Karlsruher Institut für Technologie

Module Handbook
Bachelor's Program Mechanical Engineering

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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).

Universität des Landes Baden-Württemberg und
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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.

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§ 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)

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

Fassung vom 05. September 2022

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 Erfolgskontrolle		Pr (h)	Gew
						Studienleistungen	Prüfungsleistungen		
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 Wärmeübertragung I	8	Maas	Üschein	sPr	3	8
			Technische Thermodynamik und Wärmeübertragung II	7		Üschein	sPr	3	7
	Strömungslehre	8	Strömungslehre I & II	8	Frohnapfel		sPr	3	8
	Physik	5	Wellen- und Quantenphysik	5	Pilawa		sPr	2	5
	Elektrotechnik	8	Elektrotechnik und Elektronik	8	Becker		sPr	3	8
	Mess- und Regelungstechnik	7	Grundlagen der Mess- und Regelungstechnik	7	Stiller		sPr	2,5	7

Fach	Modul	LP/ Modul	Teilleistung	LP	Koordinator	Art der Erfolgskontrolle: Studien-leistungen	Art der Erfolgskontrolle: Prüfungs-leistungen	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
	Nachhaltige Produktionswirtschaft	5	Nachhaltige Produktionswirtschaft	5	Lanza		sPr	1,5	5
Vertiefung im Maschinenbau	Schwerpunkt	12	Kern- und Ergänzungsbereich, wählbare TL siehe Modulhandbuch	12	SP-Verantwortlicher		mPr mPr	ca. 0,7 ca. 0,7	12
	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					

Studienplan für den Bachelorstudiengang Maschinenbau gem. SPO 2015. Gültig ab 01.10.2022,
auf Beschlussfassung des Fakultätsrats vom 01.12.2021. Seite 4 von 7

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			
Nachhaltige 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
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
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 Schwerpunktverantwortlichen 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
30.03.2020	Namensänderung von SP 13
01.07.2020	SP 52 gelöscht
01.12.2021	BPW durch Nachhaltige Produktionswirtschaft ersetzt

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)

5 Field of study structure

Mandatory	
Orientation Exam *This field will not influence the calculated grade of its parent.*	
Bachelor's Thesis	15 CR
Fundamentals of Engineering	143 CR
Specialization in Mechanical Engineering	16 CR
Interdisciplinary Qualifications	6 CR

5.1 Orientation Exam

Mandatory		
M-MACH-104624	Orientation Exam	0 CR

5.2 Bachelor's Thesis

Credits
15

Mandatory		
M-MACH-104494	Bachelor's Thesis	15 CR

5.3 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-105902	Sustainable Production Economics *First usage possible from 10/1/2022.*	5 CR

5.4 Specialization in Mechanical Engineering

Credits
16

Mandatory		
M-MACH-102746	Compulsory Elective Module	4 CR
Major Field (Election: 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-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

5.5 Interdisciplinary Qualifications

Credits
6

Mandatory		
M-MACH-102576	Key Competences	6 CR

6 Modules

M 6.1 Module: Advanced Mathematics [M-MATH-102859]

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

Credits	Grading scale	Duration	Language	Level	Version
21	Grade to a tenth	3 terms	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.

Prerequisites
None.

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.

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 6.2 Module: Bachelor's Thesis [M-MACH-104494]

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

Credits	Grading scale	Recurrence	Duration	Language	Level	Version
15	Grade to a tenth	Each term	1 term	German	3	1

Mandatory			
T-MACH-109188	Bachelor's 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.

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 have earned at least 120 credits in the following fields:
    - Fundamentals of Engineering
    - Interdisciplinary Qualifications
    - Specialization in Mechanical Engineering

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.

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 6.3 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	Grading scale	Recurrence	Duration	Language	Level	Version
4	Grade to a tenth	Each term	1 term	German/English	3	5

Compulsory Elective Module (Election: 1 item)			
T-MACH-105381	Virtual Engineering (Specific Topics)	4 CR	Ovtcharova
T-MACH-105212	CAE-Workshop	4 CR	Albers, Matthiesen
T-MACH-105320	Introduction to the Finite Element Method	3 CR	Böhlke, Langhoff
T-MACH-100535	Introduction into Mechatronics	6 CR	Böhland, Reischl
T-MACH-105209	Introduction to Multi-Body Dynamics	5 CR	Seemann
T-MACH-110362	Introduction to Computational Fluid Dynamics	3 CR	Frohnapfel, Stroh
T-MACH-102093	Fluid Power Systems	4 CR	Geimer
T-MACH-109919	Basics of Technical Logistics I	4 CR	Mittwollen, Oellerich
T-MACH-105213	Fundamentals of Combustion I	4 CR	Maas
T-MACH-110377	Continuum Mechanics of Solids and Fluids	3 CR	Böhlke, Frohnapfel
T-MACH-105210	Machine Dynamics	5 CR	Proppe
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	Maas, Yu
T-MACH-100532	Scientific Computing for Engineers	4 CR	Gumbsch, Weygand
Compulsary Elective Module (Tutorial) (Election:)			
T-MACH-110330	Tutorial Introduction to the Finite Element Method	1 CR	Böhlke, Langhoff
T-MACH-111033	Tutorial Introduction to Computational Fluid Dynamics	1 CR	Frohnapfel, Stroh
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

Prerequisites
None

Competence Goal
The students have deepened their knowledge in selected areas of mechanical engineering. Due to the broad variety of eligible courses, they have supplemented / sharpened their own competence profile in mechanical engineering individually and precisely..

