendt
SS 2020	3146017	Mechanical Design II Lecture	2 SWS	Lecture (V)	Albers, Burkardt
Exams					
WS 19/20	76T-MACH-105286	Mechanical Design I & II		Prüfung (PR)	Albers, Burkardt
WS 19/20	76T-MACH-105286_EN	Mechanical Design I & II (english)		Prüfung (PR)	Albers, Burkardt

Competence Certificate
written exam, graded, duration: 60 min

Prerequisites
Admission to the exam only with successful completion of the T-MACH-105282 - Mechanical Design I, prerequisites and T-MACH-105283 - Mechanical Design II, prerequisites.

Modeled Conditions
The following conditions have to be fulfilled:

1. The course T-MACH-105282 - Mechanical Design I, Prerequisites must have been passed.
2. The course T-MACH-105283 - Mechanical Design II, Prerequisites must have been passed.

Below you will find excerpts from events related to this course:

V Mechanical Design I

2145178, WS 19/20, 2 SWS, Language: German, Open in study portal

Lecture (V)

Literature
Vorlesungsumdruck:

Der Umdruck zur Vorlesung kann über die eLearning-Plattform Ilias bezogen werden.

Literatur:

Konstruktionselemente des Maschinenbaus - 1 und 2
Grundlagen der Berechnung und Gestaltung von Maschinenelementen;
Steinhilper, Sauer, Springer Verlag, ISBN 3-540-22033-X

oder Volltextzugriff über Uni-Katalog der Universitätsbibliothek

Grundlagen von Maschinenelementen für Antriebsaufgaben;
Steinhilper, Sauer, Springer Verlag, ISBN 3-540-29629-8

V **Mechanical Design I (Lecture)**
3145186, WS 19/20, 2 SWS, Language: English, Open in study portal **Lecture (V)**

Literature
Vorlesungsumdruck:

Der Umdruck zur Vorlesung kann über die eLearning-Plattform Ilias bezogen werden.

Literatur:

Konstruktionselemente des Maschinenbaus - 1 und 2
Grundlagen der Berechnung und Gestaltung von
Maschinenelementen;
Steinhilper, Sauer, Springer Verlag, ISBN 3-540-22033-X

oder Volltextzugriff über Uni-Katalog der Universitätsbibliothek

Grundlagen von Maschinenelementen für Antriebsaufgaben;
Steinhilper, Sauer, Springer Verlag, ISBN 3-540-29629-8

V **Mechanical Design II**
2146178, SS 2020, 2 SWS, Language: German, Open in study portal **Lecture (V)**

Content
Lecture content:

Bearings

Sealings

Design

Bolted Connections

Prerequisites

Concomitant to the lecture 2 online tests were carried out and the knowledge from the lecture will be tested. The knowledge from mechanical design I and II will further be controlled with a design and a CAD task.

Further information's will be announced at Ilias and at the beginning of the lecture mechanical design II.

Literature
Konstruktionselemente des Maschinenbaus - 1 und 2
Grundlagen der Berechnung und Gestaltung von
Maschinenelementen;
Steinhilper, Sauer, Springer Verlag, ISBN 3-540-22033-X

oder Volltextzugriff über Uni-Katalog der Universitätsbibliothek

Grundlagen von Maschinenelementen für Antriebsaufgaben;
Steinhilper, Sauer, Springer Verlag, ISBN 3-540-29629-8)

Vorlesungsumdruck:

Über die ILIAS-Plattform des RZ werden alle relevanten Inhalte (Folien zu Vorlesung und Saalübung, sowie Übungsblätter) entprechend den Vorlesungsblöcken gebündelt zur Verfügung gestellt.

V **Mechanical Design II Lecture**
3146017, SS 2020, 2 SWS, Language: English, Open in study portal **Lecture (V)**

Content
Bearings

Sealings

Design

Bolted Connections

Tutorials take place in concomitant to the lectures.

Prerequisites

Concomitant to the lecture 2 online tests were carried out and the knowledge from the lecture will be tested. The knowledge from mechanical design I and II will further be controlled with a design and a CAD task.

Further information's will be announced at Ilias and at the beginning of the lecture mechanical design II.

Literature
Konstruktionselemente des Maschinenbaus - 1 und 2
Grundlagen der Berechnung und Gestaltung von Maschinenelementen;
Steinhilper, Sauer, Springer Verlag, ISBN 3-540-22033-X

oder Volltextzugriff über Uni-Katalog der Universitätsbibliothek

Grundlagen von Maschinenelementen für Antriebsaufgaben;
Steinhilper, Sauer, Springer Verlag, ISBN 3-540-29629-8)

T 8.153 Course: Mechanical Design I, Prerequisites [T-MACH-105282]

Responsible: Prof. Dr.-Ing. Albert Albers
Prof. Dr.-Ing. Sven Matthiesen

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102573 - Mechanical Design

Type	Credits	Recurrence	Version
Completed coursework	1	Each winter term	2

Events					
WS 19/20	2145185	Tutorials Mechanical Design I	1 SWS	Practice (Ü)	Albers, Matthiesen, Behrendt, Mitarbeiter
WS 19/20	3145187	Mechanical Design I (Tutorial)	2 SWS	Practice (Ü)	Albers, Burkardt
Exams					
WS 19/20	76-T-MACH-105282	Mechanical Design I		Prüfung (PR)	Albers, Matthiesen

Competence Certificate
Concomitant to the lecture, a workshop with 3 workshop sessions takes place over the semester. During the workshop the students are divided into groups and their mechanical design knowledge will be tested during a colloquium at the beginning of every single workshop session. The attendance is mandatory and will be controlled. The pass of the colloquia and the process of the workshop task are required for the successful participation.

Furthermore an online test is carried out.

Prerequisites
none

Below you will find excerpts from events related to this course:

V Tutorials Mechanical Design I

2145185, WS 19/20, 1 SWS, Language: German, Open in study portal

Practice (Ü)

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)

V Mechanical Design I (Tutorial)

3145187, WS 19/20, 2 SWS, Language: English, Open in study portal

Practice (Ü)

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)

T 8.154 Course: Mechanical Design II, Prerequisites [T-MACH-105283]

Responsible: Prof. Dr.-Ing. Albert Albers
Prof. Dr.-Ing. Sven Matthiesen

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102573 - Mechanical Design

Type	Credits	Recurrence	Version
Completed coursework	1	Each summer term	2

Events					
SS 2020	2146185	Tutorials Mechanical Design II	2 SWS	Practice (Ü)	Albers, Matthiesen, Behrendt, Mitarbeiter
SS 2020	3146018	Mechanical Design II Tutorials	2 SWS	Practice (Ü)	Albers, Mitarbeiter
Exams					
WS 19/20	76-T-MACH-105283	Mechanical Design II		Prüfung (PR)	Albers, Burkardt

Competence Certificate
Concomitant to the lecture, 2 online tests are carried out and the knowledge from the lecture will be tested. The knowledge from mechanical design I and II will further be controlled with a design and a CAD task.

Prerequisites
None

Below you will find excerpts from events related to this course:

V Tutorials Mechanical Design II
2146185, SS 2020, 2 SWS, Language: German, Open in study portal

Practice (Ü)

Content
Bearings

Sealings

Desing

Bolted connections

tutorials: 10,5 h

prerequisites and preparation to exam: 55 h

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)

V Mechanical Design II Tutorials
3146018, SS 2020, 2 SWS, Language: English, Open in study portal

Practice (Ü)

Content

Bearings

Sealings

Design

Bolted Connections

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)

8.155 Course: Mechanical Design III & IV [T-MACH-104810]

Responsible: Prof. Dr.-Ing. Albert Albers
Norbert Burkardt
Prof. Dr.-Ing. Sven Matthiesen

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102573 - Mechanical Design

Type	Credits	Recurrence	Version
Written examination	13	Each winter term	2

Events					
WS 19/20	2145151	Mechanical Design III	2 SWS	Lecture (V)	Albers, Matthiesen, Mitarbeiter
WS 19/20	3145016	Mechanical Design III (Lecture)	2 SWS	Lecture (V)	Albers, Burkardt
SS 2020	2146177	Mechanical Design IV	2 SWS	Lecture (V)	Albers, Matthiesen
SS 2020	3146020	Mechanical Design IV Lecture	2 SWS	Lecture (V)	Albers, Burkardt
Exams					
WS 19/20	76-T-MACH-104810	Mechanical Design III & IV		Prüfung (PR)	Albers, Burkardt
WS 19/20	76T-MACH-104810_EN	Mechanical Design III & IV (english)		Prüfung (PR)	Albers, Burkardt

Competence Certificate
written exam consisting of:

- written part duration 60 min and
- design part duration 180 min

Sum: 240 min

Prerequisites
Admission to the exam only with successful completion of the T-MACH-105284 - Mechanical Design III, Constructing the Team and T-MACH-105285 - Mechanical Design IV, Constructing the Team.

Modeled Conditions
You have to fulfill one of 2 conditions:

1. The course T-MACH-105284 - Mechanical Design III, Constructing the Team must have been passed.
2. The course T-MACH-105285 - Mechanical Design IV, Constructing the Team must have been passed.

Below you will find excerpts from events related to this course:

V Mechanical Design III

2145151, WS 19/20, 2 SWS, Language: German, Open in study portal

Lecture (V)

Literature
Vorlesungsumdruck:

Der Umdruck zur Vorlesung kann über die eLearning-Plattform Ilias bezogen werden.

Literatur:

Konstruktionselemente des Maschinenbaus - 1 und 2
Grundlagen der Berechnung und Gestaltung von
Maschinenelementen;
Steinhilper, Sauer, Springer Verlag, ISBN 3-540-22033-X

oder Volltextzugriff über Uni-Katalog der Universitätsbibliothek

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)

V **Mechanical Design III (Lecture)** **Lecture (V)**
3145016, WS 19/20, 2 SWS, Language: English, Open in study portal

Literature
Vorlesungsumdruck:

Der Umdruck zur Vorlesung kann über die eLearning-Plattform Ilias bezogen werden.

Literatur:

Konstruktionselemente des Maschinenbaus - 1 und 2
Grundlagen der Berechnung und Gestaltung von
Maschinenelementen;
Steinhilper, Sauer, Springer Verlag, ISBN 3-540-22033-X

oder Volltextzugriff über Uni-Katalog der Universitätsbibliothek

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)

T 8.156 Course: Mechanical Design III, Constructing the Team [T-MACH-105284]

Responsible: Prof. Dr.-Ing. Albert Albers
Prof. Dr.-Ing. Sven Matthiesen

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102573 - Mechanical Design

Type	Credits	Recurrence	Version
Completed coursework	0	Each winter term	2

Events					
WS 19/20	2145153	Tutorials Mechanical Design III	2 SWS	Practice (Ü)	Albers, Matthiesen, Mitarbeiter
WS 19/20	2145154	Mechanical Design III Workshop	1 SWS	Practical course (P)	Albers, Matthiesen, Albers Assistenten
WS 19/20	3145017	Mechanical Design III (Tutorial)	2 SWS	Practice (Ü)	Albers, Burkardt
WS 19/20	3145018	Mechanical Design III (Workshop)	SWS		Albers, Burkardt
Exams					
WS 19/20	76-T-MACH-105284	Mechanical Design III, Constructing with Team		Prüfung (PR)	Albers, Burkardt, Matthiesen

Competence Certificate
Concomitant to the lecture, a workshop with 3 workshop sessions takes place over the semester. During the workshop the students are divided into groups and their mechanical design knowledge will be tested during a colloquium at the beginning of every single CAD-workshop session. The attendance is mandatory and will be controlled. The pass of the colloquia and the process of the workshop task are required for the successful participation.

Prerequisites
None

Below you will find excerpts from events related to this course:

V Tutorials Mechanical Design III

2145153, WS 19/20, 2 SWS, Language: German, Open in study portal

Practice (Ü)

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)

V Mechanical Design III Workshop

2145154, WS 19/20, 1 SWS, Open in study portal

Practical course (P)

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)

V **Mechanical Design III (Tutorial)** **Practice (Ü)**
3145017, WS 19/20, 2 SWS, Language: English, Open in study portal

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)

V **Mechanical Design III (Workshop)**
3145018, WS 19/20, SWS, Language: English, Open in study portal

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)

T 8.157 Course: Mechanical Design IV, Constructing the Team [T-MACH-105285]

Responsible: Prof. Dr.-Ing. Albert Albers
Prof. Dr.-Ing. Sven Matthiesen

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102573 - Mechanical Design

Type	Credits	Recurrence	Version
Completed coursework	0	Each summer term	2

Events					
SS 2020	2146184	Tutorials Mechanical Design IV	2 SWS	Practice (Ü)	Albers, Matthiesen, Mitarbeiter
SS 2020	2146187	Workshop 'Mechanical Design IV'	1 SWS		Albers, Matthiesen, Mitarbeiter
SS 2020	3146021	Mechanical Design IV Tutorials	1 SWS	Practice (Ü)	Albers, Mitarbeiter
SS 2020	3146022	Mechanical Design IV Workshop	1 SWS		Albers, Mitarbeiter

Competence Certificate
Concomitant to the lecture, a workshop with 3 workshop sessions takes place over the semester. During the workshop the students are divided into groups and their mechanical design knowledge will be tested during a colloquium at the beginning of every single workshop session. The attendance is mandatory and will be controlled. The pass of the colloquia and the process of the workshop task are required for the successful participation.

Prerequisites
None

Below you will find excerpts from events related to this course:

V Mechanical Design IV Tutorials

3146021, SS 2020, 1 SWS, Language: English, Open in study portal

Practice (Ü)

Content
Basic connections - part 2

- Coupling fundamentals
- Dimensioning fundamentals
- Hydraulic fundamentals

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)

V Mechanical Design IV Workshop

3146022, SS 2020, 1 SWS, Language: English, Open in study portal

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

The students are able to develop technical solutions in a team, to implement their ideas in technical solutions and to illustrate their own working- and decision process by using protocols and diagrams.

The students are able to:

- choose and design a functional clutch system.
- apply and conduct a stress analysis.
- design simple hydraulic facilities.
- make technical drawings.
- construct CAD- models with regard to the top-down method.

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)

T 8.158 Course: Mechanics and Strength of Polymers [T-MACH-105333]

Responsible: Prof. Dr.-Ing. Bernd-Steffen von Bernstorff
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102819 - Major Field: Materials Science and Engineering

Type	Credits	Recurrence	Version
Oral examination	4	Each winter term	2

Events					
WS 19/20	2173580	Mechanics and Strengths of Polymers	2 SWS	Lecture (V)	von Bernstorff
Exams					
WS 19/20	76-T-MACH-105333	Mechanics and Strengths of Polymers		Prüfung (PR)	von Bernstorff

Competence Certificate
Oral exam, about 25 minutes

Prerequisites
none

Recommendation
Basic knowledge in materials science (e.g. lecture materials science I and II)

Below you will find excerpts from events related to this course:

V Mechanics and Strengths of Polymers

2173580, WS 19/20, 2 SWS, Language: German, Open in study portal

Lecture (V)

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

learning objectives:

The students are prepared to

- repeat the calculus on strength and design of engineering parts exposed to complex loadings,
- estimate the influence of time and temperature on the strength of polymeric materials,
- relate the strength of materials to their molecular structure, morphology and processing parameters and
- derive failure mechanisms for homogenuous polymers and composite materials therefrom.

requirements:
basic knowledge in materials science (e.g. lecture materials science I and II)

workload:

The workload for the lecture Mechanics and Strengths of Polymers is 120 h per semester and consists of the presence during the lecture (28 h) as well as preparation and rework time at home (92 h).

Literature
Literaturliste, spezielle Unterlagen und ein Teilmanuskript werden in der Vorlesung ausgegeben

T 8.159 Course: Mechanics in Microtechnology [T-MACH-105334]

Responsible: Dr. Christian Greiner
Dr. Patric Gruber

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102820 - Major Field: Mechatronics

Type	Credits	Recurrence	Version
Oral examination	4	Each winter term	1

Events					
WS 19/20	2181710	Mechanics in Microtechnology	2 SWS	Lecture (V)	Gruber, Greiner
Exams					
WS 19/20	76-T-MACH-105334	Mechanics in Microtechnology		Prüfung (PR)	Gruber
WS 19/20	76-T-MACH-105334-W	Mechanics in Microtechnology		Prüfung (PR)	Gruber

Competence Certificate
Oral examination, ca. 30 min

Prerequisites
none

Below you will find excerpts from events related to this course:

V Mechanics in Microtechnology

2181710, WS 19/20, 2 SWS, Language: German, Open in study portal

Lecture (V)

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,…

The students know and understand size and scaling effects in micro- and nanosystems. They understand the impact of mechanical phenomena in small dimensions. Based on this they can judge how they determine material processing as well as working principles and design of microsensors and microactuators.

regular attendance: 22,5 hours
self-study: 97,5 hours

oral exam ca. 30 minutes

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

8.160 Course: Metallographic Lab Class [T-MACH-105447]

Responsible: Ulla Hauf
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102819 - Major Field: Materials Science and Engineering

Type	Credits	Recurrence	Version
Completed coursework	4	Each term	2

Events					
WS 19/20	2175590	Metallographic Lab Class	3 SWS	Practical course (P)	Mühl
SS 2020	2175590	Metallographic Lab Class	3 SWS	Practical course (P)	Mühl
Exams					
WS 19/20	76-T-MACH-105447	Metallographic Lab Class		Prüfung (PR)	Heilmaier

Competence Certificate
Colloquium for every experiment, about 60 minutes, protocol

Prerequisites
M-MACH-102562 - Materials Science must be passed.

Modeled Conditions
The following conditions have to be fulfilled:

1. The module M-MACH-102562 - Materials Science must have been passed.

Below you will find excerpts from events related to this course:

Metallographic Lab Class

2175590, WS 19/20, 3 SWS, Language: German, Open in study portal

Practical course (P)

Content
Light microscope in metallography

metallographic sections of metallic materials

Investigation of the microstructure of unalloyed steels and cast iron

Microstructure development of steels with accelerated cooling from the austenite area

Investigation of microstructures of alloyed steels

Investigation of failures quantitative microstructural analysis

Microstructural investigation of technically relevant non-ferrous metals

Application of Scanning electron microscope

learning objectives:
The students in this lab class gain are able to perform standard metallographic preparations and are able to apply standard software for quantitative microstructural analyses. Based on this the student can interpret unetched as well as etched microstructures with respect to relevant microstructural features. They can draw concluding correlations between heat treatments, ensuing microstructures and the resulting mechanical as well as physical properties of the investigated materials.

requirements:
Material Science I/II

workload:

The workload for the Metallographic Lab Class is 120 h per semester and consists of the presence during the lab course (25 h) as well as preparation and rework time at home (95 h).

Literature
Macherauch, E.: Praktikum in Werkstoffkunde, 10. Aufl., 1992

Schumann, H.: Metallographie, 13. Aufl., Deutscher Verlag für Grundstoffindustrie, 1991

Literaturliste wird zu jedem Versuch ausgegeben

V **Metallographic Lab Class** **Practical course (P)**
2175590, SS 2020, 3 SWS, Language: German, Open in study portal

Content

learning objectives:

requirements:

workload:

Literature
Macherauch, E.: Praktikum in Werkstoffkunde, 10. Aufl., 1992

Schumann, H.: Metallographie, 13. Aufl., Deutscher Verlag für Grundstoffindustrie, 1991

Literaturliste wird zu jedem Versuch ausgegeben

T 8.161 Course: Micro- and Nanosystem Integration for Medical, Fluidic and Optical Applications [T-MACH-108809]

Responsible: Dr. Ulrich Gengenbach
Prof. Dr. Veit Hagenmeyer
Dr. Liane Koker
PD Dr.-Ing. Ingo Sieber

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102820 - Major Field: Mechatronics

Type	Credits	Recurrence	Version
Oral examination	4	Each winter term	1

Events					
WS 19/20	2105032	Micro- and nanosystem integration for medical, fluidic and optical applications	2 SWS	Lecture (V)	Koker, Gengenbach, Sieber
Exams					
WS 19/20	76-T-MACH-108809	Micro- and nanosystem integration for medical, fluidic and optical applications		Prüfung (PR)	Gengenbach, Koker

Competence Certificate
Oral exam (Duration: 30min)

Prerequisites
T-MACH-105695 "Selected topics of system integration for micro- and nanotechnology" must not be started.

Below you will find excerpts from events related to this course:

V Micro- and nanosystem integration for medical, fluidic and optical applications — Lecture (V)
2105032, WS 19/20, 2 SWS, Language: German, Open in study portal

Content
Content:

- Introduction to the role of system integration in the product development process
- Simplistic modeling and use of analogies in system design
- Introduction to modeling and simulation in system design
- Mechanics simulation
- Optics simulation
- Fluidics simulation
- Coupling of simulation tools
- Requirements for system integration of active implants
- Design of active implants
- Approaches to system integration of active implants
- Test methods (hermeticity, accelerated aging etc.)
- Micro-optical subsystems
- Micro-fluidic subsystems
- Self-assembly as integration process at micro and nano scale

Learning objectives:

The students …:

- have a fundamental understanding of modeling using analogies
- know the basics of modeling and simulation in design of mechanical, optical, and fluidic subsystems
- can assess the need for inter-domain simulations
- understand the challenges in the design of active implants
- have an overview of different active implants and their applications
- know approaches to system integration and packaging of active implants
- are familiar with different methods of testing with the focus on hermeticity
- have an overview of processes for the integration of micro-optical and micro-fluidic subsystems
- gain insight into technical applications of self-assembly processes

T 8.162 Course: Microenergy Technologies [T-MACH-105557]

Responsible: Prof. Dr. Manfred Kohl
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102816 - Major Field: Fundamentals of Energy Technology
M-MACH-102820 - Major Field: Mechatronics

Type	Credits	Recurrence	Version
Oral examination	4	Each summer term	1

Events					
SS 2020	2142897	Microenergy Technologies	2 SWS	Lecture (V)	Kohl
Exams					
WS 19/20	76-T-MACH-105557	Microenergy Technologies		Prüfung (PR)	Kohl

Competence Certificate
Oral examination (30 Min.)

Prerequisites
none

Below you will find excerpts from events related to this course:

V Microenergy Technologies — Lecture (V)
2142897, SS 2020, 2 SWS, Language: English, Open in study portal

Content
- Basic physical principles of energy conversion
- Layout and design optimization
- Technologies
- Selected devices
- Applications

The lecture includes amongst others the following topics:

Micro energy harvesting of vibrations

Thermal micro energy harvesting

Microtechnical applications of energy harvesting

Heat pumps in micro technology

Micro cooling

Literature
- Folienskript "Micro Energy Technologies"
- Stephen Beeby, Neil White, Energy Harvesting for Autonomous Systems, Artech House, 2010
- Shashank Priya, Daniel J. Inman, Energy Harvesting Technologies, Springer, 2009

T 8.163 Course: Modelling and Simulation [T-MACH-100300]

Responsible: Prof. Dr. Peter Gumbsch
Prof. Dr. Britta Nestler

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102746 - Compulsory Elective Module

Type	Credits	Recurrence	Version
Written examination	5	Each term	2

Events					
WS 19/20	2183703	Numerical methods and simulation techniques	3 SWS	Lecture / Practice (VÜ)	Nestler
SS 2020	2183703	Modelling and Simulation	2+1 SWS	Lecture / Practice (VÜ)	Nestler
Exams					
WS 19/20	76-T-MACH-100300	Modelling and Simulation		Prüfung (PR)	Nestler

Competence Certificate
Written exam, 90 min

Prerequisites
none

Recommendation
preliminary knowlegde in mathematics, physics and materials science

Below you will find excerpts from events related to this course:

V Numerical methods and simulation techniques

Lecture / Practice (VÜ)

2183703, WS 19/20, 3 SWS, Language: German, Open in study portal

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

The student can

- explain the basic algorithms and numerical methods which are beside other applications relevant for materials simulations.
- describe and apply numerical solution methods for partial differential equations and dynamical systems
- apply numerical methods to solve heat and mass diffusion problems which can also be used to model microstructure formation processes
- has experiences in how to implement and program the introduced numerical methods from an integrated computer lab.

preliminary knowlegde in mathematics, physics and materials science recommended

regular attendance: 22,5 hours lecture, 11,5 hours exercises
self-study: 116 hours

We regularly hand out exercise sheets. In addition, the course will be accompanied by practical exercises at the computer.

written examination: 90 minutes

Literature

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

V Modelling and Simulation

2183703, SS 2020, 2+1 SWS, Language: German, Open in study portal

Lecture / Practice (VÜ)

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

The student can

- explain the basic algorithms and numerical methods which are beside other applications relevant for materials simulations.
- describe and apply numerical solution methods for partial differential equations and dynamical systems
- apply numerical methods to solve heat and mass diffusion problems which can also be used to model microstructure formation processes
- has experiences in how to implement and program the introduced numerical methods from an integrated computer lab.

preliminary knowlegde in mathematics, physics and materials science recommended

regular attendance: 22,5 hours lecture, 11,5 hours exercises
self-study: 116 hours

We regularly hand out exercise sheets. In addition, the course will be accompanied by practical exercises at the computer.

written examination: 90 minutes

Literature

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

T 8.164 Course: Modelling of Microstructures [T-MACH-105303]

Responsible: Dr. Anastasia August
Prof. Dr. Britta Nestler

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102746 - Compulsory Elective Module
M-MACH-102819 - Major Field: Materials Science and Engineering

Type	Credits	Recurrence	Version
Oral examination	5	Each winter term	2

Events					
WS 19/20	2183702	Modelling of Microstructures	3 SWS	Lecture / Practice (VÜ)	August, Nestler
Exams					
WS 19/20	76-T-MACH-105303	Modelling of Microstructures		Prüfung (PR)	August, Nestler, Weygand

Competence Certificate
oral exam 30 min

Prerequisites
none

Recommendation
materials science
fundamental mathematics

Below you will find excerpts from events related to this course:

V Modelling of Microstructures

2183702, WS 19/20, 3 SWS, Language: German, Open in study portal

Lecture / Practice (VÜ)

Content

- Brief Introduction in thermodynamics
- Statistical interpretation of entropy
- Gibbs free energy and phase diagrams
- Free energy functional
- Phasefield equation
- Gibbs-Thomson-equation
- Driving forces
- Grand chemical potential functional and the evolution equations
- For compare: Free energy functional with driving forces

The student can

- explain the thermodynamic and statistical foundations for liquid-solid and solid-solid phase transition processes and apply them to construct phase diagrams.
- describe the specific characteristics of dendritic, eutectic and peritectic microstructures.
- explain the mechanisms of grain and phase boundary motion induced by external fields
- use the phase-field method for simulation of microstructure formation processes using modeling approaches and challenges of current research
- has experiences in computing and conduction simulations of microstructure formation from an integrated computer lab.

knowledge in materials science and in fundamental mathematics recommended

regular attendance: 22,5 hours lecture, 11,5 hours exercises
self-study: 116 hours

We regularly hand out exercise sheets. The individual solutions will be corrected.

oral exam ca. 30 min

Literature

1. Gottstein, G. (2007) Physikalische Grundlagen der Materialkunde. Springer Verlag Berlin Heidelberg
2. Kurz, W. and Fischer, D. (1998) Fundamentals of Solidification. Trans Tech Publications ltd, Switzerland Germany UK USA
3. Porter, D.A. Eastering, K.E. and Sherif, M.Y. (2009) Phase transformation in metals and alloys (third edition). CRC Press, Taylor & Francis Group, Boca Raton, London, New York
4. Gaskell, D.R., Introduction to the thermodynamics of materials
5. Übungsblätter

8.165 Course: Modern Control Concepts I [T-MACH-105539]

Responsible: Dr. Lutz Groell
PD Dr.-Ing. Jörg Matthes

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102820 - Major Field: Mechatronics

Type	Credits	Recurrence	Version
Written examination	4	Each summer term	1

Events					
SS 2020	2105024	Modern Control Concepts I	2 SWS	Lecture (V)	Matthes, Groell
Exams					
WS 19/20	76-T-MACH-105539	Modern Control Concepts I		Prüfung (PR)	Matthes

Competence Certificate
Written exam (Duration: 1 h)

Prerequisites
none

Below you will find excerpts from events related to this course:

Modern Control Concepts I

2105024, SS 2020, 2 SWS, Language: German, Open in study portal

Lecture (V)

Literature

- Aström, K.-J., Murray, R.M.: Feedback Systems, 2012
- Rugh, W.: Linear System Theory. Prentice Hall, 1996

T 8.166 Course: Novel Actuators and Sensors [T-MACH-102152]

Responsible: Prof. Dr. Manfred Kohl
Dr. Martin Sommer

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102812 - Major Field: Powertrain Systems
M-MACH-102820 - Major Field: Mechatronics

Type	Credits	Recurrence	Version
Written examination	4	Each winter term	3

Events					
WS 19/20	2141865	Novel actuators and sensors	2 SWS	Lecture (V)	Kohl, Sommer
Exams					
WS 19/20	76-T-MACH-102152	Novel Actuators and Sensors		Prüfung (PR)	Kohl, Sommer

Competence Certificate
written exam, 60 minutes

Prerequisites
none

Below you will find excerpts from events related to this course:

V Novel actuators and sensors

2141865, WS 19/20, 2 SWS, Language: German, Open in study portal

Lecture (V)

Literature

- Vorlesungsskript "Neue Aktoren" und Folienskript "Sensoren"
- Donald J. Leo, Engineering Analysis of Smart Material Systems, John Wiley & Sons, Inc., 2007
- "Sensors Update", Edited by H.Baltes, W. Göpel, J. Hesse, VCH, 1996, ISBN: 3-527-29432-5
- "Multivariate Datenanalyse – Methodik und Anwendungen in der Chemie", R. Henrion, G. Henrion, Springer 1994, ISBN 3-540-58188-X

T 8.167 Course: Numerical Fluid Mechanics [T-MACH-105338]

Responsible: Dr.-Ing. Franco Magagnato
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102816 - Major Field: Fundamentals of Energy Technology
M-MACH-102838 - Major Field: Energy Converting Engines

Type	Credits	Recurrence	Version
Oral examination	4	Each winter term	2

Events					
WS 19/20	2153441	Numerical Fluid Mechanics	2 SWS	Lecture (V)	Magagnato
Exams					
WS 19/20	76T-Mach-105338	Numerical Fluid Mechanics		Prüfung (PR)	Frohnapfel, Magagnato

Competence Certificate
oral exam - 30 minutes

Prerequisites
none

Below you will find excerpts from events related to this course:

V Numerical Fluid Mechanics

2153441, WS 19/20, 2 SWS, Language: German, Open in study portal

Lecture (V)

Content
The students can describe the modern numerical simulation methods for fluid flows and can explain their relevance for industrial projects. They can choose appropriate boundary and initial conditions as well as turbulence models. They are qualified to explain the meaning of suitable meshes for processed examples. Convergence acceleration techniques like multi grid, implicit methods etc. as well as the applicability of these methods to parallel and vector computing can be described by the students. They can identify problems that occur during application of these methods and can discuss strategies to avoid them. The students are qualified to apply commercial codes like Fluent, Star-CD, CFX etc. as well as the research code SPARC. They can describe the differences between conventional methods (RANS) and more advanced approaches like Large Eddy Simulation (LES) and Direct Numerical Simulation (DNS).

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

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

T 8.168 Course: Photovoltaics [T-ETIT-101939]

Responsible: Prof. Dr.-Ing. Michael Powalla
Organisation: KIT Department of Electrical Engineering and Information Technology
Part of: M-MACH-102816 - Major Field: Fundamentals of Energy Technology

Type	Credits	Recurrence	Version
Written examination	6	Each summer term	2

Events					
SS 2020	2313737	Photovoltaics	4 SWS	Lecture (V)	Powalla, Lemmer
Exams					
WS 19/20	7313737	Photovoltaics		Prüfung (PR)	Powalla, Lemmer

Prerequisites
"M-ETIT-100524 - Solar Energy" must not have started.

T 8.169 Course: Physical and Chemical Principles of Nuclear Energy in View of Reactor Accidents and Back-End of Nuclear Fuel Cycle [T-MACH-105537]

Responsible: Dr. Ron Dagan
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102816 - Major Field: Fundamentals of Energy Technology

Type	Credits	Recurrence	Version
Oral examination	4	Each winter term	3

Events					
WS 19/20	2189906	Physical and chemical principles of nuclear energy in view of reactor accidents and back-end of nuclear fuel cycle	1 SWS	Lecture (V)	Dagan
Exams					
WS 19/20	76-T-MACH-105537	Physical and Chemical Principles of Nuclear Energy in View of Reactor Accidents and Back-End of Nuclear Fuel Cycle		Prüfung (PR)	Dagan, Stieglitz
SS 2020	76-T-MACH-105537	Physical and Chemical Principles of Nuclear Energy in View of Reactor Accidents and Back-End of Nuclear Fuel Cycle		Prüfung (PR)	Dagan

Competence Certificate
oral exam, 30 min.

Prerequisites
none

Below you will find excerpts from events related to this course:

V Physical and chemical principles of nuclear energy in view of reactor accidents and back-end of nuclear fuel cycle

Lecture (V)

2189906, WS 19/20, 1 SWS, Language: German, Open in study portal

Content

- Relevant physical terms of nuclear physics
- Decay heat removal- Borst-Wheeler equation
- The accidents in TMI- Three Mile Island, and Fukushima .
- Fission , chain reaction and reactor control systems
- Basics of nuclear cross sections
- Principles of reactor dynamics
- Reactor poisoning
- The Idaho and Chernobyl accidents
- Principles of the nuclear fuel cycle
- Reprocessing of irradiated fuel elements and vitrification of fission product solutions
- Interim storage of nuclear residues in surface facilities
- Multi barrier concepts for final disposal in deep geological formations
- The situation in the repositories Asse II, Konrad and Morsleben

The students

- understand the physical explanations of the known nuclear accidents
- can perform simplified calculations to demonstrate the accidents outcome.
- Define safety relevant properties of low/ intermediate / high level waste products
- Are able to evaluate principles and implications of reprocessing, storage and disposal options for nuclear waste.

Regular attendance: 14 h
self study 46 h
oral exam about 20 min.

Literature

AEA öffentliche Dokumentation zu den nukleare Ereignissen

K. Wirtz: Grundlagen der Reaktortechnik Teil I, II, Technische Hochschule Karlsruhe 1966

D. Emendorfer. K.H. Höcker: Theorie der Kernreaktoren, Teil I, II BI- Hochschultaschenbücher 1969

J. Duderstadt and L. Hamilton: Nuclear reactor Analysis, J. Wiley $ Sons , Inc. 1975 (in Englisch)

R.C. Ewing: The nuclear fuel cycle: a role for mineralogy and geochemistry. Elements vol. 2, p.331-339, 2006 (in Englisch)

J. Bruno, R.C. Ewing: Spent nuclear fuel. Elements vol. 2, p.343-349, 2006 (in Englisch)

T 8.170 Course: Physical Basics of Laser Technology [T-MACH-102102]

Responsible: Dr.-Ing. Johannes Schneider
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102746 - Compulsory Elective Module

Type	Credits	Recurrence	Version
Oral examination	5	Each winter term	3

Events					
WS 19/20	2181612	Physical basics of laser technology	3 SWS	Lecture / Practice (VÜ)	Schneider
Exams					
WS 19/20	76-T-MACH-102102	Physical Basics of Laser Technology		Prüfung (PR)	Schneider
SS 2020	76-T-MACH-102102	Physical Basics of Laser Technology		Prüfung (PR)	Schneider

Competence Certificate
oral examination (30 min)

no tools or reference materials

Prerequisites
It is not possible, to combine this brick with brick Laser Application in Automotive Engineering [T-MACH-105164] and brick Physical Basics of Laser Technology [T-MACH-109084]

Modeled Conditions
The following conditions have to be fulfilled:

1. The course T-MACH-105164 - Laser in Automotive Engineering must not have been started.

Recommendation
Basic knowledge of physics, chemistry and material science

Below you will find excerpts from events related to this course:

V Physical basics of laser technology

2181612, WS 19/20, 3 SWS, Language: German, Open in study portal

Lecture / Practice (VÜ)

Content
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 focuses 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) will be offered.

- 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

The lecture is complemented by a tutorial.

The student

- can explain the principles of light generation, the conditions for light amplification as well as the basic structure and function of different laser sources.
- can describe the influence of laser, material and process parameters for the most important methods of laser-based materials processing and choose laser sources suitable for specific applications.
- can illustrate the possible applications of laser sources in measurement and medicine technology
- can explain the requirements for safe handling of laser radiation and for the design of safe laser systems.

Basic knowledge of physics, chemistry and material science is assumed.

regular attendance: 33,5 hours
self-study: 116,5 hours

The assessment consists of an oral exam (ca. 30 min) taking place at the agreed date (according to Section 4(2), 2 of the examination regulation). The re-examination is offered upon agreement.

It is allowed to select only one of the lectures "Laser in automotive engineering" (2182642) or "Physical basics of laser technology" (2181612) during the Bachelor and Master studies.

Literature
F. K. Kneubühl, M. W. Sigrist: Laser, 2008, Vieweg+Teubner

T. Graf: Laser - Grundlagen der Laserstrahlquellen, 2009, Vieweg-Teubner Verlag

R. Poprawe: Lasertechnik für die Fertigung, 2005, Springer

H. Hügel, T. Graf: Laser in der Fertigung, 2009, Vieweg+Teubner

J. Eichler, H.-J. Eichler: Laser - Bauformen, Strahlführung, Anwendungen, 2006, Springer

W. T. Silfvast: Laser Fundamentals, 2008, Cambridge University Press

W. M. Steen: Laser Material Processing, 2010, Springer

T 8.171 Course: Physics for Engineers [T-MACH-100530]

Responsible: Prof. Dr. Martin Dienwiebel
Prof. Dr. Peter Gumbsch
Prof. Dr. Alexander Nesterov-Müller
Dr. Daniel Weygand

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102746 - Compulsory Elective Module

Type	Credits	Recurrence	Version
Written examination	5	Each summer term	1

Events					
SS 2020	2142890	Physics for Engineers	2 SWS	Lecture (V)	Weygand, Dienwiebel, Nesterov-Müller, Gumbsch
Exams					
WS 19/20	76-T-MACH-100530	Physics for Engineers		Prüfung (PR)	Gumbsch, Dienwiebel, Nesterov-Müller, Weygand

Competence Certificate
written exam 90 min

Prerequisites
none

Below you will find excerpts from events related to this course:

V Physics for Engineers

2142890, SS 2020, 2 SWS, Language: German, Open in study portal

Lecture (V)

Content
1) Foundations of solid state physics

- Wave particle dualism
- Tunnelling
- Schrödinger equation
- H-atom

2) Electrical conductivity of solids

- solid state: periodic potentials
- Pauli Principle
- band structure
- metals, semiconductors and isolators
- p-n junction / diode

3) Optics

- quantum mechanical principles of the laser
- linear optics
- non-linear optics

Exercises (2142891, 2 SWS) are used for complementing and deepening the contents of the lecture as well as for answering more extensive questions raised by the students and for testing progress in learning of the topics.

The student

- has the basic understanding of the physical foundations to explain the relationship between the quantum mechanical principles and the optical as well as electrical properties of materials
- can describe the fundamental experiments, which allow the illustration of these principles

regular attendance: 22,5 hours (lecture) and 22,5 hours (excerises 2142891)
self-study: 97,5 hours and 49 hours (excerises 2142891)

The assessment consists of a written exam (90 minutes) (following §4(2), 1 of the examination regulation).

Literature

- Tipler und Mosca: Physik für Wissenschaftler und Ingenieure, Elsevier, 2004
- Haken und Wolf: Atom- und Quantenphysik. Einführung in die experimentellen und theoretischen Grundlagen, 7. Aufl., Springer, 2000
- Harris, Moderne Physik, Pearson Verlag, 2013

T 8.172 Course: PLM for Product Development in Mechatronics [T-MACH-102181]

Responsible: Prof. Dr.-Ing. Martin Eigner
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102583 - Major Field: Information Management

Type	Credits	Recurrence	Version
Oral examination	4	Each summer term	1

Events					
WS 19/20	2122376	PLM for product development in mechatronics	SWS	Lecture (V)	Eigner
SS 2020	2122376	PLM for product development in mechatronics	SWS	Lecture (V)	Eigner
Exams					
WS 19/20	76-T-MACH-102181	PLM for Product Development in Mechatronics		Prüfung (PR)	Eigner

Competence Certificate
Oral examination 20 min.