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

Content
See brick courses.

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 6.4 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	Grading scale	Recurrence	Duration	Language	Level	Version
6	Grade to a tenth	Each summer term	1 term	German/English	3	2

Mandatory			
T-MACH-105205	Computer Science for Engineers	6 CR	Ovtcharova
T-MACH-105206	Computer Science for Engineers, Prerequisite *This item will not influence the grade calculation of this parent.*	0 CR	Ovtcharova

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

Prerequisites
None

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.

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.

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

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

Responsible: Prof. Dr. Martin Doppelbauer
Organisation: KIT Department of Electrical Engineering and Information Technology
Part of: Fundamentals of Engineering (Usage from 3/8/2019)

Credits	Grading scale	Recurrence	Duration	Language	Level	Version
8	Grade to a tenth	Each winter term	1 term	German	3	1

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

6.6 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	Grading scale	Recurrence	Duration	Language	Level	Version
23	Grade to a tenth	Each winter term	4 terms	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 *This item will not influence the grade calculation of this parent.*	0 CR	Böhlke, Langhoff
T-MACH-100284	Tutorial Engineering Mechanics II *This item will not influence the grade calculation of this parent.*	0 CR	Böhlke, Langhoff
T-MACH-105202	Tutorial Engineering Mechanics III *This item will not influence the grade calculation of this parent.*	0 CR	Seemann
T-MACH-105203	Tutorial Engineering Mechanics IV *This item will not influence the grade calculation of this parent.*	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.

Prerequisites
None

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.

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)

6.7 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	Grading scale	Recurrence	Duration	Language	Level	Version
8	Grade to a tenth	Each summer term	2 terms	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)

Prerequisites
none

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

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

Module grade calculation
result of exam

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

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

Responsible: Prof. Dr.-Ing. Barbara Deml
Organisation: KIT Department of Mechanical Engineering

Part of: Interdisciplinary Qualifications

Credits	Grading scale	Recurrence	Duration	Language	Level	Version
6	pass/fail	Each term	1 term	German/English	3	3

Election notes

Interdisciplinary qualifications (IQ) completed at the House-of-Competence (HoC), at the Zentrum für Angewandte Kulturwissenschaften (ZAK) or at the Sprachenzentrum (SpZ) can be assigned in self-service.

First, select a partial accomplishment named "self-assignment" in your study schedule and second, assign an IQ-achievement via the tab "IQ achievements".

Mandatory			
T-MACH-105296	Working Methods in Mechanical Engineering	4 CR	Deml
Key Competences (Election: at least 2 credits)			
T-MACH-110961	Steering of a Global Operating Company - The Robert BOSCH GmbH as an Example	2 CR	Maier
T-MACH-111684	Self-Booking-BSc-HOC-SPZ-ZAK-Non-Graded	2 CR	Heilmaier
T-MACH-111685	Self-Booking-BSc-HOC-SPZ-ZAK-Graded	2 CR	Heilmaier

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.

Prerequisites

none

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 the principles for ensuring good scientific practice
- 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.

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), the Centre for Cultural and General Studies (ZAK), and the brick courses contained in the elective block of key qualifications 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".

Module grade calculation

non graded

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.

6.9 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	Grading scale	Recurrence	Duration	Language	Level	Version
7	Grade to a tenth	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 *This item will not influence the grade calculation of this parent.*	0 CR	Bauer, Kubach, Maas, Pritz

Competence Certificate
written exam (2 h)

Prerequisites
None.

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.

Content

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

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

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

6.10 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	Grading scale	Recurrence	Duration	Language	Level	Version
12	Grade to a tenth	Each term	2 terms	German	3	5

Mandatory			
T-MACH-105652	Fundamentals of Combustion Engine Technology	5 CR	Bernhardt, Kubach, Pfeil, Toedter, Wagner
Combustion Engine Techniques (K) (Election: at least 3 credits)			
T-MACH-111623	Fuels and Lubricants for Engine Powertrains	4 CR	Kehrwald, Kubach
T-MACH-110817	Development of hybrid drivetrains	4 CR	Koch
T-MACH-105169	Engine Measurement Techniques	4 CR	Bernhardt
Combustion Engine Techniques (E) (Election: at most 1 item)			
T-MACH-105173	Analysis of Exhaust Gas and Lubricating Oil in Combustion Engines	4 CR	Gohl
T-MACH-105649	Boosting of Combustion Engines	4 CR	Kech, Kubach
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-105337	Engine Laboratory	4 CR	Wagner
T-MACH-111578	Sustainable Vehicle Drivetrains	4 CR	Koch, Toedter
T-MACH-111591	Turbo Charging of Internal Combustion Engines	4 CR	Kech, Kubach
T-MACH-105985	Ignition Systems	4 CR	Toedter

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

Prerequisites
None

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

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 6.11 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	Grading scale	Recurrence	Duration	Language	Level	Version
12	Grade to a tenth	Each term	2 terms	German	3	5

Mandatory			
T-MACH-110377	Continuum Mechanics of Solids and Fluids	3 CR	Böhlke, Frohnapfel
T-MACH-110836	Mathematical Methods in Continuum Mechanics	4 CR	Böhlke
Continuum Mechanics (E) (Election:)			
T-MACH-110362	Introduction to Computational Fluid Dynamics	3 CR	Frohnapfel, Stroh
T-MACH-105320	Introduction to the Finite Element Method	3 CR	Böhlke, Langhoff
Contiuum Mechanics (Ü) (Election:)			
T-MACH-110330	Tutorial Introduction to the Finite Element Method	1 CR	Böhlke, Langhoff
T-MACH-111033	Tutorial Introduction to Computational Fluid Dynamics	1 CR	Frohnapfel, Stroh
T-MACH-110333	Tutorial Continuum Mechanics of Solids and Fluids	1 CR	Böhlke, Frohnapfel

Competence Certificate
see different bricks

Prerequisites
none

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

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.