Prerequisites
none

Below you will find excerpts from events related to this course:

V PLM for product development in mechatronics

Lecture (V)

2122376, WS 19/20, SWS, Language: German, Open in study portal

Content
Students are able to

- compare product data management and product lifecycle management.
- describe the components and core functions of a PLM solution
- explain trends from research and practice in the field of PLM form mechatronic product development

Literature
Vorlesungsfolien / lecture slides

V PLM for product development in mechatronics

Lecture (V)

2122376, SS 2020, SWS, Language: German, Open in study portal

Content
Students are able to

- compare product data management and product lifecycle management.
- describe the components and core functions of a PLM solution
- explain trends from research and practice in the field of PLM form mechatronic product development

Literature
Vorlesungsfolien / lecture slides

T 8.173 Course: PLM-CAD Workshop [T-MACH-102153]

Responsible: Prof. Dr.-Ing. Jivka Ovtcharova
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102583 - Major Field: Information Management

Type	Credits	Recurrence	Version
Examination of another type	4	Each term	2

Events					
WS 19/20	2121357	PLM-CAD Workshop	4 SWS	Project (PRO)	Ovtcharova, Mitarbeiter
SS 2020	2121357	PLM-CAD Workshop	4 SWS	Project (PRO)	Ovtcharova, Mitarbeiter
Exams					
WS 19/20	76-T-MACH-102153	PLM-CAD Workshop		Prüfung (PR)	Ovtcharova

Competence Certificate
Alternative exam assessment (graded)

Prerequisites
None

Annotation
Number of participants is limited, compulsory attendance

Below you will find excerpts from events related to this course:

V PLM-CAD Workshop

2121357, WS 19/20, 4 SWS, Language: German, Open in study portal

Project (PRO)

Content
The aim of the workshop is to demonstrate the benefits of collaborative product development using PLM methods and to emphasize their added value compared to classical CAD development.

Students learn how to develop and produce a prototype with the help of modern PLM and CAx systems.

Literature
Workshop-Unterlagen / workshop materials

V PLM-CAD Workshop

2121357, SS 2020, 4 SWS, Language: German, Open in study portal

Project (PRO)

Content
The aim of the workshop is to demonstrate the benefits of collaborative product development using PLM methods and to emphasize their added value compared to classical CAD development.

Students learn how to develop and produce a prototype with the help of modern PLM and CAx systems.

Literature
Workshop-Unterlagen / workshop materials

T 8.174 Course: Polymer Engineering I [T-MACH-102137]

Responsible: Prof. Dr.-Ing. Peter Elsner
Dr.-Ing. Wilfried Liebig

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102819 - Major Field: Materials Science and Engineering

Type	Credits	Recurrence	Version
Oral examination	4	Each winter term	1

Events					
WS 19/20	2173590	Polymer Engineering I	2 SWS	Lecture (V)	Elsner, Liebig
Exams					
WS 19/20	76-T-MACH-102137	Polymer Engineering I		Prüfung (PR)	Elsner
SS 2020	76-T-MACH-102137	Polymer Engineering I		Prüfung (PR)	Elsner, Liebig

Competence Certificate
Oral exam, about 25 minutes

Prerequisites
none

Below you will find excerpts from events related to this course:

V Polymer Engineering I

2173590, WS 19/20, 2 SWS, Language: German, Open in study portal

Lecture (V)

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

learning objectives:

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.

The students

- are able to describe and classify polymers
  based on the fundamental synthesis processing techniques
- can find practical applications for state-of-the-art polymers and manufacturing technologies
- are able to apply the processing techniques, the application of polymers and polymer composites regarding to the basic principles of material science
- can describe the special mechanical, chemical and elctrical prooperties of polymers and correlate these properties to the chemical bindings.
- can define application areas and the limitation in the use of polymers

requirements:
none

workload:

regular attendance: 21 hours
self-study: 99 hours

Literature
Literaturhinweise, Unterlagen und Teilmanuskript werden in der Vorlesung ausgegeben.

T 8.175 Course: Powertrain Systems Technology A: Automotive Systems [T-MACH-105233]

Responsible: Prof. Dr.-Ing. Albert Albers
Prof. Dr.-Ing. Sven Matthiesen
Sascha Ott

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102812 - Major Field: Powertrain Systems
M-MACH-102815 - Major Field: Engineering Design
M-MACH-102818 - Major Field: Vehicle Technology

Type	Credits	Recurrence	Version
Written examination	4	Each summer term	2

Events					
SS 2020	2146180	Powertrain Systems Technology A: Automotive Systems	2 SWS	Lecture (V)	Albers, Ott
Exams					
WS 19/20	76-T-MACH-105233	Powertrain Systems Technology A: Automotive Systems		Prüfung (PR)	Albers, Ott

Competence Certificate
written examination: 60 min duration

Prerequisites
None

Below you will find excerpts from events related to this course:

V Powertrain Systems Technology A: Automotive Systems

2146180, SS 2020, 2 SWS, Language: German, Open in study portal

Lecture (V)

Content
Content

Students acquire the basic skills needed to develop future energy-efficient and at the same time comfortably drivable powertrains. This includes holistic development methods and evaluations of powertrain systems. The main topics can be divided into the following chapters:

- Powertrain System
- Driver System
- Environment System
- System Components
- Development Process

Recommendations for additional courses:

- Power Train Systems Technology B: Stationary Machinery

Literature
Kirchner, E.; "Leistungsübertragung in Fahrzeuggetrieben: Grundlagen der Auslegung, Entwicklung und Validierung von Fahrzeuggetrieben und deren Komponenten", Springer Verlag Berlin Heidelberg 2007

Naunheimer, H.; "Fahrzeuggetriebe: Grundlagen, Auswahl, Auslegung und Konstruktion", Springer Verlag Berlin Heidelberg 2007

T 8.176 Course: Powertrain Systems Technology B: Stationary Machinery [T-MACH-105216]

Responsible: Prof. Dr.-Ing. Albert Albers
Prof. Dr.-Ing. Sven Matthiesen
Sascha Ott

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102812 - Major Field: Powertrain Systems
M-MACH-102815 - Major Field: Engineering Design

Type	Credits	Recurrence	Version
Written examination	4	Each winter term	2

Events					
WS 19/20	2145150	Powertrain Systems Technology B: Stationary Machinery	2 SWS	Lecture (V)	Albers, Ott
Exams					
WS 19/20	76-T-MACH-105216	Powertrain Systems Technology B: Stationary Machinery		Prüfung (PR)	Albers, Ott

Competence Certificate
written examination: 60 min duration

Prerequisites
None

Below you will find excerpts from events related to this course:

V Powertrain Systems Technology B: Stationary Machinery

2145150, WS 19/20, 2 SWS, Language: German, Open in study portal

Lecture (V)

Content
Content

Students acquire the basic skills needed to develop future energy-efficient and safe drive system solutions for use in industrial environments. The course considers holistic development methods and evaluations of drive systems. The focal points can be divided into the following chapters:

- Powertrain System
- Operator System
- Environment System
- System Components
- Development Process

Recommendations:

- Powertrain Systems Technology A: Automotive Systems

Literature
VDI-2241: "Schaltare fremdbetätigte Reibkupplungen und -bremsen", VDI Verlag GmbH, Düsseldorf

Geilker, U.: "Industriekupplungen - Funktion, Auslegung, Anwendung", Die Bibliothek der Technik, Band 178, verlag moderne industrie, 1999

T 8.177 Course: Practical Training in Measurement of Vibrations [T-MACH-105373]

Responsible: Prof. Dr.-Ing. Alexander Fidlin
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102820 - Major Field: Mechatronics
M-MACH-104442 - Major Field: Vibration Theory

Type	Credits	Recurrence	Version
Completed coursework	4	Each summer term	1

Events					
SS 2020	2162208	Schwingungstechnisches Praktikum	SWS	Practical course (P)	Fidlin, Keller
Exams					
SS 2020	76-T-MACH-105373	Practical Training in Measurement of Vibrations		Prüfung (PR)	Fidlin

Competence Certificate
Colloquium to each session, 10 out of 10 colloquiums must be passed

Prerequisites
Can not be combined with Experimental Dynamics (T-MACH-105514).

Modeled Conditions
The following conditions have to be fulfilled:

1. The course T-MACH-105514 - Experimental Dynamics must not have been started.

Recommendation
Vibration Theory, Mathematical Methods of Vibration Theory, Dynamic Stability, Nonlinear Vibrations

T 8.178 Course: Presentation [T-MACH-109189]

Responsible: Prof. Dr.-Ing. Martin Heilmaier
Organisation: KIT Department of Mechanical Engineering
Part of: M-MACH-104494 - Bachelor Thesis

Type	Credits	Recurrence	Version
Completed coursework	3	Each term	1

Competence Certificate
The colloquium presentation must be held within 6 weeks after the submission of the bachelor thesis. The presentation should last around 20 minutes followed by a scientific discussion with the present expert audience. The students should show that they are able to independently present and discuss the content of their bachelor thesis according to scientific criteria.

Prerequisites
Bachelor Thesis has been started

Modeled Conditions
The following conditions have to be fulfilled:

1. The course T-MACH-109188 - Bachelor Thesis must have been started.

Annotation
The workload for the presentation of the bachelor thesis is about 90 hours.

T 8.179 Course: Principles of Ceramic and Powder Metallurgy Processing [T-MACH-102111]

Responsible: Dr. Günter Schell
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102819 - Major Field: Materials Science and Engineering

Type	Credits	Recurrence	Version
Oral examination	4	Each winter term	1

Events					
WS 19/20	2193010	Basic principles of powder metallurgical and ceramic processing	2 SWS	Lecture (V)	Schell
Exams					
WS 19/20	76-T-MACH-102111	Principles of Ceramic and Powder Metallurgy Processing		Prüfung (PR)	Schell

Competence Certificate
The assessment consists of an oral exam (20-30 min) taking place at the agreed date. The re-examination is offered upon agreement.

Prerequisites
none

Below you will find excerpts from events related to this course:

V Basic principles of powder metallurgical and ceramic processing

Lecture (V)

2193010, WS 19/20, 2 SWS, Language: German, Open in study portal

Literature

- R.J. Brook: Processing of Ceramics I+II, VCH Weinheim, 1996
- M.N. Rahaman: Cermamic Processing and Sintering, 2nd Ed., Marcel Dekker, 2003
- 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

T 8.180 Course: Product- and Production-Concepts for modern Automobiles [T-MACH-110318]

Responsible: Dr. Stefan Kienzle
Dr. Dieter Steegmüller

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102818 - Major Field: Vehicle Technology

Type	Credits	Recurrence	Version
Oral examination	4	Each winter term	1

Events					
WS 19/20	2149670	Product- and Production-Concepts for modern Automobiles	2 SWS	Lecture (V)	Steegmüller, Kienzle
Exams					
WS 19/20	76-T-MACH-110318	Product- and Production-Concepts for modern Automobiles		Prüfung (PR)	Steegmüller, Kienzle

Competence Certificate
Oral Exam (20 min)

Prerequisites
T-MACH-105166 - Materials and Processes for Body Leightweight Construction in the Automotive Industry must not have been started.

Below you will find excerpts from events related to this course:

V Product- and Production-Concepts for modern Automobiles

Lecture (V)

2149670, WS 19/20, 2 SWS, Language: German, Open in study portal

Content

The lecture illuminates the practical challenges of modern automotive engineering. As former leaders of the automotive industry, the lecturers refer to current aspects of automotive product development and production.

The aim is to provide students with an overview of technological trends in the automotive industry. In this context, the course also focuses on changes in requirements due to new vehicle concepts, which may be caused by increased demands for individualisation, digitisation and sustainability. The challenges that arise in this context will be examined from both a production technology and product development perspective and will be illustrated with practical examples thanks to the many years of industrial experience of both lecturers.

The topics covered are:

- General conditions for vehicle and body development
- Integration of new drive technologies
- Functional requirements (crash safety etc.), also for electric vehicles
- Development Process at the Interface Product & Production, CAE/Simulation
- Energy storage and supply infrastructure
- Aluminium and lightweight steel construction
- FRP and hybrid parts
- Battery, fuel cell and electric motor production
- Joining technology in modern car bodies
- Modern factories and production processes, Industry 4.0.

Learning Outcomes:

The students …

- are able to name the presented general conditions of vehicle development and are able to discuss their influences on the final product using practical examples.
- are able to name the various lightweight approaches and identify possible areas of application.
- are able to identify the different production processes for manufacturing lightweight structures and explain their functions.
- are able to perform a process selection based on the methods and their characteristics.

Workload:

regular attendance: 25 hours
self-study: 95 hours

Literature
Medien:
Skript zur Veranstaltung wird über (https://ilias.studium.kit.edu/) bereitgestellt.

Media:
Lecture notes will be provided in Ilias (https://ilias.studium.kit.edu/).

T 8.181 Course: Product Lifecycle Management [T-MACH-105147]

Responsible: Prof. Dr.-Ing. Jivka Ovtcharova
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102583 - Major Field: Information Management
M-MACH-102589 - Major Field: Production Systems
M-MACH-102746 - Compulsory Elective Module

Type	Credits	Recurrence	Version
Written examination	4	Each winter term	2

Events					
WS 19/20	2121350	Product Lifecycle Management	2 SWS	Lecture (V)	Ovtcharova
Exams					
WS 19/20	76-T-MACH-105147	Product Lifecycle Management		Prüfung (PR)	Ovtcharova

Competence Certificate
Writen examination 90 min.

Prerequisites
None

Below you will find excerpts from events related to this course:

V Product Lifecycle Management

2121350, WS 19/20, 2 SWS, Language: German, Open in study portal

Lecture (V)

Content
The course includes:

- Basics for product data management and data exchange
- IT system solutions for Product Lifecycle Management (PLM)
- Economic viability analysis and implementation problems
- Illustrative scenario for PLM using the example of the institute's own I4.0Lab

After successful attendance of the course, students can:

- identify the challenges of data management and exchange and describe solution concepts for these challenges.
- clarify the management concept PLM and its goals and highlight the economic benefits.
- explain the processes required to support the product life cycle and describe the most important business software systems (PDM, ERP, ...) and their functions.

Literature
Vorlesungsfolien.

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.

T 8.182 Course: Product, Process and Resource Integration in the Automotive Industry [T-MACH-102155]

Responsible: Dr.-Ing. Sama Mbang
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102583 - Major Field: Information Management
M-MACH-102818 - Major Field: Vehicle Technology

Type	Credits	Recurrence	Version
Oral examination	4	Each summer term	2

Events					
SS 2020	2123364	Product, Process and Resource Integration in the Automotive Industry	2 SWS	Lecture (V)	Mbang

Competence Certificate
Oral examination 20 min.

Prerequisites
None

Annotation
Limited number of participants.

Below you will find excerpts from events related to this course:

V Product, Process and Resource Integration in the Automotive Industry — Lecture (V)
2123364, SS 2020, 2 SWS, Language: German, Open in study portal

Content

- 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)

Literature
Vorlesungsfolien

T 8.183 Course: Production Operations Management [T-MACH-100304]

Responsible: Prof. Dr.-Ing. Kai Furmans
Prof. Dr.-Ing. Gisela Lanza
Prof. Dr. Frank Schultmann

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-100297 - Production Operations Management

Type	Credits	Recurrence	Version
Written examination	3	Each winter term	2

Events					
WS 19/20	2110085	Production Operations Management	3 SWS	Lecture / Practice (VÜ)	Furmans, Lanza
Exams					
WS 19/20	76-T-MACH-100304	Production Operations Management		Prüfung (PR)	Furmans, Lanza, Deml

Competence Certificate
written exam (duration: 90 min)

Prerequisites
T-MACH-108734 - Production Operations Management-Project must have been completed successfully.

Modeled Conditions
The following conditions have to be fulfilled:

1. The course T-MACH-108734 - Production Operations Management-Project must have been passed.

Below you will find excerpts from events related to this course:

V Production Operations Management

2110085, WS 19/20, 3 SWS, Language: German, Open in study portal

Lecture / Practice (VÜ)

Content
It is a joint lecture of the Institute of Materials Handling and Logistics (IFL) and the Institute of Production Science (WBK). The institutes alternate with each cycle.

The lecture covers the basics of operations and supply chain management as well as business management basics in accounting, investment calculation and legal forms.

If you successfully passed this course you will be able to:

- state the relevant technical terms of business administration, logistics and production engineering
- describe the interrelation between these technical terms
- describe the most important decision problems qualitatively and quantitatively
- apply the appropriate decision models to solve the respective decision problems
- critically evaluate the results and draw appropriate conclusions
- extend the learned methods and models by researching on you own

The brick "Production Operations Management-Project" must be successfully completed before the course "Production Operations Management" can be completed.

Media:

Lecture notes will be provided in ilias (https://ilias.studium.kit.edu/).

regular attendance: 25 hours
self-study: 65 hours

Literature
F. Robert Jacobs, Richard B. Chase (2014): Operations and supply chain management

T 8.184 Course: Production Operations Management-Project [T-MACH-108734]

Responsible: Prof. Dr.-Ing. Kai Furmans
Prof. Dr.-Ing. Gisela Lanza
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-100297 - Production Operations Management

Type	Credits	Recurrence	Version
Examination of another type	2	Each winter term	1

Events					
WS 19/20	2110086	Production Operations Management-Project	1 SWS	Project (PRO)	Furmans, Lanza
Exams					
WS 19/20	76-T-MACH-108734	Production Operations Management-Project		Prüfung (PR)	Furmans, Lanza

Competence Certificate
Assignments during the semester consisting of solving 4 and presenting 2 case studies, whereof:

- 80% assessment of the case study as group work
- 20% evaluation of the defense of the case studies as an individual grade

Prerequisites
none

Below you will find excerpts from events related to this course:

V Production Operations Management-Project

Project (PRO)

2110086, WS 19/20, 1 SWS, Language: German, Open in study portal

Content
Students are divided into groups for this course. Four case studies will be carried out in these groups. The results of the group work will be presented and evaluated in writing. Prerequisite for the participation in the case study is the previous successful participation in a multiple choice test, which can be repeated online several times in a given period. The result of the group work is presented and evaluated in writing. In addition, selected groups will present and defend their results.

After successful completion of the lecture you will be able to work alone and in a team

- to **name** the treated **technical terms** in the areas of production, logistics and business administration,
- to accurately **describe** the connections between these areas in a discussion with experts,
- to describe **qualitatively** and **quantitatively** the most important decision-making problems in this field,
- to use the corresponding qualitative and quantitative decision models,
- to critically **evaluate** their results and draw conclusions from them,
- as well as to expand the methods and models discussed through **own research**.

The participation of all members of the selected groups in the oral defenses is compulsory and will be controlled. Four written submissions must be passed. For the written submission the group receives a common grade, in the defense each group member is evaluated individually. The defenses are fully included in the grade, but they do not have to be passed in order to pass the entire event. The final score of the event consists of 80% of the written submissions and 20% of the defense evaluation.

It is a joint lecture of the Institute of Materials Handling and Logistics (IFL) and the Institute of Production Science (WBK). The institutes alternate with each cycle.

Attendance time: 17 hours,

Self-study: 43 hours

Literature
F. Robert Jacobs, Richard B. Chase (2014): Operations and supply chain management

T 8.185 Course: Project Management in Global Product Engineering Structures [T-MACH-105347]

Responsible: Prof. Dr.-Ing. Albert Albers
Prof. Dr.-Ing. Peter Gutzmer
Prof. Dr.-Ing. Sven Matthiesen

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102583 - Major Field: Information Management
M-MACH-102812 - Major Field: Powertrain Systems
M-MACH-102815 - Major Field: Engineering Design
M-MACH-102818 - Major Field: Vehicle Technology
M-MACH-102820 - Major Field: Mechatronics

Type	Credits	Recurrence	Version
Oral examination	4	Each winter term	1

Events					
WS 19/20	2145182	Project management in Global Product Engineering Structures	2 SWS	Lecture (V)	Gutzmer
Exams					
WS 19/20	76-T-MACH-105347	Project Management in Global Product Engineering Structures		Prüfung (PR)	Gutzmer, Albers

Competence Certificate
oral exam (20 min)

Aids: None

Prerequisites
none

Below you will find excerpts from events related to this course:

V Project management in Global Product Engineering Structures

Lecture (V)

2145182, WS 19/20, 2 SWS, Language: German, Open in study portal

Literature
Vorlesungsumdruck

T 8.186 Course: Project Management in Rail Industry [T-MACH-104599]

Responsible: Prof. Dr.-Ing. Peter Gratzfeld
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102638 - Major Field: Rail System Technology

Type	Credits	Recurrence	Version
Oral examination	4	Each winter term	1

Events					
WS 19/20	2115995	Project Management in Rail Industry	2 SWS	Lecture (V)	Gratzfeld
Exams					
WS 19/20	76-T-MACH-104599	Project Management in Rail Industry		Prüfung (PR)	Gratzfeld
SS 2020	76-T-MACH-104599	Project Management in Rail Industry		Prüfung (PR)	Gratzfeld

Competence Certificate
Oral examination

Duration: ca. 20 minutes

No tools or reference materials may be used during the exam.

Prerequisites
none

Below you will find excerpts from events related to this course:

V Project Management in Rail Industry

2115995, WS 19/20, 2 SWS, Language: German, Open in study portal

Lecture (V)

Content
Rail vehicles are capital-intensive goods which are manufactured in small series (like aircraft). The work to done at industry and customers is organized in "projects". This is completely different to the way of working in large-scale production (like car industry). Everybody working in this type of business is part of a project and should be aware of the typical processes.

The lecturer provides a comprehensive overview about modern project management for small series of capital-intensive goods. The content is valid not for rail vehicle business but also for other areas with similar business processes.
The following topics will be discussed:

1. Introduction: definition of project and project management
2. Project management system: project phases, main processes and supporting processes, governance
3. Organization: organizational structure within a company, project organization, roles in a project organization
4. Main processes: project start, project plan, work brake down structure, detailed project schedule, risk and opportunity management, change management, project closure
5. Governance

Literature
Eine Literaturliste steht den Studierenden auf der Ilias-Plattform zum Download zur Verfügung.

A bibliography is available for download (Ilias-platform).

T 8.187 Course: Project Workshop: Automotive Engineering [T-MACH-102156]

Responsible: Dr.-Ing. Michael Frey
Prof. Dr. Frank Gauterin
Dr.-Ing. Martin Gießler

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102818 - Major Field: Vehicle Technology

Type	Credits	Recurrence	Version
Oral examination	6	Each term	1

Events					
WS 19/20	2115817	Project Workshop: Automotive Engineering	3 SWS	Lecture (V)	Gauterin, Gießler, Frey
SS 2020	2115817	Project Workshop: Automotive Engineering	3 SWS	Lecture (V)	Gauterin, Gießler, Frey
Exams					
WS 19/20	76-T-MACH-102156	Project Workshop: Automotive Engineering		Prüfung (PR)	Gauterin

Competence Certificate
Oral examination

Duration: 30 up to 40 minutes

Auxiliary means: none

Prerequisites
none

Below you will find excerpts from events related to this course:

V Project Workshop: Automotive Engineering

2115817, WS 19/20, 3 SWS, Language: German, Open in study portal

Lecture (V)

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.

Learning Objectives:

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

Skripte werden beim Start-up Meeting ausgegeben.

The scripts will be supplied in the start-up meeting.

V

Project Workshop: Automotive Engineering

2115817, SS 2020, 3 SWS, Language: German, Open in study portal

Lecture (V)

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.

Learning Objectives:

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. They are able to analyze and to judge complex relations. They are ready to work self-dependently, to apply different development methods and to work on approaches to solve a problem, to develop practice-oriented products or processes.

Literature
Steinle, Claus; Bruch, Heike; Lawa, Dieter (Hrsg.), Projektmanagement, Instrument moderner Innovation, FAZ Verlag, Frankfurt a. M., 2001, ISBN 978-3929368277

Skripte werden beim Start-up Meeting ausgegeben.

T 8.188 Course: Python Algorithm for Vehicle Technology [T-MACH-110796]

Responsible: Stephan Rhode
Organisation:
Part of: M-MACH-102818 - Major Field: Vehicle Technology

Type	Credits	Recurrence	Version
Written examination	4	Each summer term	1

Events					
SS 2020	2114862	Python Algorithms for Automotive Engineering	2 SWS	Lecture (V)	Rhode

Competence Certificate
Written Examination

Duration: 90 minutes

Prerequisites
none

Below you will find excerpts from events related to this course:

V Python Algorithms for Automotive Engineering

2114862, SS 2020, 2 SWS, Language: German, Open in study portal

Lecture (V)

Content
Teaching content:

- Introduction to Python and useful tools and libraries for creating algorithms, graphical representation, optimization, symbolic arithmetic and machine learning
  - Anaconda, Pycharm, Jupyter
  - NumPy, Matplotlib, SymPy, Scikit-Learn
- Methods and tools for creating software
  - Version management GitHub, git
  - Testing software pytest, Pylint
  - Documentation Sphinx
  - Continuous Integration (CI) Travis CI
  - Workflows in Open Source and Inner Source, Kanban, Scrum
- Practical programming projects to:
  - Road sign recognition
  - Vehicle state estimation
  - Calibration of vehicle models by mathematical optimization
  - Data-based modelling of the powertrain of an electric vehicle

Objectives:

The students have an overview of the programming language Python and important Python libraries to solve automotive engineering problems with computer programs. The students know current tools around Python to create algorithms, to apply them and to interpret and visualize their results. Furthermore, the students know
basics in the creation of software to be used in later programming projects in order to develop high-quality software solutions in teamwork. Through practical programming projects (road sign recognition, vehicle state estimation, calibration, data-based modelling), the students can perform future complex tasks from the area of driver assistance systems.

Literature

- A Whirlwind Tour of Python, Jake VanderPlas, Publisher: O'Reilly Media, Inc. Release Date: August 2016, ISBN: 9781492037859 link
- Scientific Computing with Python 3, Olivier Verdier, Jan Erik Solem, Claus Führer, Publisher: Packt Publishing, Release Date: December 2016, ISBN: 9781786463517 link
- Introduction to Machine Learning with Python, Sarah Guido, Andreas C. Müller, Publisher: O'Reilly Media, Inc., Release Date: October 2016, ISBN: 9781449369880, link
- Clean Code, Robert C. Martin, Publisher: Prentice Hall, Release Date: August 2008, ISBN: 9780136083238, link

T 8.189 Course: Quality Management [T-MACH-102107]

Responsible: Prof. Dr.-Ing. Gisela Lanza
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102589 - Major Field: Production Systems
M-MACH-102815 - Major Field: Engineering Design
M-MACH-102821 - Major Field: Technical Logistics

Type	Credits	Recurrence	Version
Written examination	4	Each winter term	1

Events					
WS 19/20	2149667	Quality Management	2 SWS	Lecture (V)	Lanza
Exams					
WS 19/20	76-T-MACH-102107	Quality Management		Prüfung (PR)	Lanza

Competence Certificate
Written Exam (60 min)

Prerequisites
none

Below you will find excerpts from events related to this course:

V Quality Management
2149667, WS 19/20, 2 SWS, Language: German, Open in study portal

Lecture (V)

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:

- The term "Quality"
- Total Quality Management (TQM) and Six Sigma
- Universal methods and tools
- QM during early product stages – product denition
- QM during product development and in procurement
- QM in production – manufacturing metrology
- QM in production – statistical methods
- QM in service
- Quality management systems
- Legal aspects of QM

Learning Outcomes:

The students …

- are capable to comment on the content covered by the lecture.
- are capable of substantially quality philosophies.
- are able to apply the QM tools and methods they have learned about in the lecture to new problems from the context of the lecture.
- are able to analyze and evaluate the suitability of the methods, procedures and techniques they have learned about in the lecture for a specific problem.

Workload:

regular attendance: 21 hours
self-study: 99 hours

Literature
Medien:
Skript zur Veranstaltung wird über (https://ilias.studium.kit.edu/) bereitgestellt:

Media:
Lecture notes will be provided in Ilias (https://ilias.studium.kit.edu/).

T 8.190 Course: Rail System Technology [T-MACH-106424]

Responsible: Prof. Dr.-Ing. Peter Gratzfeld
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102638 - Major Field: Rail System Technology

Type	Credits	Recurrence	Version
Oral examination	4	Each term	1

Events					
WS 19/20	2115919	Rail System Technology	2 SWS	Lecture (V)	Gratzfeld
SS 2020	2115919	Rail System Technology	2 SWS	Lecture (V)	Gratzfeld
Exams					
WS 19/20	76-T-MACH-106424	Rail System Technology		Prüfung (PR)	Gratzfeld
SS 2020	76-T-MACH-106424	Rail System Technology		Prüfung (PR)	Gratzfeld

Competence Certificate
Oral examination

Duration: ca. 20 minutes

No tools or reference materials may be used during the exam.

Prerequisites
none

Below you will find excerpts from events related to this course:

V Rail System Technology
2115919, WS 19/20, 2 SWS, Language: German, Open in study portal

Lecture (V)

Content

1. Railway System: railway as system, subsystems and interdependencies, definitions, laws, rules, railway and environment, economic impact
2. Operation: Transportation, public transport, regional transport, long-distance transport, freight service, scheduling
3. Infrastructure: rail facilities, track alignment, railway stations, clearance diagram
4. Wheel-rail-contact: carrying of vehicle mass, adhesion, wheel guidance, current return
5. Vehicle dynamics: tractive and brake effort, driving resistance, inertial force, load cycles
6. Signaling and Control: operating procedure, succession of trains, European Train Control System, blocking period, automatic train control
7. Traction power supply: power supply of rail vehicles, power networks, filling stations
8. History (optional)

Literature
Eine Literaturliste steht den Studierenden auf der Ilias-Plattform zum Download zur Verfügung.

A bibliography is available for download (Ilias-platform).

V Rail System Technology
2115919, SS 2020, 2 SWS, Language: German, Open in study portal

Lecture (V)

Content

1. Railway System: railway as system, subsystems and interdependencies, definitions, laws, rules, railway and environment, economic impact
2. Operation: Transportation, public transport, regional transport, long-distance transport, freight service, scheduling
3. Infrastructure: rail facilities, track alignment, railway stations, clearance diagram
4. Wheel-rail-contact: carrying of vehicle mass, adhesion, wheel guidance, current return
5. Vehicle dynamics: tractive and brake effort, driving resistance, inertial force, load cycles
6. Signaling and Control: operating procedure, succession of trains, European Train Control System, blocking period, automatic train control
7. Traction power supply: power supply of rail vehicles, power networks, filling stations
8. History (optional)

Literature
Eine Literaturliste steht den Studierenden auf der Ilias-Plattform zum Download zur Verfügung.

A bibliography is available for download (Ilias-platform).

T 8.191 Course: Rail Vehicle Technology [T-MACH-105353]

Responsible: Prof. Dr.-Ing. Peter Gratzfeld
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102638 - Major Field: Rail System Technology

Type	Credits	Recurrence	Version
Oral examination	4	Each term	1

Events					
WS 19/20	2115996	Rail Vehicle Technology	2 SWS	Lecture (V)	Gratzfeld
SS 2020	2115996	Rail Vehicle Technology	2 SWS	Lecture (V)	Gratzfeld
Exams					
WS 19/20	76-T-MACH-105353	Rail Vehicle Technology		Prüfung (PR)	Gratzfeld
SS 2020	76-T-MACH-105353	Rail Vehicle Technology		Prüfung (PR)	Gratzfeld

Competence Certificate
Oral examination

Duration: ca. 20 minutes

No tools or reference materials may be used during the exam.

Prerequisites
none

Below you will find excerpts from events related to this course:

V Rail Vehicle Technology
2115996, WS 19/20, 2 SWS, Language: German, Open in study portal

Lecture (V)

Content

1. Vehicle system technology: structure and main systems of rail vehicles
2. Car body: functions, requirements, design principles, crash elements, interfaces
3. Bogies: forces, running gears, axle configuration
4. Drives: vehicle with/without contact wire, dual-mode vehicle
5. Brakes: tasks, basics, principles, blending, brake control
6. Train control management system: definitions, networks, bus systems, components, examples
7. Vehicle concepts: trams, metros, regional trains, intercity trains, high speed trains, double deck coaches, locomotives, freight wagons

Literature
Eine Literaturliste steht den Studierenden auf der Ilias-Plattform zum Download zur Verfügung.

A bibliography is available for download (Ilias-platform).

V Rail Vehicle Technology
2115996, SS 2020, 2 SWS, Language: German, Open in study portal

Lecture (V)

Content

1. Vehicle system technology: structure and main systems of rail vehicles
2. Car body: functions, requirements, design principles, crash elements, interfaces
3. Bogies: forces, running gears, axle configuration
4. Drives: vehicle with/without contact wire, dual-mode vehicle
5. Brakes: tasks, basics, principles, blending, brake control
6. Train control management system: definitions, networks, bus systems, components, examples
7. Vehicle concepts: trams, metros, regional trains, intercity trains, high speed trains, double deck coaches, locomotives, freight wagons

Literature
Eine Literaturliste steht den Studierenden auf der Ilias-Plattform zum Download zur Verfügung.

A bibliography is available for download (Ilias-platform).

T 8.192 Course: Railways in the Transportation Market [T-MACH-105540]

Responsible: Prof. Dr.-Ing. Peter Gratzfeld
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102638 - Major Field: Rail System Technology

Type	Credits	Recurrence	Version
Oral examination	4	Each summer term	1

Events					
SS 2020	2114914	Railways in the Transportation Market	2 SWS	Block (B)	Gratzfeld
Exams					
WS 19/20	76-T-MACH-105540	Railways in the Transportation Market		Prüfung (PR)	Gratzfeld
SS 2020	76-T-MACH-105540	Railways in the Transportation Market		Prüfung (PR)	Gratzfeld

Competence Certificate
Oral examination

Duration: ca. 20 minutes

No tools or reference materials may be used during the exam.

Prerequisites
none

Below you will find excerpts from events related to this course:

V Railways in the Transportation Market
2114914, SS 2020, 2 SWS, Language: German, Open in study portal

Block (B)

Content
The lecture conveys the entrepreneurial view on chances and challenges of rail systems in the market. Following items will be discussed:

- Introduction and basics
- Rail reform in Germany
- Overview of Deutsche Bahn
- Financing and development of infrastructure
- Regulation of railways
- Intra- and intermodal competition
- Field of actions in transport policy
- Railways and enviroment
- Trends in the transportation market
- Future of Deutsche Bahn
- Digitalization

Qualification aims:

The students learn about the entrepreneurial perspective of transport authorities and can follow their fields of action. They understand regulative policies and learn to assess intra- and intermodal competition.

Literature
keine

T 8.193 Course: Reliability Engineering 1 [T-MACH-107447]

Responsible: Dr.-Ing. Alexei Konnov
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102817 - Major Field: Information Technology
M-MACH-102838 - Major Field: Energy Converting Engines

Type	Credits	Recurrence	Version
Written examination	3	Each winter term	1

Events					
WS 19/20	2169550	Reliability Engineering 1	2 SWS	Lecture (V)	Konnov

Competence Certificate
written exam

Prerequisites
none

Below you will find excerpts from events related to this course:

V Reliability Engineering 1

2169550, WS 19/20, 2 SWS, Language: English, Open in study portal

Lecture (V)

Content
This module should provide an introduction to the theoretical and practical aspects of the reliability engineering using the example of availability and safety analysis of the power plant digital control system (DCS).

It contains the necessary basics of the probability and dependability theory as well as a general introduction to the digital control systems (DCS).

In the next step, the principal approach of the availibilty and safety analysis of the complex systems will be explained.

The main point of the module is "the balance between safety and process related functions" and their influence on the economic effectiveness of the technical installation.

Technical background: instrumentation and control systems in power plants

Introduction to reliability theory
Introduction to probability theory
Introduction to formal logic
Introduction to statistic

Basic knowledge in formal logic, KV-maps, probility calculus.

Recommendation:

In combination with lesson "Combined Cycle Power Plants" - Lesson No. 2170490

After having successfully completed the course, the students should

- have a general understanding of the sturcutre and operating principal of the digital control systems,
- have an understanding of availability and safety importance in modern technical systems (e.g. DCS),
- understand and be able to use the fundamnental concepts of availability and safety analysis,
- be aware of the necessity of finding an ooptimum balance between safety and availability in a technical installation,
-be able to use the appropriate terminology in English

regular attandance: 25 h

self-study: 65 h

written exam

duration: 90 min.

Auxiliary: no tools or reference materials may be used during the exam

Literature
Lesson script (link will be available)

Recommended books:

o Birolini, Alessandro: *Reliability Engineering Theory and Practice*

o Pham, Hoang: *Handbook of reliability engineering*

T 8.194 Course: Robotics I - Introduction to Robotics [T-INFO-108014]

Responsible: Prof. Dr.-Ing. Tamim Asfour
Organisation: KIT Department of Informatics
Part of: M-MACH-102820 - Major Field: Mechatronics

Type	Credits	Recurrence	Version
Written examination	6	Each winter term	1

Events					
WS 19/20	2424152	Robotics I - Introduction to Robotics	3/1 SWS	Lecture (V)	Asfour, Paus
Exams					
WS 19/20	7500106	Robotics I - Introduction to Robotics		Prüfung (PR)	Asfour
SS 2020	7500218	Robotik I - Einführung in die Robotik		Prüfung (PR)	Asfour

T 8.195 Course: Safety Engineering [T-MACH-105171]

Responsible: Hans-Peter Kany
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102815 - Major Field: Engineering Design
M-MACH-102821 - Major Field: Technical Logistics

Type	Credits	Recurrence	Version
Oral examination	4	Each winter term	2

Events					
WS 19/20	2117061	Safety Engineering	2 SWS	Lecture (V)	Kany
Exams					
WS 19/20	7600004	Safety Engineering		Prüfung (PR)	Kany

Competence Certificate
The assessment consists of an oral exam (20 min.) taking place in the recess period according to § 4 paragraph 2 Nr. 2 of the examination regulation.

Prerequisites
none

Below you will find excerpts from events related to this course:

V Safety Engineering

2117061, WS 19/20, 2 SWS, Language: German, Open in study portal

Lecture (V)

Content
Media
Presentations

Learning 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.

Learning goals
The students are able to:

- Name and describe relevant safety concepts of safety engineering,
- Discuss basics of health at work and labour protection in Germany,
- Evaluate the basics for the safe methods of design of machinery with the national and European safety regulations and
- Realize these objectives by using examples in the field of storage and material handling systems.

Recommendations
None

Workload
Regular attendance: 21 hours
Self-study: 99 hours

Note
Dates: See IFL-Homepage

Literature
Defren/Wickert: Sicherheit für den Maschinen- und Anlagenbau, Druckerei und
Verlag: H. von Ameln, Ratingen

T 8.196 Course: Scientific Computing for Engineers [T-MACH-100532]

Responsible: Prof. Dr. Peter Gumbsch
Dr. Daniel Weygand

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102746 - Compulsory Elective Module

Type	Credits	Recurrence	Version
Written examination	4	Each winter term	3

Events					
WS 19/20	2181738	Scientific computing for Engineers	2 SWS	Lecture (V)	Weygand, Gumbsch
WS 19/20	2181739	Exercises for Scientific Computing for Engineers	2 SWS	Practice (Ü)	Weygand
Exams					
WS 19/20	76-T-MACH-100532	Scientific Computing for Engineers		Prüfung (PR)	Weygand, Gumbsch
SS 2020	76-T-MACH-100532	Scientific Computing for Engineers		Prüfung (PR)	Weygand, Gumbsch

Competence Certificate
Written exam (90 minutes)

Prerequisites
The brick can not be combined with the brick "Application of advanced programming languages in mechanical engineering" (T-MACH-105390).