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 6.12 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	Grading scale	Recurrence	Duration	Language	Level	Version
12	Grade to a tenth	Each term	2 terms	German	3	3

Energy Converting Engines (K) (Election: at least 8 credits)			
T-MACH-111550	CO2-Neutral Combustion Engines and their Fuels I	4 CR	Koch
T-MACH-105326	Hydraulic Fluid Machinery	8 CR	Pritz
T-MACH-105363	Thermal Turbomachines I	6 CR	Bauer
Energy Converting Engines (E) (Election: at most 5 credits)			
T-CIWVT-105780	Design of a Jet Engine Combustion Chamber	6 CR	Zarzalis
T-MACH-111623	Fuels and Lubricants for Engine Powertrains	4 CR	Kehrwald, Kubach
T-MACH-111560	CO2-Neutral Combustion Engines and their Fuels II	5 CR	Koch
T-MACH-105515	Introduction to Numerical Fluid Dynamics	4 CR	Pritz
T-MACH-110817	Development of hybrid drivetrains	4 CR	Koch
T-MACH-102093	Fluid Power Systems	4 CR	Geimer
T-MACH-105533	Gasdynamics	4 CR	Gatti, Kriegseis
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-105213	Fundamentals of Combustion I	4 CR	Maas
T-MACH-105325	Fundamentals of Combustion II	4 CR	Bykov, Maas
T-MACH-105337	Engine Laboratory	4 CR	Wagner
T-MACH-111578	Sustainable Vehicle Drivetrains	4 CR	Koch, Toedter
T-MACH-105338	Numerical Fluid Mechanics	4 CR	Gatti, 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-105652	Fundamentals of Combustion Engine Technology	5 CR	Bernhardt, Kubach, Pfeil, Toedter, Wagner
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
T-MACH-111591	Turbo Charging of Internal Combustion Engines	4 CR	Kech, Kubach
T-MACH-111585	Hydrogen and reFuels - Energy Conversion in Combustion Engines	4 CR	Kubach
T-MACH-105985	Ignition Systems	4 CR	Toedter

Competence Certificate
refer to different brick descriptions of SP24

Prerequisites
None

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.

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.

Workload

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

Recommendation

Recommended compulsory optional subject: Heat and mass transfer

Learning type

Lectures and Exercises

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

Responsible: Prof. Dr.-Ing. Albert Albers
Organisation: KIT Department of Mechanical Engineering

Part of: Specialization in Mechanical Engineering (Major Field)

Credits	Grading scale	Recurrence	Duration	Language	Level	Version
12	Grade to a tenth	Each term	2 terms	German/English	3	6

Engineering Design (K) (Election: 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
Engineering Design (E) (Election:)			
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-108719	Designing with numerical methods in product development	4 CR	Schnack
T-MACH-108374	Vehicle Ergonomics	4 CR	Deml
T-MACH-102105	Manufacturing Technology	8 CR	Schulze
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-111389	Fundamentals in the Development of Commercial Vehicles	4 CR	Weber
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-110984	Production Technology for E-Mobility	4 CR	Fleischer
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-111382	Technical Acoustics	4 CR	Pantle, Walter
T-MACH-105361	Technical Design in Product Development	4 CR	Albers, Matthiesen, Schmid
T-MACH-102148	Gear Cutting Technology	4 CR	Klaiber
T-MACH-110962	Machine Tools and High-Precision Manufacturing Systems	8 CR	Fleischer
Engineering Design (P) (Election: at most 4 credits)			

T-MACH-105370	Laboratory Mechatronics *This item will not influence the grade calculation of this parent.*	4 CR	Hagenmeyer, Seemann, Stiller
T-MACH-111431	Programming in CAE-Applications	4 CR	Kärger
T-MACH-110960	Project Internship Aditive Manufacturing: Development and Production of an Additive Component	4 CR	Zanger
Engineering Design (Ü) (Election:)			
T-MACH-108887	Design and Development of Mobile Machines - Advance *This item will not influence the grade calculation of this parent.*	0 CR	Geimer, Siebert

Prerequisites
None

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

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

Responsible: Prof. Dr.-Ing. Hans-Jörg Bauer
Organisation: KIT Department of Mechanical Engineering
Institute of Thermal Turbomachinery
Part of: Specialization in Mechanical Engineering (Major Field)

Credits	Grading scale	Recurrence	Duration	Language	Level	Version
12	Grade to a tenth	Each term	2 terms	German/English	3	4