Below you will find excerpts from events related to this course:

V Scientific computing for Engineers

Lecture (V)

2181738, WS 19/20, 2 SWS, Language: German, Open in study portal

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.

The student can

- apply the programming language C++ for scientific computing in the field of materials science
- adapt programs for use on parallel platforms
- choose suitable numerical methods for the solution of differential equations.

The lecture can not be combined with the lecture "Application of advanced programming languages in mechanical engineering" (2182735).

regular attendance: 22,5 hours
Lab: 22,5 hours (optional)
self-study: 75 hours

written exam 90 minutes

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

V Exercises for Scientific Computing for Engineers

2181739, WS 19/20, 2 SWS, Language: German, Open in study portal

Practice (Ü)

Content
Exercises for the different topics of the lecture "Scientific computing for Engineers" (2181738)

regular attendance: 22,5 hours

Literature
Skript zur Vorlesung "Wissenschaftliches Programmieren für Ingenieure" (2181738)

T 8.197 Course: Selected Applications of Technical Logistics [T-MACH-102160]

Responsible: Viktor Milushev
Dr.-Ing. Martin Mittwollen

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102821 - Major Field: Technical Logistics

Type	Credits	Recurrence	Version
Oral examination	4	Each summer term	1

Events					
SS 2020	2118087	Selected Applications of Technical Logistics	3 SWS	Lecture (V)	Mittwollen, Milushev
Exams					
WS 19/20	76-T-MACH-102160	Selected Applications of Technical Logistics		Prüfung (PR)	Mittwollen

Competence Certificate
The assessment consists of an oral exam (20 min.) taking place in the recess period according to § 4 paragraph 2 Nr. 2 of the examination regulation.

Prerequisites
none

Recommendation
Knowledge out of Basics of Technical Logistics I (T-MACH-109919) / Elements and Systems of Technical Logistics (T-MACH-102159) preconditioned.

Below you will find excerpts from events related to this course:

V Selected Applications of Technical Logistics

2118087, SS 2020, 3 SWS, Language: German, Open in study portal

Lecture (V)

Content

- design and dimension of machines from intralogistics
- static and dynamic behaviour
- operation properties and specifics
- Inside practical lectures: sample applications and calculations in addition to the lectures

Details according schedule will be published

Literature
Empfehlungen in der Vorlesung

8.198 Course: Selected Applications of Technical Logistics - Project [T-MACH-108945]

Responsible: Viktor Milushev
Dr.-Ing. Martin Mittwollen

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102821 - Major Field: Technical Logistics

Type	Credits	Recurrence	Version
Examination of another type	2	Each summer term	1

Events					
SS 2020	2118088	Selected Applications of Technical Logistics - Project	1 SWS	Project (PRO)	Milushev, Mittwollen
Exams					
WS 19/20	76-T-MACH-108945	Selected Applications of Technical Logistics - Project		Prüfung (PR)	Mittwollen

Competence Certificate
presentation of performed project and defense (30min) according to $4 (2), No. 3 of the examination regulation

Prerequisites
T-MACH-102160 (selected applications of technical logistics) must have been started

Modeled Conditions
The following conditions have to be fulfilled:

1. The course T-MACH-102160 - Selected Applications of Technical Logistics must have been started.

Recommendation
Knowledge out of Basics of Technical Logistics I (T-MACH-109919) / Elements and Systems of Technical Logistics (T-MACH-102159) preconditioned.

Below you will find excerpts from events related to this course:

V Selected Applications of Technical Logistics - Project

2118088, SS 2020, 1 SWS, Language: German, Open in study portal

Project (PRO)

Literature
Empfehlungen in der Vorlesung

T 8.199 Course: Selected Problems of Applied Reactor Physics and Exercises [T-MACH-105462]

Responsible: Dr. Ron Dagan
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102816 - Major Field: Fundamentals of Energy Technology

Type	Credits	Recurrence	Version
Oral examination	4	Each summer term	1

Events					
SS 2020	2190411	Selected Problems of Applied Reactor Physics and Exercises	2 SWS	Lecture (V)	Dagan
Exams					
WS 19/20	76-T-MACH-105462	Selected Problems of Applied Reactor Physics and Exercises		Prüfung (PR)	Dagan, Stieglitz
SS 2020	76-T-MACH-105462	Selected Problems of Applied Reactor Physics and Exercises		Prüfung (PR)	Dagan

Competence Certificate
oral exam, 1/2 hour

Prerequisites
none

Below you will find excerpts from events related to this course:

V Selected Problems of Applied Reactor Physics and Exercises

2190411, SS 2020, 2 SWS, Language: German, Open in study portal

Lecture (V)

Content

- Nuclear energy and forces
- Radioactive decay
- Nuclear processes
- Fission and the importance of delayed neutrons
- Basics of nuclear cross sections
- Principles of chain reaction
- Static theory of mono energetic reactors
- Introduction to reactor kinetic
- student laboratory

The students

- have solid understanding of the basic reactor physics
- are able to estimate processes of growth and decay of radionuclides; out of it, they can perform dose calculation and introduce their biological hazards
- can calculate the relationship of basic parameters which are needed for a stable reactor operation
- understand important dynamical processes of nuclear reactors.

Regular attendance: 26 h

self study 94 h

oral exam about 30 min.

Literature

K. Wirtz Grundlagen der Reaktortechnik Teil I, II, Technische Hochschule Karlsruhe 1966

D. Emendorfer. K.H. Höcker Theorie der Kernreaktoren, BI- Hochschultaschenbücher 1969

J. Duderstadt and L. Hamilton, Nuclear reactor Analysis, J. Wiley $ Sons, Inc. 1975 (in English)

T 8.200 Course: Seminar for Rail System Technology [T-MACH-108692]

Responsible: Prof. Dr.-Ing. Peter Gratzfeld
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102638 - Major Field: Rail System Technology

Type	Credits	Recurrence	Version
Examination of another type	3	Each term	2

Events					
WS 19/20	2115009	Seminar for Rail System Technology	1 SWS	Seminar (S)	Gratzfeld
SS 2020	2115009	Seminar for Rail System Technology	1 SWS	Seminar (S)	Gratzfeld
Exams					
WS 19/20	76-T-MACH-00002	Seminar for Rail System Technology		Prüfung (PR)	Gratzfeld
SS 2020	76-T-MACH-00002	Seminar for Rail System Technology		Prüfung (PR)	Gratzfeld

Competence Certificate
Examination: Writing a Seminararbeit, final presentation

Prerequisites
none

Below you will find excerpts from events related to this course:

V Seminar for Rail System Technology

2115009, WS 19/20, 1 SWS, Language: German, Open in study portal

Seminar (S)

Content

- Railway system: railway as system, subsystems and interdependencies, definitions, laws, rules, railway and environment, economic impact, history, challenges and future developments in the context of mega trends
- Operation: Transportation, public/regional/long-distance transport, freight service, scheduling
- System structure of railway vehicles: Tasks and classification, main systems
- Project management: definitions, project management, main and side processes, transfer to practice
- Scientific working: structuring and writing of scientific papers, literature research, scheduling (mile stones), self-management, presentation skills, using the software Citavi for literature and knowledge management, working with templates in Word, giving and taking feedback
- The learnt knowledge regarding scientific writing is used to elaborate a Seminararbeit. To this the students create a presentation, train and reflect it and finally present it to an auditorium.

Literature
Eine Literaturliste steht den Studierenden auf der Ilias-Plattform zum Download zur Verfügung.

A bibliography is available for download (Ilias-platform).

V Seminar for Rail System Technology

2115009, SS 2020, 1 SWS, Language: German, Open in study portal

Seminar (S)

Content

- Railway system: railway as system, subsystems and interdependencies, definitions, laws, rules, railway and environment, economic impact, history, challenges and future developments in the context of mega trends
- Operation: Transportation, public/regional/long-distance transport, freight service, scheduling
- System structure of railway vehicles: Tasks and classification, main systems
- Project management: definitions, project management, main and side processes, transfer to practice
- Scientific working: structuring and writing of scientific papers, literature research, scheduling (mile stones), self-management, presentation skills, using the software Citavi for literature and knowledge management, working with templates in Word, giving and taking feedback
- The learnt knowledge regarding scientific writing is used to elaborate a Seminararbeit. To this the students create a presentation, train and reflect it and finally present it to an auditorium.

Literature
Eine Literaturliste steht den Studierenden auf der Ilias-Plattform zum Download zur Verfügung.

A bibliography is available for download (Ilias-platform).

T 8.201 Course: Signals and Systems [T-ETIT-109313]

Responsible: Prof. Dr.-Ing. Fernando Puente León
Organisation: KIT Department of Electrical Engineering and Information Technology
Part of: M-MACH-102820 - Major Field: Mechatronics

Type	Credits	Recurrence	Expansion	Version
Written examination	6	Each winter term	1 terms	1

Events					
WS 19/20	2302109	Signals and Systems	2 SWS	Lecture (V)	Puente León
Exams					
WS 19/20	7302109	Signals and Systems		Prüfung (PR)	Puente León, Jäschke

Prerequisites
none

T 8.202 Course: Simulation of Coupled Systems [T-MACH-105172]

Responsible: Prof. Dr.-Ing. Marcus Geimer
Yusheng Xiang

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-104430 - Major Field: Modeling and Simulation in Dynamics

Type	Credits	Recurrence	Version
Oral examination	4	Each summer term	2

Events					
SS 2020	2114095	Simulation of Coupled Systems	2 SWS	Lecture (V)	Geimer, Xiang
Exams					
WS 19/20	76T-MACH-105172	Simulation of Coupled Systems		Prüfung (PR)	Geimer
WS 19/20	76-T-MACH-105172	Simulation of Coupled Systems		Prüfung (PR)	Geimer
SS 2020	76T-MACH-105172	Simulation of Coupled Systems		Prüfung (PR)	Geimer

Competence Certificate
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 very ordinary examination date.

A registration in mandatory, the details will be announced on the webpages of the *Institute of Vehicle System Technology / Institute of Mobile Machines.* In case of too many applications, attendance will be granted based on pre-qualification.

Prerequisites
Required for the participation in the examination is the preparation of a report during the semester. The partial service with the code T-MACH-108888 must have been passed.

Modeled Conditions
The following conditions have to be fulfilled:

1. The course T-MACH-108888 - Simulation of Coupled Systems - Advance must have been passed.

Recommendation

- Knowledge of ProE (ideally in actual version)
- Basic kniwledge of Matlab/Simulink
- Basic knowledge of dynamics of machnies
- Basic knowledge of hydraulics

Annotation
After completion of course, students are able to:

- build a coupled simulation
- parametrize models
- perform simulations
- conduct troubleshooting
- check results for plausibility

The number of participants is limited.

Content:

- Basics of multi-body and hydralics simulation programs
- Possibilities of coupled simulations
- Modelling and Simulation of Mobile Machines using a wheel loader
- Documentation of the result in a short report

Literature:

Software guide books (PDFs)

Information about wheel-type loader specifications

Below you will find excerpts from events related to this course:

V **Simulation of Coupled Systems**
2114095, SS 2020, 2 SWS, Language: German, Open in study portal
Lecture (V)

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

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

- regular attendance: 21 hours
- total self-study: 92 hours

Literature
Weiterführende Literatur:

- Diverse Handbücher zu den Softwaretools in PDF-Form
- Informationen zum verwendeten Radlader

T 8.203 Course: Simulation of Coupled Systems - Advance [T-MACH-108888]

Responsible: Prof. Dr.-Ing. Marcus Geimer
Yusheng Xiang

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-104430 - Major Field: Modeling and Simulation in Dynamics

Type	Credits	Recurrence	Version
Completed coursework	0	Each summer term	1

Exams				
WS 19/20	76-T-MACH-108888	Simulation of Coupled Systems - Advance	Prüfung (PR)	Geimer
SS 2020	76-T-MACH-108888	Simulation of Coupled Systems - Advance	Prüfung (PR)	Geimer

Competence Certificate
Preparation of semester report

Prerequisites
none

T 8.204 Course: SmartFactory@Industry (MEI) [T-MACH-106733]

Responsible: Prof. Dr.-Ing. Gisela Lanza
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102644 - Major Field: Production Engineering

Type	Credits	Recurrence	Version
Examination of another type	4	Each summer term	1

Events					
SS 2020	3150044	SmartFactory@Industry	2 SWS		Lanza
Exams					
WS 19/20	76-T-MACH-106733	SmartFactory@Industry (MEI)		Prüfung (PR)	Lanza

Competence Certificate
alternative test achievement (graded)

- colloquium (approx. 15 min)
- presentation (approx. 20 min)

Prerequisites
Successful completion of the following courses:

- M-MACH-102563 - Computer Science
- MACH-102573 - Mechanical Design

Modeled Conditions
The following conditions have to be fulfilled:

1. The module M-MACH-102563 - Computer Science must have been passed.
2. The module M-MACH-102573 - Mechanical Design must have been passed.

Below you will find excerpts from events related to this course:

V SmartFactory@Industry
3150044, SS 2020, 2 SWS, Language: English, Open in study portal

Content

The students will get to know different real industrial tasks and problems and will learn how to address them with the methods they got to know and even beyond these.

- Drive and control technology
- Handling technology for handling work pieces and tools
- Industrial Robotics
- automatic machines, cells, centers and systems for manufacturing and assembly
- planning of automated manufacturing systems

In the second part of the lecture, the basics are illustrated using implemented manufacturing processes for the production of automotive components. The analysis of automated manufacturing systems for manufacturing of defined components is also included.

Learning Goals:

The students …

- know about different processes in industry
- can accomplish industrial tasks on their-own and in groups
- can summarize their work in a comprehensive presentation for industrial receivers

Prerequisites:

S. Modul

Successful completion of the following courses:
Mechanical Design I-IV
Computer Science

T 8.205 Course: Solar Thermal Energy Systems [T-MACH-106493]

Responsible: Dr. Ron Dagan
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102816 - Major Field: Fundamentals of Energy Technology

Type	Credits	Recurrence	Version
Oral examination	4	Each winter term	3

Events					
WS 19/20	2189400	Solar Thermal Energy Systems	2 SWS	Lecture (V)	Dagan
Exams					
WS 19/20	76-T-MACH-106493	Solar Thermal Energy Systems		Prüfung (PR)	Dagan, Stieglitz
SS 2020	76-T-MACH-106493	Solar Thermal Energy Systems		Prüfung (PR)	Dagan

Competence Certificate
oral exam of about 30 minutes

Prerequisites
none

Recommendation
Literature

1. "Solar Engineering of Thermal Processes", 4th Edition, J. Duffie &W. Beckman. Published by Wiley & Sons
2. “Heat Transfer”, 10th Edition, J. P. Holman Mc. Graw Hill publisher
3. “Fundamentals of classical Thermodynamics”, G. Van Wylen & R. E. Sonntag. Published by Wiley &Sons

Below you will find excerpts from events related to this course:

V Solar Thermal Energy Systems

Lecture (V)

2189400, WS 19/20, 2 SWS, Language: English, Open in study portal

Content

The course deals with fundamental aspects of solar energy

1. Introduction to solar energy – global energy panorama

2. Solar energy resource-

Structure of the sun, Black body radiation, solar constant, solar spectral distribution

Sun-Earth geometrical relationship

3. Passive and active solar thermal applications.

4. Solar thermal systems- solar collector-types, concentrating collectors, solar towers,

Heat losses, efficiency

5. Selected topics on thermodynamics and heat transfer which are relevant for solar systems.

6. Introduction to Solar induced systems: Wind , Heat pumps, Biomass , Photovoltaic

7. Energy storage

The course deals with fundamental aspects of solar energy. Starting from a global energy panorama the course deals with the sun as a thermal energy source. In this context, basic issues such as the sun's structure, blackbody radiation and solar–earth geometrical relationship are discussed. In the next part, the lectures cover passive and active thermal applications and review various solar collector types including concentrating collectors and solar towers and the concept of solar tracking. Further, the collector design parameters determination is elaborated, leading to improved efficiency. This topic is augmented by a review of the main laws of thermodynamics and relevant heat transfer mechanisms.

The course ends with an overview on energy storage concepts which enhance practically the benefits of solar thermal energy systems.

The students get familiar with the global energy demand and the role of renewable energies learn about improved designs for using efficiently the potential of solar energy gain basic understanding of the main thermal hydraulic phenomena which support the work on future innovative applications will be able to evaluate quantitatively various aspects of the thermal solar systems.

Total 120 h, hereof 30 h contact hours and 90 h homework and self-studies

oral exam about 30 min.

Literature

- "Solar Engineering of Thermal Processes "4th Edition, J. Duffie &W. Beckman. Published by Wiley & Sons.
- "Heat Transfer", 10th Edition, P. Holman Mc. Graw Hill publisher.
- "Fundamentals of classical Thermodynamics", G. Van Wylen & R. E. Sonntag. Published by Wiley & Sons

T 8.206 Course: Strategic Product Development - Identification of Potentials of Innovative Products [T-MACH-105696]

Responsible: Prof. Dr.-Ing. Albert Albers
Prof. Dr.-Ing. Sven Matthiesen
Dr.-Ing. Andreas Siebe

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102812 - Major Field: Powertrain Systems
M-MACH-102815 - Major Field: Engineering Design
M-MACH-102818 - Major Field: Vehicle Technology

Type	Credits	Recurrence	Version
Oral examination	3	Each summer term	2

Events					
SS 2020	2146198	Strategic product development - identification of potentials of innovative products	2 SWS	Lecture (V)	Siebe

Competence Certificate
Oral exam in small groups (30 minutes)

Prerequisites
The precondition of this partial work is the successful processing of a case study(T-MACH-110396): written elaboration & presentation of the results (15 minutes)

Modeled Conditions
The following conditions have to be fulfilled:

1. The course T-MACH-110396 - Strategic Product Development - Identification of Potentials of Innovative Products - Case Study must have been passed.

Below you will find excerpts from events related to this course:

V Strategic product development - identification of potentials of innovative products

Lecture (V)

2146198, SS 2020, 2 SWS, Language: German, Open in study portal

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.

T 8.207 Course: Strategic Product Development - Identification of Potentials of Innovative Products - Case Study [T-MACH-110396]

Responsible: Prof. Dr.-Ing. Albert Albers
Prof. Dr.-Ing. Sven Matthiesen
Dr.-Ing. Andreas Siebe

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102812 - Major Field: Powertrain Systems
M-MACH-102815 - Major Field: Engineering Design
M-MACH-102818 - Major Field: Vehicle Technology

Type	Credits	Recurrence	Version
Completed coursework (practical)	1	Each summer term	1

Events					
SS 2020	2146198	Strategic product development - identification of potentials of innovative products	2 SWS	Lecture (V)	Siebe

Competence Certificate
Successful processing of a case study(T-MACH-110396): written elaboration & presentation of the results (15 minutes)

Below you will find excerpts from events related to this course:

V Strategic product development - identification of potentials of innovative products

Lecture (V)

2146198, SS 2020, 2 SWS, Language: German, Open in study portal

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.

T 8.208 Course: Structural Analysis of Composite Laminates [T-MACH-105970]

Responsible: Dr.-Ing. Luise Kärger
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102746 - Compulsory Elective Module
M-MACH-102819 - Major Field: Materials Science and Engineering

Type	Credits	Recurrence	Version
Oral examination	4	Each winter term	1

Events					
WS 19/20	2113106	Structural Analysis of Composite Laminates	2 SWS	Lecture (V)	Kärger
Exams					
WS 19/20	76-T-MACH 105970	Structural Analysis of Composite Laminates		Prüfung (PR)	Kärger

Competence Certificate
oral exam, 20 min

Prerequisites
none

Below you will find excerpts from events related to this course:

V Structural Analysis of Composite Laminates

Lecture (V)

2113106, WS 19/20, 2 SWS, Language: German, Open in study portal

T 8.209 Course: Sustainable Product Engineering [T-MACH-105358]

Responsible: Prof. Dr.-Ing. Albert Albers
Prof. Dr.-Ing. Sven Matthiesen
Dr. Karl-Friedrich Ziegahn

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102583 - Major Field: Information Management
M-MACH-102812 - Major Field: Powertrain Systems
M-MACH-102815 - Major Field: Engineering Design
M-MACH-102818 - Major Field: Vehicle Technology
M-MACH-102820 - Major Field: Mechatronics

Type	Credits	Recurrence	Version
Written examination	4	Each summer term	1

Events					
SS 2020	2146192	Sustainable Product Engineering	2 SWS	Lecture (V)	Ziegahn

Competence Certificate
written exam (60 min)

Prerequisites
none

Below you will find excerpts from events related to this course:

V Sustainable Product Engineering
2146192, SS 2020, 2 SWS, Open in study portal

Lecture (V)

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

The goal of the lecture is to convey the main elements of sustainable product development in the economic, social and ecological context.

The students are able to ...

- identify und describe the 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.
- discuss the skills for life-cycle product design using the example of complex automotive components such as airbag systems and other current products.
- understand the 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.
- develop skills such as team skills / project / self / presentation based on realistic projects.

T 8.210 Course: System Integration in Micro- and Nanotechnology [T-MACH-105555]

Responsible: Dr. Ulrich Gengenbach
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102820 - Major Field: Mechatronics

Type	Credits	Recurrence	Version
Oral examination	4	Each summer term	1

Events					
SS 2020	2106033	System Integration in Micro- and Nanotechnology	2 SWS	Lecture (V)	Gengenbach

Competence Certificate
oral exam (Duration: 30 min)

Prerequisites
none

Below you will find excerpts from events related to this course:

V System Integration in Micro- and Nanotechnology
2106033, SS 2020, 2 SWS, Language: German, Open in study portal

Lecture (V)

Content
Content:

- Introduction
- Definition system integration
- Integration of mechanical functions (flexures)
- Plasma treatment of surfaces
- Adhesive bonding
    - Packaging
    - Low Temperature Cofired Ceramics (LTCC)
    - Assembly of hybrid systems

- Monolithic/hybrid system integration)
- Modular system integration

- Integration of electrical/electronic functions
- Mounting techniques
- molded Interconnect Devices (MID)
- Functional printing

- Coating
- Capping
- Housing

First steps towards system integration nanotechnology

Learning objectives:

Students acquire fundamental knowledge about challenges and system integration processes.

Literature

- A. Risse, Fertigungsverfahren der Mechatronik, Feinwerk- und Präzisionsgerätetechnik, Vieweg+Teubner Verlag, Wiesbaden, 2012
- M. Madou, Fundamentals of microfabrication and nanotechnology, CRC Press Boca Raton, 2012
- G. Habenicht, Kleben Grundlagen, Technologien, Anwendungen, Springer-Verlag Berlin Heidelberg, 2009
- J. Franke, Räumliche elektronische Baugruppen (3D-MID), Carl Hanser-Verlag München, 2013

T 8.211 Course: Systematic Materials Selection [T-MACH-100531]

Responsible: Dr.-Ing. Stefan Dietrich
Prof. Dr.-Ing. Volker Schulze

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102746 - Compulsory Elective Module

Type	Credits	Recurrence	Version
Written examination	4	Each summer term	3

Events					
SS 2020	2174576	Systematic Materials Selection	3 SWS	Lecture (V)	Dietrich
SS 2020	2174577	Übungen zu 'Systematische Werkstoffauswahl'	1 SWS	Practice (Ü)	Dietrich, Mitarbeiter
Exams					
WS 19/20	76-T-MACH-100531	Systematic Materials Selection		Prüfung (PR)	Dietrich

Competence Certificate
The assessment is carried out as a written exam of 2 h.

Prerequisites
M-MACH-102562 - Materials Science must be passed.

Modeled Conditions
The following conditions have to be fulfilled:

1. The module M-MACH-102562 - Materials Science must have been passed.

Recommendation
Basic knowledge in materials science, mechanics and mechanical design due to the lecture Materials Science I/II.

Below you will find excerpts from events related to this course:

V Systematic Materials Selection

2174576, SS 2020, 3 SWS, Language: German, Open in study portal

Lecture (V)

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:

- Information and introduction
- Necessary basics of materials
- Selected methods / approaches of the material selection
- Examples for material indices and materials property charts
- Trade-off and shape factors
- Sandwich materials and composite materials
- High temperature alloys
- Regard of process influences
- Material selection for production lines
- Incorrect material selection and the resulting consequences
- Abstract and possibility to ask questions

learning objectives:
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.
requirements:

WiIng SPO 2007 (B.Sc.)

The course Material Science I [21760] has to be completed beforehand.

WiIng (M.Sc.)

The course Material Science I [21760] has to be completed beforehand.

workload:

The workload for the lecture is 120 h per semester and consists of the presence during the lecture (30 h) as well as preparation and rework time at home (30 h) and preparation time for the oral exam (60 h).

Literature
Vorlesungsskriptum; Übungsblätter; Lehrbuch: 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

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

T 8.212 Course: Technical Design in Product Development [T-MACH-105361]

Responsible: Prof. Dr.-Ing. Albert Albers
Prof. Dr.-Ing. Sven Matthiesen
Dr.-Ing. Markus Schmid

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102815 - Major Field: Engineering Design

Type	Credits	Recurrence	Version
Written examination	4	Each summer term	1

Events					
SS 2020	2146179	Technical Design in Product Development	2 SWS	Lecture (V)	Schmid

Competence Certificate
Written exam (60 min)

Only dictionnary is allowed

Prerequisites
none

Below you will find excerpts from events related to this course:

V Technical Design in Product Development

2146179, SS 2020, 2 SWS, Language: German, Open in study portal

Lecture (V)

Literature
Hexact (R) Lehr- und Lernportal

T 8.213 Course: Technical Thermodynamics and Heat Transfer I [T-MACH-104747]

Responsible: Prof. Dr. Ulrich Maas
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102574 - Technical Thermodynamics

Type	Credits	Recurrence	Version
Written examination	8	Each winter term	2

Events					
WS 19/20	2165501	Technical Thermodynamics and Heat Transfer I	4 SWS	Lecture (V)	Maas
WS 19/20	3165014	Technical Thermodynamics and Heat Transfer I	4 SWS	Lecture (V)	Schießl, Maas
Exams					
WS 19/20	76-T-MACH-104747	Technical Thermodynamics and Heat Transfer I		Prüfung (PR)	Maas
WS 19/20	76-T-MACH-104747-english	Technical Thermodynamics and Heat Transfer I		Prüfung (PR)	Maas
WS 19/20	76-T-MACH-104747-Wiederholer	Technical Thermodynamics and Heat Transfer I		Prüfung (PR)	Maas

Competence Certificate
Written exam [duration: 180 min]

Prerequisites
Successful participation in the tutorial (T-MACH-105204 - Excercises in Technical Thermodynamics and Heat Transfer I)

Modeled Conditions
The following conditions have to be fulfilled:

1. The course T-MACH-105204 - Excercises in Technical Thermodynamics and Heat Transfer I must have been passed.

Below you will find excerpts from events related to this course:

V Technical Thermodynamics and Heat Transfer I

Lecture (V)

2165501, WS 19/20, 4 SWS, Language: German, Open in study portal

Literature
Vorlesungsskriptum

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.

T 8.214 Course: Technical Thermodynamics and Heat Transfer II [T-MACH-105287]

Responsible: Prof. Dr. Ulrich Maas
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102574 - Technical Thermodynamics

Type	Credits	Recurrence	Version
Written examination	7	Each summer term	1

Events					
SS 2020	2166526	Technical Thermodynamics and Heat Transfer II	3 SWS	Lecture (V)	Maas
SS 2020	3166526	Technical Thermodynamics and Heat Transfer II	3 SWS	Lecture (V)	Schießl
Exams					
WS 19/20	76-T-MACH-105287	Technical Thermodynamics and Heat Transfer II		Prüfung (PR)	Maas
WS 19/20	76-T-MACH-105287-english	Technical Thermodynamics and Heat Transfer II		Prüfung (PR)	Maas
WS 19/20	76-T-MACH-105287-Wiederholer	Technical Thermodynamics and Heat Transfer II		Prüfung (PR)	Maas

Competence Certificate
Written exam [duration: 180 min]

Prerequisites
Successful participation in the tutorial (T-MACH-105288 - Exercises in Technical Thermodynamics and Heat Transfer II)

Modeled Conditions
The following conditions have to be fulfilled:

1. The course T-MACH-105288 - Excercises in Technical Thermodynamics and Heat Transfer II must have been passed.

Below you will find excerpts from events related to this course:

V Technical Thermodynamics and Heat Transfer II

2166526, SS 2020, 3 SWS, Language: German, Open in study portal

Lecture (V)

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

Literature
Vorlesungsskriptum

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.

T 8.215 Course: Technology of Steel Components [T-MACH-105362]

Responsible: Prof. Dr.-Ing. Volker Schulze
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102819 - Major Field: Materials Science and Engineering

Type	Credits	Recurrence	Version
Oral examination	4	Each summer term	2

Events					
SS 2020	2174579	Technology of steel components	2 SWS	Lecture (V)	Schulze
Exams					
WS 19/20	76-T-MACH-105362	Technology of Steel Components		Prüfung (PR)	Schulze

Competence Certificate
Oral exam, about 25 minutes

Prerequisites
M-MACH-102562 - Materials Science must be passed.

Modeled Conditions
The following conditions have to be fulfilled:

1. The module M-MACH-102562 - Materials Science must have been passed.

Below you will find excerpts from events related to this course:

V Technology of steel components
2174579, SS 2020, 2 SWS, Language: German, Open in study portal **Lecture (V)**

Content
Meaning, Development and characterization of component states

Description of the influence of component state on mechanical properties

Stability of component states

Steel manufacturing

Component states due to forming

Component states due to heat treatments

Component states due to surface hardening

Component states due to machining

Component states due to mechanical surface treatments

Component states due to joining

Summarizing evaluation

learning objectives:
The students have the background to evaluate the influence of manufacture processes on the compound state of metallic compounds. The students can assess the influence and the stability of compound state under mechanical load. The students are capable to describe the individual aspects of interaction of the compound state of steel components due to forming, heat treatment, mechanical surface treatment and joining processes.
requirements:
Materials Science and Engineering I & II
workload:

regular attendance: 21 hours
self-study: 99 hours

Literature

Skript wird in der Vorlesung ausgegeben

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

T 8.216 Course: Theoretical Description of Mechatronic Systems [T-MACH-105521]

Responsible: Prof. Dr.-Ing. Wolfgang Seemann
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102820 - Major Field: Mechatronics

Type	Credits	Recurrence	Version
Oral examination	4	Each winter term	1

Events					
WS 19/20	2161117	Theoretical Description of Mechatronic Systems	2 SWS	Lecture (V)	Seemann
Exams					
WS 19/20	76-T-MACH-105521	Theoretical Description of Mechatronic Systems		Prüfung (PR)	Seemann
SS 2020	76-T-MACH-105521	Theoretical Description of Mechatronic Systems		Prüfung (PR)	Seemann

Competence Certificate
oral exam, approx. 30 min..

Prerequisites
none

Below you will find excerpts from events related to this course:

V Theoretical Description of Mechatronic Systems

2161117, WS 19/20, 2 SWS, Language: German, Open in study portal

Lecture (V)

Content
Aim of the course is to provide principles and tools to derive the mathematical models of mechatronic systems. The students are able to generate physical models of mechatronic systems. They know the description by across and through variables. With the help of energy principles variational methods can be applied to electromechanic systems. The basics of applied mechanics and of electric systems are known. The students are able to complete the mechatronic system by a corresponding tool.

T 8.217 Course: Theory of Stability [T-MACH-105372]

Responsible: Prof. Dr.-Ing. Alexander Fidlin
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102820 - Major Field: Mechatronics
M-MACH-104442 - Major Field: Vibration Theory

Type	Credits	Recurrence	Version
Oral examination	6	Each summer term	1

Events					
SS 2020	2163113	Theory of Stability	2 SWS	Lecture (V)	Fidlin
SS 2020	2163114	Übungen zu Stabilitätstheorie	2 SWS	Practice (Ü)	Fidlin, Aramendiz Fuentes
Exams					
WS 19/20	76-T-MACH-105372	Theory of Stability		Prüfung (PR)	Fidlin
SS 2020	76-T-MACH-105372	Theory of Stability		Prüfung (PR)	Fidlin

Competence Certificate
oral exam, 30 min.

Prerequisites
none

Recommendation
Vibration theory, Mathematical Methods of Vibration Theory

Below you will find excerpts from events related to this course:

V Theory of Stability

Lecture (V)

2163113, SS 2020, 2 SWS, Language: German, Open in study portal

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.

T 8.218 Course: Thermal Solar Energy [T-MACH-105225]

Responsible: Prof. Dr. Robert Stieglitz
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102816 - Major Field: Fundamentals of Energy Technology

Type	Credits	Recurrence	Version
Oral examination	4	Each winter term	1

Events					
WS 19/20	2169472	Thermal Solar Energy	2 SWS	Lecture (V)	Stieglitz
Exams					
WS 19/20	76-T-MACH-105225	Thermal Solar Energy		Prüfung (PR)	Stieglitz
SS 2020	76-T-MACH-105225	Thermal Solar Energy		Prüfung (PR)	Stieglitz

Competence Certificate
Oral examination, 30 minutes

Prerequisites
none

Below you will find excerpts from events related to this course:

V Thermal Solar Energy

Lecture (V)

2169472, WS 19/20, 2 SWS, Language: German, Open in study portal

Content
Basics 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 climatisation.

In detail:

1 Introduction to energy requirements and evaluation of the potential use of solar thermal energy.

2 Primary energy source SUN: sun, solar constant, radiation (direct, diffuse scattering, absorption, impact angle, radiation balance).

3 Solar collectors: schematic structure of a collector, fundamentals of efficiency, meaning of concentration and their limitations.

4 Passive solar mechanisms: heat conduction in solids and gases, radiation heat transfer in transparent and opaque bodies, selective absorber - typical materials and manufacturing processes.

5 Momentum and heat transport: basic equations of single and multiphase transport, calculation methods, stability limits.

optional

6 Low temperature solar thermal systems: collector types, methods for system simulation, planning and dimensioning of systems, system design and stagnation scenarios.

7 High temperature solar thermal systems: solar towers and solar-farm concept, loss mechanisms, chimney power plants and energy production processes

The lecture elaborates the basics of the solar technology and the definition of the major wordings and its physical 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 end the ways for solar cooling is discussed.

The aim of the course is to provide the basic physical principles and the derivation of key parameters for the individual solar thermal use. This involves in addition to the selective absorber, mirrors, glasses, and storage technology. In addition, a utilization of solar thermal energy means an interlink of the collector with a thermal-hydraulic circuit and a storage. The goal is to capture the regularities of linking to derive efficiency correlations as a function of their use and evaluate the performance of the entire system.

Recommendations / previous knowledge

Basics in heat and mass transfer, material science and fluid mechanics, desirable are reliable knowledge in physics in optics and thermodynamics

Oral exam of about 25 minutes, no tools or reference materials may be used during the exam

Literature
Bereitstellung des Sudienmaterials in gedruckter und elektronischer Form.

Stieglitz & Heinzel; Thermische Solarenergie -Grundlagen-Technologie- Anwendungen. Springer Vieweg Verlag. 711 Seiten. ISBN 978-3-642-29474-7

T 8.219 Course: Thermal Turbomachines I [T-MACH-105363]

Responsible: Prof. Dr.-Ing. Hans-Jörg Bauer
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102838 - Major Field: Energy Converting Engines

Type	Credits	Recurrence	Version
Oral examination	6	Each winter term	1

Events					
WS 19/20	2169453	Thermal Turbomachines I	3 SWS	Lecture / Practice (VÜ)	Bauer
WS 19/20	2169454	Tutorial - Thermal Turbo Machines I (Übungen zu Thermische Turbomaschinen I)	2 SWS	Practice (Ü)	Bauer
WS 19/20	2169553	Thermal Turbomachines I (in English)	3 SWS	Lecture / Practice (VÜ)	Bauer
Exams					
WS 19/20	76-T-MACH-105363	Thermal Turbomachines I		Prüfung (PR)	Bauer
WS 19/20	76-T-MACH-105363-Wdh	Thermal Turbomachines I (for repeaters)		Prüfung (PR)	Bauer
SS 2020	76-T-MACH-105363	Thermal Turbomachines I		Prüfung (PR)	Bauer

Competence Certificate
oral exam, duration 30 min.

Prerequisites
none

Below you will find excerpts from events related to this course:

V Thermal Turbomachines I

2169453, WS 19/20, 3 SWS, Language: German, Open in study portal

Lecture / Practice (VÜ)

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

The students are able to explain and comment on the design and operation of thermal turbomachines in detail. Moreover, they can evaluate the range of applications for turbomachinery. Therefore, students are able to to describe and analyse not only the individual components but also entire assemblies. The students can asses and evaluate the effects of physical, economical and ecological boundary conditions.

regular attendance: 31,50 h
self-study: 64,40 h

Recommendations:

Recommended in combination with the lecture 'Thermal Turbomachines II'.

Examination:

oral
Duration: approximately 30 min

no tools or reference materials may be used during the exam

Literature
Vorlesungsskript (erhältlich im 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

V **Thermal Turbomachines I (in English)** — **Lecture / Practice (VÜ)**
2169553, WS 19/20, 3 SWS, Language: English, Open in study portal

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

Recommendations:

Recommended in combination with the lecture 'Thermal Turbomachines II'.

The students are able to explain and comment on the design and operation of thermal turbomachines in detail. Moreover, they can evaluate the range of applications for turbomachinery. Therefore, students are able to to describe and analyse not only the individual components but also entire assemblies. The students can asses and evaluate the effects of physical, economical and ecological boundary conditions.

regular attendance: 31,50 h
self-study: 64,40 h

Exam:

oral
Duration: approximately 30 min

no tools or reference materials may be used during the exam

Literature
Vorlesungsskript (erhältlich im 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

T 8.220 Course: Thermal Turbomachines II [T-MACH-105364]

Responsible: Prof. Dr.-Ing. Hans-Jörg Bauer
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102838 - Major Field: Energy Converting Engines

Type	Credits	Recurrence	Version
Oral examination	6	Each summer term	2

Events					
SS 2020	2170476	Thermal Turbomachines II	3 SWS	Lecture (V)	Bauer
SS 2020	2170477	Tutorial - Thermal Turbomachines II (Übung - Thermische Turbomaschinen II)	2 SWS	Practice (Ü)	Bauer, Mitarbeiter
SS 2020	2170553	Thermal Turbomachines II (in English)	3 SWS	Lecture / Practice (VÜ)	Bauer, Mitarbeiter
Exams					
WS 19/20	76-T-MACH-105364	Thermal Turbomachines II		Prüfung (PR)	Bauer
SS 2020	76-T-MACH-105364	Thermal Turbomachines II		Prüfung (PR)	Bauer

Competence Certificate
oral exam, duration: 30 min.

Prerequisites
none

Below you will find excerpts from events related to this course:

V Thermal Turbomachines II — Lecture (V)
2170476, SS 2020, 3 SWS, Language: German, Open in study portal

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

Based on the fundamental skills learned in 'Thermal Turbomachines I' the students have the ability to design turbines and compressors and to analyse the operational behavior of these machines.

Recommendations:

Recommended in combination with the lecture 'Thermal Turbomachines I'.

regular attendance: 31,50 h
self-study: 64,40 h

Exam:

oral (can only be taken in combination with 'Thermal Turbomachines I')
Duration: 30 min (--> 1 hour including Thermal Turbomachines I)

Auxiliary: no tools or reference materials may be used during the exam

Literature
Vorlesungsskript (erhältlich im 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

V **Thermal Turbomachines II (in English)** **Lecture / Practice (VÜ)**
2170553, SS 2020, 3 SWS, Language: English, Open in study portal

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

Recommendations:

Recommended in combination with the lecture 'Thermal Turbomachines II'.

regular attendance: 31,50 h
self-study: 64,40 h

The students are able to explain and comment on the design and operation of thermal turbomachines in detail. Moreover, they can evaluate the range of applications for turbomachinery. Therefore, students are able to to describe and analyse not only the individual components but also entire assemblies. The students can asses and evaluate the effects of physical, economical and ecological boundary conditions.