Mandatory			
T-MACH-105220	Fundamentals of Energy Technology	8 CR	Badea, Cheng
Fundamentals of Energy Technology (K) (Election:)			
T-MACH-105525	Introduction to Nuclear Energy	4 CR	Cheng
T-MACH-105325	Fundamentals of Combustion II	4 CR	Bykov, Maas
T-MACH-105326	Hydraulic Fluid Machinery	8 CR	Pritz
Fundamentals of Energy Technology (E) (Election:)			
T-MACH-105462	Selected Problems of Applied Reactor Physics and Exercises	4 CR	Dagan
T-MACH-105151	Energy Efficient Intralogistic Systems	4 CR	Kramer, Schönung
T-MACH-105408	Energy Systems I: Renewable Energy	4 CR	Dagan
T-MACH-105533	Gasdynamics	4 CR	Gatti, Kriegseis
T-MACH-105557	Microenergy Technologies	4 CR	Kohl
T-MACH-105338	Numerical Fluid Mechanics	4 CR	Gatti, Magagnato
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-110984	Production Technology for E-Mobility	4 CR	Fleischer
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-111382	Technical Acoustics	4 CR	Pantle, Walter
T-MACH-105652	Fundamentals of Combustion Engine Technology	5 CR	Bernhardt, Kubach, Pfeil, Toedter, Wagner
T-MACH-105225	Thermal Solar Energy	4 CR	Stieglitz
T-MACH-105234	Windpower	4 CR	Lewald
Fundamentals of Energy Technology (P) (Election: at most 4 credits)			
T-MACH-105331	Laboratory Exercise in Energy Technology *This item will not influence the grade calculation of this parent.*	4 CR	Bauer, Maas, Wirbser
T-MACH-106707	Workshop on Computer-based Flow Measurement Techniques *This item will not influence the grade calculation of this parent.*	4 CR	Bauer

Competence Certificate
Oral exam

Prerequisites
None

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.

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 6.15 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	Grading scale	Recurrence	Duration	Language	Level	Version
12	Grade to a tenth	Each term	2 terms	German	3	3

Information Management (K) (Election: 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
Information Management (E) (Election:)			
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-111283	Development Methods of Technical Systems	4 CR	Maier, Ovtcharova
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	4 CR	Thomas
T-MACH-105442	Intellectual Property Rights and Strategies in Industrial Companies	4 CR	Albers, Matthiesen, Zacharias
T-MACH-102153	PLM-CAD Workshop	4 CR	Ovtcharova
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
T-MACH-102149	Virtual Reality Practical Course	4 CR	Ovtcharova
Information Management (P) (Election: at most 4 credits)			
T-MACH-102185	CATIA CAD Training Course	2 CR	Ovtcharova
T-MACH-102187	CAD-NX Training Course	2 CR	Ovtcharova

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

Prerequisites
None

Competence Goal
The students should:

- understand the relevance of information management in product development in consideration of increasing product and process complexity.
- have basic knowledge in handling information, which is generated by product development activities along the lifecycle.

Content
Generation and management of information

Architecture and functionality of information systems

CAX-systems, Industry 4.0

Workload
360 hours

Learning type
Lectures, Tutorials

M 6.16 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	Grading scale	Recurrence	Duration	Language	Level	Version
12	Grade to a tenth	Each term	2 terms	German/English	3	3

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

Information Technology (K) (Election: at least 8 credits)			
T-MACH-105314	Computational Intelligence	4 CR	Mikut, Reischl
T-MACH-105694	Data Analytics for Engineers	5 CR	Meisenbacher, 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
Information Technology (E) (Election: at most 6 credits)			
T-MACH-102150	BUS-Controls	4 CR	Becker, Geimer
T-MACH-108889	BUS-Controls - Advance	0 CR	Geimer
T-MACH-105218	Automotive Vision	6 CR	Lauer, Stiller
T-MACH-102128	Information Systems and Supply Chain Management	3 CR	Kilger
T-INFO-101466	Information Processing in Sensor Networks	6 CR	Hanebeck
T-MACH-105187	IT-Fundamentals of Logistics	4 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	6 CR	Naumann, Werling
T-MACH-105370	Laboratory Mechatronics	4 CR	Hagenmeyer, Seemann, Stiller
T-MACH-105341	Lab Computer-Aided Methods for Measurement and Control	4 CR	Stiller

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.

Prerequisites
none

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.

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

M 6.17 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	Grading scale	Recurrence	Duration	Language	Level	Version
12	Grade to a tenth	Each term	2 terms	German/English	3	7

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
Materials Science and Engineering (E) (Election:)			
T-MACH-105308	Atomistic Simulations and Molecular Dynamics	4 CR	Gumbsch, Schneider, Weygand
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	Liebig
T-MACH-110960	Project Internship Aditive Manufacturing: Development and Production of an Additive Component	4 CR	Zanger
T-MACH-105724	Failure Analysis	4 CR	Greiner, Schneider
T-MACH-105170	Welding Technology	4 CR	Farajian
T-MACH-112106	Fatigue of Materials	4 CR	Guth
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, Schneider
T-MACH-111258	Introduction to High Temperature Materials	4 CR	Gorr
T-MACH-105211	Materials of Lightweight Construction	4 CR	Elsner, Liebig
T-MACH-110937	Materials Recycling and Sustainability	4 CR	Elsner, Liebig
Materials Science and Engineering (P) (Election: at most 4 credits)			
T-MACH-105651	Biomechanics: Design in Nature and Inspired by Nature *This item will not influence the grade calculation of this parent.*	4 CR	Mattheck
T-MACH-105447	Metallographic Lab Class *This item will not influence the grade calculation of this parent.*	4 CR	Heilmaier, Mühl
T-MACH-102154	Laboratory Laser Materials Processing *This item will not influence the grade calculation of this parent.*	4 CR	Schneider
Materials Science and Engineering (Ü) (Election:)			
T-MACH-107685	Exercises for Materials Characterization *This item will not influence the grade calculation of this parent.*	2 CR	Gibmeier, Schneider

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.