Exam:

oral

Duration: approximately 30 min

no tools or reference materials may be used during the exam.

Literature
Vorlesungsskript (erhältlich im 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

T 8.221 Course: Tires and Wheel Development for Passenger Cars [T-MACH-102207]

Responsible: Dr.-Ing. Günter Leister
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102818 - Major Field: Vehicle Technology

Type	Credits	Recurrence	Version
Oral examination	4	Each summer term	1

Events					
SS 2020	2114845	Tires and Wheel Development for Passenger Cars	2 SWS	Lecture (V)	Leister
Exams					
WS 19/20	76-T-MACH-102207	Tires and Wheel Development for Passenger Cars		Prüfung (PR)	Leister

Competence Certificate
Oral Examination

Duration: 30 up to 40 minutes

Auxiliary means: none

Prerequisites
none

Below you will find excerpts from events related to this course:

V Tires and Wheel Development for Passenger Cars

2114845, SS 2020, 2 SWS, Open in study portal

Lecture (V)

Content

1. The role of the tires and wheels in a vehicle
2. Geometrie of Wheel and tire, Package, load capacity and endurance, 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
6. Wheel technology incuding Design and manifacturing methods, Wheeltesting
7. Tire presssure: Indirect and direct measuring systems
8. Tire testing subjective and objective

Learning Objectives:

The students are informed about the interactions of tires, wheels and chassis. They have an overview of the processes regarding the tire and wheel development. They have knowledge of the physical relationships.

Literature
Manuskript zur Vorlesung

Manuscript to the lecture

T 8.222 Course: Tribology [T-MACH-105531]

Responsible: Prof. Dr. Martin Dienwiebel
Prof. Dr.-Ing. Matthias Scherge

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102812 - Major Field: Powertrain Systems

Type	Credits	Recurrence	Version
Oral examination	8	Each winter term	2

Events					
WS 19/20	2181114	Tribology	5 SWS	Lecture / Practice (VÜ)	Dienwiebel, Scherge
Exams					
WS 19/20	76-T-MACH-105531	Tribology		Prüfung (PR)	Dienwiebel

Competence Certificate
oral examination (ca. 40 min)

no tools or reference materials

Prerequisites
admission to the exam only with successful completion of the exercises [T-MACH-109303]

Modeled Conditions
The following conditions have to be fulfilled:

1. The course T-MACH-109303 - Exercices - Tribology must have been passed.

Recommendation
preliminary knowlegde in mathematics, mechanics and materials science

Below you will find excerpts from events related to this course:

V Tribology

2181114, WS 19/20, 5 SWS, Language: German, Open in study portal

Lecture / Practice (VÜ)

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.
- Chapter 4: Measurement Techniques
  friction measurement, tribometer, dissipated frictional power, conventional wear measurement, continuous wear measurement(RNT)
- Chapter 5: Roughness
  profilometry, surface roughness parameters, evaluation length and filters, bearing ratio curve, measurement error
- Chapter 6: Accompanying Analysis
  multi-scale topography measurement, chemical surface analysis, structural analysis, mechanical analysis

Exercises are used for complementing and deepening the contents of the lecture as well as for answering more extensive questions raised by the students.

The student can

- describe the fundamental friction and wear mechanisms, which occur in tribologically stressed systems
- evaluate the friction and wear behavior of tribological systems
- explain the effects of lubricants and their most important additives
- identify suitable approaches to optimize tribological systems
- explain the most important experimental methods for the measurement of friction and wear, and is able to use them for the characterisation of tribo pairs
- choose suitable methods for the evaluation of roughness and topography from the nm-scale to the mm-scale and is able to interpret the determined values in respect to their effect on the tribological behavior
- describe the most important surface-analytical methods and their physical principles for the characterization of tribologically stressed sliding surfaces

preliminary knowlegde in mathematics, mechanics and materials science recommended

regular attendance: 45 hours
self-study: 195 hours

oral examination (ca. 40 min)

no tools or reference materials

admission to the exam only with successful completion of the exercises

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)

T 8.223 Course: Turbo Jet Engines [T-MACH-105366]

Responsible: Prof. Dr.-Ing. Hans-Jörg Bauer
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102838 - Major Field: Energy Converting Engines

Type	Credits	Recurrence	Version
Oral examination	4	Each summer term	1

Events					
SS 2020	2170478	Turbo Jet Engines	2 SWS	Lecture (V)	Bauer, Mitarbeiter
Exams					
WS 19/20	76-T-MACH-105366	Turbo Jet Engines		Prüfung (PR)	Bauer, Schulz
SS 2020	76-T-MACH-105366	Turbo Jet Engines		Prüfung (PR)	Bauer, Schulz

Competence Certificate
oral exam, duration: 20 min.

Prerequisites
none

Below you will find excerpts from events related to this course:

V Turbo Jet Engines
2170478, SS 2020, 2 SWS, Language: German, Open in study portal

Lecture (V)

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
The students have the ability to:

- compare the design concepts of modern jet engines
- analyse the operation of modern jet engines
- apply the thermodynamic and fluidmechanic basics of jet engines
- choose the main components intake, compressor, combustor, turbine and thrust nozzle based on given criteria
- comment on different methods for the reduction of pollutant emissions, noise and fuel consumption

regular attendance:21 h
self-study: 42 h
Exam:
oral
Duration: approximately 30 minutes

no tools or reference materials may be used during the exam

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

T 8.224 Course: Tutorial Advanced Mathematics I [T-MATH-100525]

Responsible: PD Dr. Tilo Arens
Prof. Dr. Roland Griesmaier
PD Dr. Frank Hettlich

Organisation: KIT Department of Mathematics

Part of: M-MATH-102859 - Advanced Mathematics

Type	Credits	Recurrence	Version
Completed coursework (written)	0	Each winter term	2

Events					
WS 19/20	0131100	Übungen zu 0131000	2 SWS	Practice (Ü)	Arens
WS 19/20	0131300	Übungen zu 0131200	2 SWS	Practice (Ü)	Arens
Exams					
WS 19/20	6700005	Problem Class for Advanced Mathematics I		Prüfung (PR)	Arens, Griesmaier, Hettlich

Competence Certificate
Learning assessment is carried out by written assigments (pre-requesite). Exact requirements will be communicated in the lectures.

Prerequisites
None.

8.225 Course: Tutorial Advanced Mathematics II [T-MATH-100526]

Responsible: PD Dr. Tilo Arens
Prof. Dr. Roland Griesmaier
PD Dr. Frank Hettlich

Organisation: KIT Department of Mathematics

Part of: M-MATH-102859 - Advanced Mathematics

Type	Credits	Recurrence	Version
Completed coursework (written)	0	Each summer term	2

Events					
SS 2020	0180900	Übungen zu 0180800	2 SWS	Practice (Ü)	Hettlich
SS 2020	0181100	Übungen zu 0181000	2 SWS	Practice (Ü)	Hettlich

Competence Certificate
Learning assessment is carried out by written assigments (pre-requesite). Exact requirements will be communicated in the lectures.

Prerequisites
None.

T 8.226 Course: Tutorial Advanced Mathematics III [T-MATH-100527]

Responsible: PD Dr. Tilo Arens
Prof. Dr. Roland Griesmaier
PD Dr. Frank Hettlich

Organisation: KIT Department of Mathematics

Part of: M-MATH-102859 - Advanced Mathematics

Type	Credits	Recurrence	Version
Completed coursework (written)	0	Each winter term	2

Events					
WS 19/20	0131500	Übungen zu 0131400	2 SWS	Practice (Ü)	Griesmaier
Exams					
WS 19/20	6700006	Tutorial Advanced Mathematics III		Prüfung (PR)	Arens, Griesmaier, Hettlich

Competence Certificate
Learning assessment is carried out by written assigments (pre-requesite). Exact requirements will be communicated in the lectures.

Prerequisites
None.

8.227 Course: Tutorial Continuum Mechanics of Solids and Fluids [T-MACH-110333]

Responsible: Prof. Dr.-Ing. Thomas Böhlke
Prof. Dr.-Ing. Bettina Frohnapfel

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102746 - Compulsory Elective Module

Type	Credits	Recurrence	Version
Completed coursework	1	Each winter term	1

Events					
WS 19/20	2161253	Tutorial Continuum mechanics of solids and fluids	1 SWS	Practice (Ü)	Dyck, Böhlke
Exams					
WS 19/20	76-T-MACH-110333	Tutorial Continuum Mechanics of solids and fluids		Prüfung (PR)	Böhlke, Frohnapfel

Competence Certificate
Successfully passing the Tutorial is a prerequisite for taking part in the exam "Continuum Mechanics of Solids and Fluids" (T-MACH-110377)

For students of Mechanical Engineering (Bachelor) that have chosen the Major Field "Continuum Mechanics", the prerequisites consist of successfully solving the written homework sheets as well as the computational homework sheets using the commercial Finite Element Program Abaqus.during the associated Lab Course.

For students of Mechanical Engineering (Bachelor) that have chosen a different Major Field of students from different fields of study the prerequisites consist of successfully solving only the written homework sheets. For organizational matters these students can not take part into the Lab Course.

Prerequisites
None

Below you will find excerpts from events related to this course:

V Tutorial Continuum mechanics of solids and fluids

Practice (Ü)

2161253, WS 19/20, 1 SWS, Language: German, Open in study portal

Content
Please refer to the lecture "Continuum mechanics of solids and fluids".

Literature
Siehe Vorlesung " Kontinuumsmechanik der Festkörper und Fluide ".

Please refer to the lecture "Continuum mechanics of solids and fluids".

T 8.228 Course: Tutorial Engineering Mechanics I [T-MACH-100528]

Responsible: Prof. Dr.-Ing. Thomas Böhlke
Dr.-Ing. Tom-Alexander Langhoff

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102572 - Engineering Mechanics

Type	Credits	Recurrence	Version
Completed coursework	0	Each winter term	2

Events					
WS 19/20	2161246	Tutorial Engineering Mechanics I	2 SWS	Practice (Ü)	Lang, Gajek, Böhlke
WS 19/20	3161011	Engineering Mechanics I (Tutorial)	2 SWS	Practice (Ü)	Pallicity, Langhoff
Exams					
WS 19/20	76-T-MACH-100528	Tutorial Engineering Mechanics I		Prüfung (PR)	Böhlke, Langhoff
WS 19/20	76-T-MACH-100528-englisch	Tutorial Engineering Mechanics I		Prüfung (PR)	Böhlke, Langhoff

Competence Certificate
Attestations have to be achieved in the following four categories: mandatory written homework problems, written homework problems, computational homework problems, colloquia.

This course is passed if all mandatory written homework problems are passed and if in the other three categories (written homework problems, computational homework problems, colloquia) in total at most three attestations have been finally not passed, at most one in each of the three categories.

Succesful participation in this course allows for registration to the Exam "Engineering Mechanics I" (see T-MACH-100282)

Prerequisites
None

Below you will find excerpts from events related to this course:

V Tutorial Engineering Mechanics I

Practice (Ü)

2161246, WS 19/20, 2 SWS, Language: German, Open in study portal

Content
Please refer to the lecture Engineering Mechanics I.

Literature
Siehe Vorlesung Technische Mechanik I

T 8.229 Course: Tutorial Engineering Mechanics II [T-MACH-100284]

Responsible: Prof. Dr.-Ing. Thomas Böhlke
Dr.-Ing. Tom-Alexander Langhoff

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102572 - Engineering Mechanics

Type	Credits	Recurrence	Version
Completed coursework (written)	0	Each summer term	2

Events					
SS 2020	2162251	Tutorial Engineering Mechanics II	2 SWS	Practice (Ü)	Dyck, Gajek, Böhlke
SS 2020	3162011	Engineering Mechanics II (Tutorial)	2 SWS	Practice (Ü)	Pallicity, Langhoff

Competence Certificate
Attestations have to be achieved in the following four categories: mandatory written homework problems, written homework problems, computational homework problems, colloquia.

This course is passed if all mandatory written homework problems are passed and if in the other three categories (written homework problems, computational homework problems, colloquia) in total at most two attestations have been finally not passed, at most one in each of the three categories.

Succesful participation in this course allows for registration to the Exam "Engineering Mechanics II" (see T-MACH-100283)

Prerequisites
None

Below you will find excerpts from events related to this course:

V Tutorial Engineering Mechanics II

Practice (Ü)

2162251, SS 2020, 2 SWS, Language: German, Open in study portal

Content
see lecture Engineering Mechanics II

Literature
Siehe Vorlesung Technische Mechanik II

V Engineering Mechanics II (Tutorial)

Practice (Ü)

3162011, SS 2020, 2 SWS, Language: English, Open in study portal

Content
see lecture "Engineering Mechanics II"

Literature
see lecture "Engineering Mechanics II"

T 8.230 Course: Tutorial Engineering Mechanics III [T-MACH-105202]

Responsible: Prof. Dr.-Ing. Wolfgang Seemann
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102572 - Engineering Mechanics

Type	Credits	Recurrence	Version
Completed coursework (written)	0	Each winter term	2

Events					
WS 19/20	2161204	Engineering Mechanics III (Tutorial)	2 SWS	Practice (Ü)	Seemann, Keller, N.N.
WS 19/20	3161013	Engineering Mechanics III (Tutorial)	2 SWS	Practice (Ü)	Seemann, Keller
Exams					
WS 19/20	76-T-MACH-105202	Tutorial Engineering Mechanics III		Prüfung (PR)	Seemann

Competence Certificate
Attestations, succesful accomplishment of exercise sheets

Prerequisites
None

Below you will find excerpts from events related to this course:

V Engineering Mechanics III (Tutorial)

Practice (Ü)

2161204, WS 19/20, 2 SWS, Language: German, Open in study portal

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.

V Engineering Mechanics III (Tutorial)

Practice (Ü)

3161013, WS 19/20, 2 SWS, Language: English, Open in study portal

Content
Exercises related to the lecture

T 8.231 Course: Tutorial Engineering Mechanics IV [T-MACH-105203]

Responsible: Prof. Dr.-Ing. Wolfgang Seemann
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102572 - Engineering Mechanics

Type	Credits	Recurrence	Version
Completed coursework (written)	0	Each summer term	1

Events					
SS 2020	2162232	Engineering Mechanics IV (Tutorial)	2 SWS	Practice (Ü)	Seemann, Bitner, Schröders
SS 2020	3162013	Engineering Mechanics 4 (Tutorial)	2 SWS	Practice (Ü)	Seemann, Bitner, Schröders

Competence Certificate
Attestations, succesful accomplishment of exercise sheets

Below you will find excerpts from events related to this course:

V Engineering Mechanics IV (Tutorial)

2162232, SS 2020, 2 SWS, Language: German, Open in study portal

Practice (Ü)

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

T 8.232 Course: Tutorial Mathematical Methods in Continuum Mechanics [T-MACH-110376]

Responsible: Prof. Dr.-Ing. Thomas Böhlke
Organisation: KIT Department of Mechanical Engineering
Part of: M-MACH-102746 - Compulsory Elective Module

Type	Credits	Recurrence	Expansion	Version
Completed coursework	2	Each winter term	1 terms	2

Events					
WS 19/20	2161255	Tutorial Mathematical Methods in Confinuum Mechanics	2 SWS	Practice (Ü)	Wicht, Böhlke
Exams					
WS 19/20	76-T-MACH-110376	Tutorial Mathematical Methods in Continuum Mechanics		Prüfung (PR)	Böhlke

Competence Certificate
successfully solving the homework sheets. Details are announced in the first lecture.

Prerequisites
None

Below you will find excerpts from events related to this course:

V Tutorial Mathematical Methods in Confinuum Mechanics

Practice (Ü)

2161255, WS 19/20, 2 SWS, Language: German, Open in study portal

Content
See "Mathematical Methods in Continuum Mechanics"

Literature
Siehe "Mathematische Methoden der Kontinuumsmechanik"

T 8.233 Course: Value Stream within Enterprises – The Value Chain at Bosch [T-MACH-106375]

Responsible: Dr. Rudolf Maier
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102576 - Key Competences

Type	Credits	Recurrence	Version
Completed coursework	2	Each winter term	1

Events					
WS 19/20	2149661	The value stream in an industrial company - The value chain at BOSCH as an example	2 SWS	Seminar (S)	Maier
Exams					
WS 19/20	76-T-MACH-106375	Value stream within enterprises – The value chain at Bosch		Prüfung (PR)	Fleischer, Maier

Competence Certificate
alternative achievement (ungraded):
- attendance on at least 12 lecture units

Prerequisites
none

Below you will find excerpts from events related to this course:

V The value stream in an industrial company - The value chain at BOSCH as an example

Seminar (S)

2149661, WS 19/20, 2 SWS, Language: German, Open in study portal

Content

The seminar provides an insight into the main functional units of a company and their typical processes by using Bosch as an example. Furthermore it is based on discussions with the students. Former Bosch top managers explain the essential business processes and functions of the individual departments as well as the classic tasks of an engineer in a worldwide operating automotive supplier. The seminar also provides an insight into the careers of the Bosch directors. In addition to the company processes, the seminar will therefore focus on reports of challenges, successes, failures and product and process innovations.

The topics are as follows:

- Introduction, strategy, innovation
- R&D, product development process
- Production
- Quality management
- Market, marketing, sales
- Aftermarket, service
- Finance, controlling
- Logistics
- Purchasing, supply chain
- IT
- HR, leadership, compliance

Learning Outcomes:

The students …

- are able to deduce, understand and assess the structure of a global operating enterprise.
- are capable to identify and compare the work flows and processes within a global operating enterprise.
- are able to recognize and assess the problems within interfaces between functional and organizational units which are identified by the experts. Furthermore the students can develop solutions based on this knowledge in order to overcome these problems.

Workload:

regular attendance: 21 hours
self-study: 39 hours

Literature

Skript zur Veranstaltung wird über
(https://ilias.studium.kit.edu/) bereitgestellt.

Lecture notes will be provided in Ilias
(https://ilias.studium.kit.edu/).

T 8.234 Course: Vehicle Comfort and Acoustics I [T-MACH-105154]

Responsible: Prof. Dr. Frank Gauterin
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102818 - Major Field: Vehicle Technology
M-MACH-104442 - Major Field: Vibration Theory

Type	Credits	Recurrence	Version
Oral examination	4	Each winter term	1

Events					
WS 19/20	2113806	Vehicle Comfort and Acoustics I	2 SWS	Lecture (V)	Gauterin
SS 2020	2114856	Vehicle Ride Comfort & Acoustics I	2 SWS	Lecture (V)	Gauterin
Exams					
WS 19/20	76-T-MACH-105154	Vehicle Comfort and Acoustics I		Prüfung (PR)	Gauterin

Competence Certificate
Oral Examination

Duration: 30 up to 40 minutes

Auxiliary means: none

Prerequisites
Can not be combined with lecture T-MACH-102206

Below you will find excerpts from events related to this course:

V Vehicle Comfort and Acoustics I — Lecture (V)
2113806, WS 19/20, 2 SWS, Language: German, Open in study portal

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.

Learning Objectives:

The students know what noises and vibrations mean, 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. They are ready to apply different tools and methods to analyze relations and to judge them. They are able to develop the chasis regarding driving comfort and acoustic under consideration of goal conflicts.

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

Das Skript wird zu jeder Vorlesung zur Verfügung gestellt

V

Vehicle Ride Comfort & Acoustics I

2114856, SS 2020, 2 SWS, Language: English, Open in study portal

Lecture (V)

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.

Learning Objectives:

The students know what noises and vibrations mean, 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. They are ready to apply different tools and methods to analyze relations and to judge them. They are able to develop the chasis regarding driving comfort and acoustic under consideration of goal conflicts.