Prerequisites
None

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.

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 6.18 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	Grading scale	Recurrence	Duration	Language	Level	Version
12	Grade to a tenth	Each term	2 terms	German/English	3	5

Mechatronics (K) (Election: at least 8 credits)			
T-MACH-105314	Computational Intelligence	4 CR	Mikut, Reischl
T-MACH-105694	Data Analytics for Engineers	5 CR	Meisenbacher, Mikut, Reischl
T-MACH-100535	Introduction into Mechatronics	6 CR	Böhland, Reischl
T-MACH-105209	Introduction to 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	6 CR	Naumann, Werling
Mechatronics (E) (Election: at most 1 item)			
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	Doppelbauer
T-MACH-105187	IT-Fundamentals of Logistics	4 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-MACH-105370	Laboratory Mechatronics	4 CR	Hagenmeyer, Seemann, Stiller
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-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-108878	Laboratory Production Metrology	4 CR	Lanza
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-MACH-105373	Practical Training in Measurement of Vibrations	4 CR	Fidlin
T-ETIT-109313	Signals and Systems	6 CR	Heizmann
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-110272	System Integration in Micro- and Nanotechnology 2	4 CR	Gengenbach
T-MACH-105290	Vibration Theory	5 CR	Fidlin, Seemann

T-MACH-102149	Virtual Reality Practical Course	4 CR	Ovtcharova
Mechatronics (Ü) (Election:)			
T-MACH-108889	BUS-Controls - Advance *This item will not influence the grade calculation of this parent.*	0 CR	Geimer
T-INFO-106257	Human-Machine-Interaction Pass *This item will not influence the grade calculation of this parent.*	0 CR	Beigl

Competence Certificate
Written exam and oral exam.

Prerequisites
none

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.

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.

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

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

Part of: Specialization in Mechanical Engineering (Major Field)

Credits	Grading scale	Recurrence	Duration	Language	Level	Version
12	Grade to a tenth	Each term	2 terms	German	3	4

Modeling and Simulation in Dynamics (K) (Election: at least 8 credits)			
T-MACH-105226	Dynamics of the Automotive Drive Train	5 CR	Fidlin
T-MACH-105209	Introduction to 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-105290	Vibration Theory	5 CR	Fidlin, Seemann
Modeling and Simulation in Dynamics (E) (Election: at most 5 credits)			
T-MACH-105308	Atomistic Simulations and Molecular Dynamics	4 CR	Gumbsch, Schneider, Weygand
T-MACH-111260	Dynamics of Electro-Mechanical Systems	5 CR	Altoé, Fidlin
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-105172	Simulation of Coupled Systems	4 CR	Geimer
T-MACH-108888	Simulation of Coupled Systems - Advance *This item will not influence the grade calculation of this parent.*	0 CR	Geimer, Xiang

Competence Certificate
oral examination

Prerequisites
None

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.

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

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

Responsible: Prof. Dr.-Ing. Albert Albers
Organisation: KIT Department of Mechanical Engineering

Part of: Specialization in Mechanical Engineering (Major Field)

Credits	Grading scale	Recurrence	Duration	Language	Level	Version
12	Grade to a tenth	Each term	2 terms	German/English	3	4

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

Powertrain Systems (K) (Election: 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
Powertrain Systems (E) (Election:)			
T-MACH-105215	Applied Tribology in Industrial Product Development	4 CR	Albers, Lorentz, Matthiesen
T-MACH-110958	Design and Optimization of Conventional and Electrified Automotive Transmissions	4 CR	Albers, Faust
T-MACH-102150	BUS-Controls	4 CR	Becker, Geimer
T-MACH-105209	Introduction to Multi-Body Dynamics	5 CR	Seemann
T-MACH-105151	Energy Efficient Intralogistic Systems	4 CR	Kramer, Schönung
T-ETIT-100784	Hybrid and Electric Vehicles	4 CR	Doppelbauer
T-MACH-105187	IT-Fundamentals of Logistics	4 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-110984	Production Technology for E-Mobility	4 CR	Fleischer
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
T-MACH-102148	Gear Cutting Technology	4 CR	Klaiber
Powertrain Systems (Ü) (Election:)			
T-MACH-109303	Exercices - Tribology *This item will not influence the grade calculation of this parent.*	0 CR	Dienwiebel

Prerequisites
none

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.

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

6.21 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	Grading scale	Recurrence	Duration	Language	Level	Version
12	Grade to a tenth	Each term	2 terms	German	3	4

Production Systems (K) (Election: 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
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-110962	Machine Tools and High-Precision Manufacturing Systems	8 CR	Fleischer
Production Systems (E) (Election:)			
T-MACH-108844	Automated Manufacturing Systems	8 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
Production Systems (P) (Election: at most 4 credits)			
T-MACH-108878	Laboratory Production Metrology	4 CR	Lanza
T-MACH-110960	Project Internship Aditive Manufacturing: Development and Production of an Additive Component	4 CR	Zanger

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.

Prerequisites
None

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.

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

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

Responsible: Prof. Dr.-Ing. Marcus Geimer
Prof. Dr.-Ing. Peter Gratzfeld

Organisation: KIT Department of Mechanical Engineering

Part of: Specialization in Mechanical Engineering (Major Field)

Credits	Grading scale	Recurrence	Duration	Language	Level	Version
12	Grade to a tenth	Each term	2 terms	German	3	3

Mandatory			
T-MACH-106424	Rail System Technology	4 CR	Geimer, Gratzfeld
T-MACH-105353	Rail Vehicle Technology	4 CR	Geimer, Gratzfeld
Rail System Technology (E) (Election:)			
T-MACH-105540	Railways in the Transportation Market	4 CR	Geimer, 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-105350	Computational Vehicle Dynamics	4 CR	Proppe
T-MACH-108692	Seminar for Rail System Technology	3 CR	Geimer, 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.

Prerequisites
None

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.

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, comparison electric traction and diesel traction, dc and ac networks, system pantograph and contact wire, filling stations
8. Vehicle system technology: structure and main systems of rail vehicles
9. Car body: functions, requirements, design principles, crash elements, coupling, doors and windows
10. Bogies: forces, running gears, bogies, Jakobs-bogies, active components, connection to car body, wheel arrangement
11. Drives: priciples, electric drives (main components, asynchronous traction motor, inverter, with DC supply, with AC supply, without line supply, multisystem vehicles, dual mode vehicles, hybrid vehicles), non-electric drives
12. Brakes: basics, principles (wheel brakes, rail brakes, blending), brake control (requirements and operation modes, pneumatic brake, electropneumatic brake, emergency brake, parking brake)
13. Train control management system: definition of TCMS, bus systems, components, network architectures, examples, future trends
14. Vehicle concepts: trams, metros, regional trains, intercity trains, high speed trains, double deck vehicles, locomotives, freight wagons
15. 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.

6.23 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	Grading scale	Recurrence	Duration	Language	Level	Version
12	Grade to a tenth	Each term	2 terms	German	3	4

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

Technical Logistics (K) (Election: at least 8 credits)			
T-MACH-112113	Dynamic Systems of Technical Logistics	6 CR	Mittwollen
T-MACH-109919	Basics of Technical Logistics I	4 CR	Mittwollen, Oellerich
T-MACH-109920	Basics of Technical Logistics II	6 CR	Hochstein
Technical Logistics (E) (Election:)			
T-MACH-112114	Dynamic Systems of Technical Logistics - Project	4 CR	Mittwollen
T-MACH-105174	Warehousing and Distribution Systems	3 CR	Furmans
T-MACH-105151	Energy Efficient Intralogistic Systems	4 CR	Kramer, Schönung
T-MACH-105175	Airport Logistics	3 CR	Richter
T-MACH-105187	IT-Fundamentals of Logistics	4 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	6 CR	Naumann, Werling

Competence Certificate
Written and oral exams, see brick courses

Prerequisites
None

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.

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 6.24 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	Grading scale	Recurrence	Duration	Language	Level	Version
12	Grade to a tenth	Each term	2 terms	German/English	3	7

Mandatory			
T-MACH-100092	Automotive Engineering I	8 CR	Gauterin, Unrau
Automotive Technology (E) (Election:)			
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-110958	Design and Optimization of Conventional and Electrified Automotive Transmissions	4 CR	Albers, Faust
T-MACH-108844	Automated Manufacturing Systems	8 CR	Fleischer
T-MACH-111550	CO2-Neutral Combustion Engines and their Fuels I	4 CR	Koch
T-MACH-111560	CO2-Neutral Combustion Engines and their Fuels II	5 CR	Koch
T-MACH-105226	Dynamics of the Automotive Drive Train	5 CR	Fidlin
T-MACH-110817	Development of hybrid drivetrains	4 CR	Koch
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	Deml
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-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-111389	Fundamentals in the Development of Commercial Vehicles	4 CR	Weber
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	Doppelbauer
T-MACH-105375	Industrial Aerodynamics	4 CR	Frohnapfel, Kröber
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-110954	Lightweight Constructions with Fiber-Reinforced-Polymers – Theory and Practice	4 CR	Kärger, Liebig
T-MACH-105169	Engine Measurement Techniques	4 CR	Bernhardt
T-MACH-111578	Sustainable Vehicle Drivetrains	4 CR	Koch, Toedter

T-MACH-105442	Intellectual Property Rights and Strategies in Industrial Companies	4 CR	Albers, Matthiesen, Zacharias
T-MACH-110984	Production Technology for E-Mobility	4 CR	Fleischer
T-MACH-110318	Product- and Production-Concepts for Modern Automobiles	4 CR	Kienzle, Steegmüller
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-110796	Python Algorithm for Vehicle Technology	4 CR	Rhode
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-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-105652	Fundamentals of Combustion Engine Technology	5 CR	Bernhardt, Kubach, Pfeil, Toedter, Wagner
T-MACH-102194	Combustion Engines I	4 CR	Koch, Kubach
T-MACH-105367	Behaviour Generation for Vehicles	6 CR	Naumann, Werling
T-MACH-102148	Gear Cutting Technology	4 CR	Klaiber
T-MACH-111585	Hydrogen and reFuels - Energy Conversion in Combustion Engines	4 CR	Kubach
T-MACH-112126	Data-Driven Algorithms in Vehicle Technology	4 CR	Scheubner

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.

Prerequisites
None

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.

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.

6.25 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	Grading scale	Recurrence	Duration	Language	Level	Version
12	Grade to a tenth	Each term	2 terms	German	3	2

Vibration Theory (K) (Election: at least 8 credits)			
T-MACH-105439	Introduction to Nonlinear Vibrations	7 CR	Fidlin
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-105290	Vibration Theory	5 CR	Fidlin, Seemann
Vibration Theory (E) (Election: at most 4 credits)			
T-MACH-105226	Dynamics of the Automotive Drive Train	5 CR	Fidlin
T-MACH-111260	Dynamics of Electro-Mechanical Systems	5 CR	Altoé, 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-105224	Machine Dynamics II	4 CR	Proppe
T-MACH-105349	Computational Dynamics	4 CR	Proppe
T-MACH-105373	Practical Training in Measurement of Vibrations	4 CR	Fidlin
T-MACH-105443	Wave Propagation	4 CR	Seemann

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.