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

Das Skript wird zu jeder Vorlesung zur Verfügung gestellt

T 8.235 Course: Vehicle Comfort and Acoustics II [T-MACH-105155]

Responsible: Prof. Dr. Frank Gauterin
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102818 - Major Field: Vehicle Technology
M-MACH-104442 - Major Field: Vibration Theory

Type	Credits	Recurrence	Version
Oral examination	4	Each summer term	1

Events					
SS 2020	2114825	Vehicle Comfort and Acoustics II	2 SWS	Lecture (V)	Gauterin
SS 2020	2114857	Vehicle Ride Comfort & Acoustics II	2 SWS	Lecture (V)	Gauterin
Exams					
WS 19/20	76-T-MACH-105155	Vehicle Comfort and Acoustics II		Prüfung (PR)	Gauterin

Competence Certificate
Oral Examination

Duration: 30 up to 40 minutes

Auxiliary means: none

Prerequisites
Can not be combined with lecture T-MACH-102205

Below you will find excerpts from events related to this course:

V Vehicle Comfort and Acoustics II

2114825, SS 2020, 2 SWS, Language: German, Open in study portal

Lecture (V)

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

Learning Objectives:

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. They are ready to analyze, to judge and to optimize the vehicle with its single components regarding acoustic and vibration phenomena. They are also able to contribute competently to the development of a vehicle regarding the noise emission.

Literature
Das Skript wird zu jeder Vorlesung zur Verfügung gestellt.

V Vehicle Ride Comfort & Acoustics II

2114857, SS 2020, 2 SWS, Language: English, Open in study portal

Lecture (V)

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

Learning Objectives:

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. They are ready to analyze, to judge and to optimize the vehicle with its single components regarding acoustic and vibration phenomena. They are also able to contribute competently to the development of a vehicle regarding the noise emission.

Literature
Das Skript wird zu jeder Vorlesung zur Verfügung gestellt.

The script will be supplied in the lectures.

T 8.236 Course: Vehicle Ergonomics [T-MACH-108374]

Responsible: Dr.-Ing. Tobias Heine
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102815 - Major Field: Engineering Design
M-MACH-102818 - Major Field: Vehicle Technology

Type	Credits	Recurrence	Version
Written examination	4	Each summer term	1

Events					
SS 2020	2110050	Vehicle Ergonomics	2 SWS	Lecture (V)	Heine
Exams					
SS 2020	76-T-MACH-108374	Vehicle Ergonomics		Prüfung (PR)	Deml

Competence Certificate
written exam, 60 minutes

Prerequisites
none

Below you will find excerpts from events related to this course:

V Vehicle Ergonomics
2110050, SS 2020, 2 SWS, Language: German, Open in study portal

Lecture (V)

Content
- Basics of physical-body related ergonomics
- Basics of cognitive ergonomics
- Theories of driver behaviour
- interface design
- usability testing

Learning objective:

An ergonomic vehicle is best adapted to the requirements, needs and characteristics of its users and thus enables effective, efficient and satisfying interaction. After attending the lecture, students are able to analyse and evaluate the ergonomic quality of various vehicle concepts and derive design recommendations. They can consider aspects of both physical and cognitive ergonomics. Students are familiar with basic ergonomic methods, theories and concepts as well as with theories of human information processing, especially theories of driver behaviour. They are capable of critically reflecting this knowledge and applying it in a flexible way within the user-centered design process.

Literature
Die Literaturliste wird in der Vorlesung ausgegeben. Die Folien zur Vorlesung stehen auf ILIAS zum Download zur Verfügung.

T 8.237 Course: Vehicle Lightweight Design - Strategies, Concepts, Materials [T-MACH-105237]

Responsible: Prof. Dr.-Ing. Frank Henning
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102638 - Major Field: Rail System Technology
M-MACH-102818 - Major Field: Vehicle Technology

Type	Credits	Recurrence	Version
Written examination	4	Each winter term	1

Events					
WS 19/20	2113102	Vehicle Lightweight design – Strategies, Concepts, Materials	2 SWS	Lecture (V)	Henning
Exams					
WS 19/20	76-T-MACH 105236	Vehicle Lightweight Design - Strategies, Concepts, Materials		Prüfung (PR)	Henning
WS 19/20	76-T-MACH-105237	Vehicle Lightweight Design - Strategies, Concepts, Materials		Prüfung (PR)	Henning
SS 2020	762113102	Vehicle Lightweight Design - Strategies, Concepts, Materials		Prüfung (PR)	Henning

Competence Certificate
Written exam, 90 minutes

Prerequisites
none

Recommendation
none

Below you will find excerpts from events related to this course:

V Vehicle Lightweight design – Strategies, Concepts, Materials

Lecture (V)

2113102, WS 19/20, 2 SWS, Language: German, Open in study portal

Literature

[1] E. Moeller, *Handbuch Konstruktionswerkstoffe : Auswahl, Eigenschaften, Anwendung*. München: Hanser, 2008.
[2] H.-J. Bargel*, et al.*, *Werkstoffkunde*, 10., bearb. Aufl. ed. Berlin: Springer, 2008.
[3] C. Kammer, *Aluminium-Taschenbuch : Grundlagen und Werkstoffe*, 16. Aufl. ed. Düsseldorf: Aluminium-Verl., 2002.
[4] K. U. Kainer, "Magnesium - Eigenschaften, Anwendungen, Potentiale ", Weinheim [u.a.], 2000, pp. VIII, 320 S.
[5] A. Beck and H. Altwicker, *Magnesium und seine Legierungen*, 2. Aufl., Nachdr. d. Ausg. 1939 ed. Berlin: Springer, 2001.
[6] M. Peters, *Titan und Titanlegierungen*, [3., völlig neu bearb. Aufl.] ed. Weinheim [u.a.]: Wiley-VCH, 2002.
[7] H. Domininghaus and P. Elsner, *Kunststoffe : Eigenschaften und Anwendungen; 240 Tab*, 7., neu bearb. u. erw. Aufl. ed. Berlin: Springer, 2008.

T 8.238 Course: Vehicle Mechatronics I [T-MACH-105156]

Responsible: Prof. Dr.-Ing. Dieter Ammon
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102818 - Major Field: Vehicle Technology

Type	Credits	Recurrence	Version
Written examination	4	Each winter term	1

Exams				
WS 19/20	76-T-MACH-105156	Vehicle Mechatronics I	Prüfung (PR)	Ammon

Competence Certificate
Written examination

Duration: 90 minutes

Auxiliary means: none

Prerequisites
none

T 8.239 Course: Vibration Theory [T-MACH-105290]

Responsible: Prof. Dr.-Ing. Alexander Fidlin
Prof. Dr.-Ing. Wolfgang Seemann

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102746 - Compulsory Elective Module
M-MACH-102820 - Major Field: Mechatronics
M-MACH-104430 - Major Field: Modeling and Simulation in Dynamics
M-MACH-104442 - Major Field: Vibration Theory

Type	Credits	Recurrence	Version
Written examination	5	Each winter term	2

Events					
WS 19/20	2161212	Vibration Theory	2 SWS	Lecture (V)	Fidlin, Römer
WS 19/20	2161213	Übungen zu Technische Schwingungslehre	2 SWS	Practice (Ü)	Fidlin, Römer, Burgert
Exams					
WS 19/20	76-T-MACH-105290	Vibration Theory		Prüfung (PR)	Fidlin
SS 2020	76-T-MACH-105290	Vibration Theory		Prüfung (PR)	Fidlin

Competence Certificate
written exam, 180 min.

Prerequisites
none

Below you will find excerpts from events related to this course:

V Vibration Theory

2161212, WS 19/20, 2 SWS, Language: German, Open in study portal

Lecture (V)

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 und Bd. 2, Berlin, 1987

Wittenburg: Schwingungslehre, Springer-Verlag, Berlin, 1995

V **Übungen zu Technische Schwingungslehre**
2161213, WS 19/20, 2 SWS, Language: German, Open in study portal **Practice (Ü)**

Content
Exercises related to the lecture

T 8.240 Course: Virtual Engineering (Specific Topics) [T-MACH-105381]

Responsible: Prof. Dr.-Ing. Jivka Ovtcharova
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102746 - Compulsory Elective Module

Type	Credits	Recurrence	Version
Oral examination	4	Each summer term	1

Events					
SS 2020	3122031	Virtual Engineering (Specific Topics)	2 SWS	Lecture (V)	Ovtcharova, Maier

Competence Certificate
oral exam, 20 min.

Prerequisites
none

Below you will find excerpts from events related to this course:

V Virtual Engineering (Specific Topics)

3122031, SS 2020, 2 SWS, Language: English, Open in study portal

Lecture (V)

Content
Students can

- explain the basics of virtual engineering and name exemplary modeling tools and assign them to the corresponding methods and processes
- Formulate validation questions in the product development process and name obvious solution methods
- explain the basics of systems engineering and establish the connection to the product development process
- explain individual methods of the digital factory and present the functions of the digital factory in the context of the product creation process
  explain the theoretical and technical basics of Virtual Reality technology and show the connection to Virtual Engineering

Literature
Lecture slides / Vorlesungsfolien

T 8.241 Course: Virtual Reality Practical Course [T-MACH-102149]

Responsible: Prof. Dr.-Ing. Jivka Ovtcharova
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102583 - Major Field: Information Management
M-MACH-102820 - Major Field: Mechatronics

Type	Credits	Recurrence	Version
Examination of another type	4	Each term	2

Events					
WS 19/20	2123375	Virtual Reality Practical Course	3 SWS	Project (PRO)	Ovtcharova, Mitarbeiter
Exams					
WS 19/20	76-T-MACH-102149	Virtual Reality Practical Course		Prüfung (PR)	Ovtcharova

Competence Certificate
Assessment of another type (graded)

Prerequisites
None

Annotation
Number of participants is limited

Below you will find excerpts from events related to this course:

V Virtual Reality Practical Course
2123375, WS 19/20, 3 SWS, Language: German/English, Open in study portal

Project (PRO)

Content

- Introduction in Virtual Reality (hardware, software, applications)
- Exercises in the task specific software systems
- Autonomous project work in the area of Virtual Reality in small groups

Literature
Keine / None

T 8.242 Course: Warehousing and Distribution Systems [T-MACH-105174]

Responsible: Prof. Dr.-Ing. Kai Furmans
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102821 - Major Field: Technical Logistics

Type	Credits	Recurrence	Version
Written examination	3	Each summer term	2

Events					
SS 2020	2118097	Warehousing and distribution systems	2 SWS	Lecture (V)	Furmans

Competence Certificate
The assessment consists of a 60 minutes written examination (according to §4(2), 1 of the examination regulation).

Prerequisites
none

Below you will find excerpts from events related to this course:

V Warehousing and distribution systems

2118097, SS 2020, 2 SWS, Language: German, Open in study portal

Lecture (V)

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

Eine ausführliche Übersicht wissenschaftlicher Paper findet sich bei:

ROODBERGEN, Kees Jan (2007)
Warehouse Literature

T 8.243 Course: Wave and Quantum Physics [T-PHYS-108322]

Responsible: Prof. Dr. Gernot Goll
Prof. Dr. Bernd Pilawa

Organisation: KIT Department of Physics

Part of: M-PHYS-104030 - Physics

Type	Credits	Recurrence	Version
Written examination	5	Each summer term	1

Events					
SS 2020	4040411	Wellen und Quantenphysik	2 SWS	Lecture (V)	Pilawa
SS 2020	4040412	Übungen zu Wellen und Quantenphysik	1 SWS	Practice (Ü)	Pilawa, NN
SS 2020	4040431	Wave and Quantum Physics	2 SWS	Lecture (V)	Goll
SS 2020	4040432	Exercises to Wave and Quantum Physics	1 SWS	Practice (Ü)	Goll, Loïc
Exams					
WS 19/20	7800123	Wellen- und Quantenphysik (Exam in German)		Prüfung (PR)	Pilawa
WS 19/20	7800124	Wave and Quantum Physics (Exam in English)		Prüfung (PR)	Goll

Competence Certificate
Written exam (usually about 180 min)

Prerequisites
none

T 8.244 Course: Wave Propagation [T-MACH-105443]

Responsible: Prof. Dr.-Ing. Wolfgang Seemann
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-104442 - Major Field: Vibration Theory

Type	Credits	Recurrence	Version
Oral examination	4	Each winter term	2

Events					
WS 19/20	2161219	Wave Propagation	2 SWS	Lecture (V)	Seemann
Exams					
WS 19/20	76-T-MACH-105443	Wave Propagation		Prüfung (PR)	Seemann
SS 2020	76-T-MACH-105443	Wave Propagation		Prüfung (PR)	Seemann

Competence Certificate
oral exam, 30 min.

Below you will find excerpts from events related to this course:

V Wave Propagation
2161219, WS 19/20, 2 SWS, Language: German, Open in study portal

Lecture (V)

Content
The course gives an introduction into wave propagation phenomena. This contains both one-dimensional continua (beams, rods, strings) as well as two- and three-dimensional continua. Initial condition problems are treated. Fundamental effects like velocity, group velocity or dispersion are explained. Wave propagation is used to show the limits of structural models like beams. In addition surface waves and acoustic waves are covered.

Literature
P. Hagedorn and A. Dasgupta: Vibration and waves in continuous mechanical systems. Wiley, 2007.

T 8.245 Course: Welding Technology [T-MACH-105170]

Responsible: Dr. Majid Farajian
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102819 - Major Field: Materials Science and Engineering

Type	Credits	Recurrence	Version
Oral examination	4	Each winter term	1

Events					
WS 19/20	2173571	Welding Technology	2 SWS	Lecture (V)	Farajian
Exams					
WS 19/20	76-T-MACH-105170	Welding Technology		Prüfung (PR)	Farajian

Competence Certificate
Oral exam, about 20 minutes

Prerequisites
none

Recommendation
Basics of material science (iron- and non-iron alloys), materials, processes and production, design.

All the relevant books of the German Welding Institute (DVS: Deutscher Verband für Schweißen und verwandte Verfahren) in the field of welding and joining is recommended.

Below you will find excerpts from events related to this course:

V Welding Technology

2173571, WS 19/20, 2 SWS, Language: German, Open in study portal

Lecture (V)

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.

weld seam preparation/design

welding positions

weldability

gas welding, thermal cutting, manual metal-arc welding

submerged arc welding

gas-shielded metal-arc welding, friction stir welding, laser beam and electron beam welding, other fusion and pressure welding processes

static and cyclic behavior of welded joints,

fatigue life improvement techniques

learning objectives:

The students have knowledge and understanding of the most important welding processes and its industrial application.

They are able to recognize, understand and handle problems occurring during the application of different welding processes relating to design, material and production.

They know the classification and the importance of welding technology within the scope of connecting processes (advantages/ disadvantages, alternatives).

The students will understand the influence of weld quality on the performance and behavior of welded joints under static and cyclic load.

How the fatigue life of welded joints could be increased, will be part of the course.

requirements:
basics of material science (iron- and non-iron alloys), of electrical engineering, of production processes.

workload:

The workload for the lecture Welding Technology is 120 h per semester and consists of the presence during the lecture (18 h) as well as preparation and rework time at home (102 h).

exam:

oral, ca. 20 minutes, no auxiliary material

Literature
Für ergänzende, vertiefende Studien gibt das

Handbuch der Schweißtechnik von J. Ruge, Springer Verlag Berlin, mit seinen vier Bänden

Band I: Werkstoffe

Band II: Verfahren und Fertigung

Band III: Konstruktive Gestaltung der Bauteile

Band IV: Berechnung der Verbindungen

einen umfassenden Überblick. Der Stoff der Vorlesung Schweißtechnik findet sich in den Bänden I und II. Einen kompakten Einblick in die Lichtbogenschweißverfahren bietet das Bändchen

Nies: Lichtbogenschweißtechnik, Bibliothek der Technik Band 57, Verlag moderne Industrie AG und Co., Landsberg / Lech

Im Übrigen sei auf die zahlreichen Fachbücher des DVS Verlages, Düsseldorf, zu allen Einzelgebieten der Fügetechnik verwiesen.

T 8.246 Course: Windpower [T-MACH-105234]

Responsible: Dr. Norbert Lewald
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102816 - Major Field: Fundamentals of Energy Technology
M-MACH-102838 - Major Field: Energy Converting Engines

Type	Credits	Recurrence	Version
Written examination	4	Each winter term	2

Exams				
WS 19/20	7600008	Windpower	Prüfung (PR)	Lewald

Competence Certificate
written exam, 120 minutes

Prerequisites
none

T 8.247 Course: Working Methods in Mechanical Engineering [T-MACH-105296]

Responsible: Prof. Dr.-Ing. Barbara Deml
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102576 - Key Competences

Type	Credits	Recurrence	Version
Completed coursework	4	Each summer term	1

Events					
SS 2020	2110969	Working Methods in Mechanical Engineering	1 SWS	Course (Ku)	Deml
SS 2020	2114990	Workshop 'Working Methods in Mechanical Engineering' (FAST - Bahnsystemtechnik)	1 SWS	Others (sonst.)	Gratzfeld
SS 2020	2174970	Working Methods in Mechanical Engineering	1 SWS	Course (Ku)	Deml
Exams					
SS 2020	76-T-MACH-105296	Working Techniques for Mechanical Engineering		Prüfung (PR)	Deml
SS 2020	76-T-MACH-105296-englisch	Working Methods in Mechanical Engineering		Prüfung (PR)	Deml

Competence Certificate
e-larning module certificates, group exercises, submission of a scientific thesis of at least 30 pages and submisson and execution of a maximal 30 minutes scientific presentation.

Prerequisites
none

Below you will find excerpts from events related to this course:

V Working Methods in Mechanical Engineering
Course (Ku)
2110969, SS 2020, 1 SWS, Language: English, Open in study portal

V Workshop 'Working Methods in Mechanical Engineering' (FAST - Bahnsystemtechnik)
Others (sonst.)
2114990, SS 2020, 1 SWS, Language: German, Open in study portal

Content
Workshop 1: work organisation, teamwork
Workshop 2: literature research
Workshop 3: scientific writing
Workshop 4: scientific presentation

Attendance and active collaboration in all four workshops is mandatory!

After the workshop the students should be able:

- to plan a definite task under the consideration of specific regulations in a goal- and resource-oriented way
- to find and chose scientific information according to predefined quality criteria
- to write a precise and conclusive scientific abstract and to evaluate scientific papers
- to prepare a poster and an oral presentation in order to present scientific information
- to work in a team in a motivating and team-oriented way.

T 8.248 Course: Workshop on Computer-based Flow Measurement Techniques [T-MACH-106707]

Responsible: Prof. Dr.-Ing. Hans-Jörg Bauer
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102816 - Major Field: Fundamentals of Energy Technology

Type	Credits	Recurrence	Version
Completed coursework	4	Each term	1

Events					
WS 19/20	2171488	Workshop on computer-based flow measurement techniques	3 SWS	Practical course (P)	Bauer, Mitarbeiter
SS 2020	2171488	Workshop on computer-based flow measurement techniques	3 SWS	Practical course (P)	Bauer, Mitarbeiter
Exams					
WS 19/20	76-T-MACH-106707	Workshop on computer-based flow measurement techniques		Prüfung (PR)	Bauer
SS 2020	76-T-MACH-106707	Workshop on computer-based flow measurement techniques		Prüfung (PR)	Bauer

Competence Certificate
Group colloquia for each topic

Duration: approximately 10 minutes

no tools or reference materials may be used

Prerequisites
none

Below you will find excerpts from events related to this course:

V Workshop on computer-based flow measurement techniques

2171488, WS 19/20, 3 SWS, Language: German, Open in study portal

Practical course (P)

Content
Registration during the lecture period via the website.

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

regular attendance: 52,5
self-study: 67,5

Lernziele:

Die Studenten können:

- die wesentlichen Grundlagen der rechnergestützen Messwerterfassung theoretisch beschreiben und praktisch anwenden
- nach jedem Lernabschnitt den vorgestellten Stoff anhand eines Beispiels am PC in die Praxis umsetzen

The students are able to:

- theoretically describe and explain the fundamentals of computer aided measurements and and adopt them practically
- apply the basics learned during the lecture to a practical problem in the form of a PC excercise

Group colloquia for each topic

Duration: approximately 10 minutes

no tools or reference materials may be used

Literature
Germer, H.; Wefers, N.: Meßelektronik, Bd. 1, 1985

LabView User Manual

Hoffmann, Jörg: Taschenbuch der Messtechnik, 6., aktualisierte. Aufl. , 2011

V **Workshop on computer-based flow measurement techniques** **Practical course (P)**
2171488, SS 2020, 3 SWS, Language: German, Open in study portal

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