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

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

Part of: Fundamentals of Engineering

Credits	Grading scale	Recurrence	Duration	Language	Level	Version
4	Grade to a tenth	Each winter term	1 term	German	3	1

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

Competence Certificate
written exam (duration: 60 min)

Prerequisites
none

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.

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 hours
self-study: 99 hours

Learning type
Lecture

6.27 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	Grading scale	Recurrence	Duration	Language	Level	Version
14	Grade to a tenth	Each winter term	2 terms	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.

Prerequisites
none

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

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 6.28 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	Grading scale	Recurrence	Duration	Language	Level	Version
7	Grade to a tenth	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

Prerequisites
none

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.

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

Module grade calculation
result of exam

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

Recommendation
Fundamentals in physics and electrical engineering, ordinary linear diffential epuations, Laplace transform

Learning type
Lecture

Tutorials

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

Measurement and Control Systems

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

Responsible: Prof. Dr.-Ing. Sven Matthiesen
Organisation: KIT Department of Mechanical Engineering

Part of: Fundamentals of Engineering

Credits	Grading scale	Recurrence	Duration	Language	Level	Version
20	Grade to a tenth	Each winter term	4 terms	German/English	3	4

Mandatory			
T-MACH-105286	Mechanical Design I and II	5 CR	Matthiesen
T-MACH-104810	Mechanical Design III and IV	11 CR	Matthiesen
T-MACH-105282	Mechanical Design I, Prerequisites *This item will not influence the grade calculation of this parent.*	1 CR	Matthiesen
T-MACH-105283	Mechanical Design II, Prerequisites *This item will not influence the grade calculation of this parent.*	1 CR	Matthiesen
T-MACH-110955	Mechanical Design III, Tutorial	1 CR	Matthiesen
T-MACH-110956	Mechanical Design IV, Tutorial	1 CR	Matthiesen

Competence Certificate
Mechanical Design I and 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 90 min plus reading time

Mechanical Design III and 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

Prerequisites
None

Competence Goal
In mechanical design, students acquire skills in analysis and synthesis using examples (= leading examples). The examples include individual machine elements such as bearings or springs as well as more complex systems such as gears or clutches. After completing the machine design course, the students can apply the learned contents to further technical systems - even those not known from the lecture - by transferring the exemplary learned operating principles and basic functions to other contexts. This enables students to independently analyze unknown technical systems and to synthesize systems suitable for given problems.

Content
MKL I:

- Introduction to product development
- Springs
- Tools for visualization (technical drawing)
- Technical systems
- Bearings and guides

MKL II:

- Basics of the design
- Basics of screw connections
- Basics Seals

MKL III:

- Component connections
- Tolerances and clearance
- Transmission

MKL IV:

- Clutches
- Fluid Technology
- Dimensioning
- Electrical machines

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:

presence: 33,5 h

Attendance in lectures: 15 * 1.5 h = 22.5 h

Presence in exercises: 8 * 1.5 h = 12 h

self-study: 56,5 h

Personal preparation and wrap-up of lecture and exercises including the processing of the test certificates and preparation for the exam: 56.5 h

Total: 90 h = 3 LP

MKL2:

Presence: 33 h

Attendance in lectures: 15 * 1.5 h = 22.5 h

Presence in exercises: 7 * 1.5 h = 10.5 h

Self study: 87 h

Personal preparation and wrap-up of lectures and exercises, including the processing of the test certificates and preparation for the exam: 87h

Total: 120 h = 4 LP

MKL 3:

Presence: 45h

Attendance lectures (15 L): 22,5h

Presence exercises (7 exercises): 10,5h

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

Self-study: 135h

Project work in a team: 90h

Personal preparation and follow-up of lecture and exercise: 45h

Total: 180 h = 6 LP

MKL 4:

Presence: 40,5h

Attendance lectures (13 L): 19,5h

Presence exercises (6 exercises): 9h

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

Self-study: 169,5h

Project work in a team: 105h

Personal preparation and follow-up of lecture and exercise, incl. preparation for the exam: 64,5h

Total: 210 h = 7 LP

Learning type
Lecture

Tutorial

Project work during the semester

M 6.30 Module: Orientation Exam [M-MACH-104624]

Organisation: University
Part of: Orientation Exam

Credits	Grading scale	Recurrence	Duration	Language	Level	Version
0	pass/fail	Each term	2 terms	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**.

Annotation
For students who are or were enrolled in a degree program in the summer semester 2020, winter semester 2020/2021, summer semester 2021, or winter semester 2021/2022, the deadline for taking the orientation exam has been extended by one semester in each case (section 32 (5 a), sentence 1 LHG).
This means that the deadline has been extended for
- students enrolled in one of the above semesters in the same program by one semester;
- students enrolled in two of the above semesters in the same program by two semesters;
- students enrolled in three or more of the above semesters in the same program by a maximum of three semesters.

M 6.31 Module: Physics [M-PHYS-104030]

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

Organisation: KIT Department of Physics

Part of: Fundamentals of Engineering

Credits	Grading scale	Recurrence	Duration	Language	Level	Version
5	Grade to a tenth	Each summer term	1 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.

Prerequisites
None

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

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 6.32 Module: Sustainable Production Economics (BSc-Modul 22 MWT) [M-MACH-105902]

Responsible: Prof. Dr.-Ing. Kai Furmans
Prof. Dr.-Ing. Gisela Lanza

Organisation: KIT Department of Mechanical Engineering

Part of: Fundamentals of Engineering (Usage from 10/1/2022)

Credits	Grading scale	Recurrence	Duration	Language	Level	Version
5	Grade to a tenth	Each winter term	1 term	German	3	1

Mandatory			
T-MACH-111859	Sustainable Production Economics	5 CR	Furmans, Lanza

Competence Certificate
Written Exam (90 minutes)

Prerequisites
none

Competence Goal
After successful completion of the course, the students are able …

- to discuss, alone and in a team, the terms, contexts and models by which manufacturing companies are described;
- to discuss typical problems of manufacturing companies, especially against the background of current and future challenges of ecological, social and economic sustainability;
- to apply the most important methods for efficient and sustainable management in industrial enterprises, in particular in the sense of the circular economy, in a problem-related manner;
- to select and justify decision-making alternatives by applying the methods learned;
- to critically question the methods learned and to independently acquire methods that go beyond this.

Content
The module conveys an overall understanding of operational production management with special consideration of aspects of sustainability as well as an application-oriented understanding of the fundamental issues and methods in industrial companies. Through exercises as well as a business game synchronous to the lecture, the taught contents are deepened through application, so that the participants can apply them directly in their later professional environment.

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
Regluar attendance: 42 hours
Self-study: 108 hours

Learning type

1. Lectures (Obligatory)
2. Tutorials (Obligatory)

6.33 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	Grading scale	Recurrence	Duration	Language	Level	Version
15	Grade to a tenth	Each winter term	2 terms	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 *This item will not influence the grade calculation of this parent.*	0 CR	Maas
T-MACH-105288	Excercises in Technical Thermodynamics and Heat Transfer II *This item will not influence the grade calculation of this parent.*	0 CR	Maas

Competence Certificate
Prerequisite: attestation each semester by homework assignments

Thermodynamics I: Written exam, graded, approx. 3 hours

Thermodynamics II: Written exam, graded, approx. 3 hours

Prerequisites
None

Competence Goal
The students acquire the competency to master the fundamentals of thermodynamics and the ability to apply the knowledge a 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 that are important in mechanical engineering. Using tools also applied in industry, they are capable of analyzing and rating the efficiency of processes. The students are capable of discussing the thermodynamic correlation of ideal gas mixtures, real gases and of humid air as well explaining the properties on a molecular basis and analyzing them with the help of the laws of thermodynamic. Furthermore, the students are capable of explaining chemical reactions in the context of thermodynamics as well as defining and applying the heat transfer mechanisms.

Content
Thermodynamics I:

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

Thermodynamics II:

- Repetition of the topics of "Thermodynamics and Heat Transfer I"
- Behavior of mixtures
- Moist air
- Kinetic theory of gases
- Behavior of real substances described by equations of state
- Chemical reactions and applications of the laws of thermodynamics to chemical reactions
- Reaction kinetics
- Heat Transfer

Module grade calculation
weight according to CP

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

7 Courses

T 7.1 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	Grading scale	Recurrence	Version
Written examination	7	Grade to a third	Each term	3

Events					
WT 22/23	0131000	Höhere Mathematik I für die Fachrichtung Maschinenbau, Geodäsie, Materialwissenschaft und Werkstofftechnik	4 SWS	Lecture	Arens
WT 22/23	0131200	Höhere Mathematik I für die Fachrichtungen Chemieingenieurwesen, Verfahrenstechnik, Bioingenieurwesen und MIT	4 SWS	Lecture	Arens
Exams					
ST 2022	6700025	Advanced Mathematics I			Arens, Griesmaier, Hettlich
WT 22/23	6700007	Advanced Mathematics I			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 7.2 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	Grading scale	Recurrence	Version
Written examination	7	Grade to a third	Each term	2

Events					
ST 2022	0180800	Höhere Mathematik II für die Fachrichtungen Maschinenbau, Geodäsie, Materialwissenschaft und Werkstofftechnik	4 SWS	Lecture	Arens
ST 2022	0181000	Höhere Mathematik II für die Fachrichtungen Chemieingenieurwesen, Verfahrenstechnik, Bioingenieurwesen und MIT	4 SWS	Lecture	Arens
Exams					
ST 2022	6700001	Advanced Mathematics II			Arens, Griesmaier, Hettlich
WT 22/23	6700008	Advanced Mathematics II			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.

T 7.3 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	Grading scale	Recurrence	Version
Written examination	7	Grade to a third	Each term	2

Events					
WT 22/23	0131400	Höhere Mathematik III für die Fachrichtungen Maschinenbau, Chemieingenieurwesen, Verfahrenstechnik, Bioingenieurwesen und das Lehramt Maschinenbau	4 SWS	Lecture	Hettlich
Exams					
ST 2022	6700002	Advanced Mathematics III			Arens, Griesmaier, Hettlich
WT 22/23	6700009	Advanced Mathematics III			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 7.4 Course: Agile Product Innovation Management - Value-driven Planning of New Products [T-MACH-106744]

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

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

Type	Credits	Grading scale	Recurrence	Version
Oral examination	4	Grade to a third	Each summer term	3

Competence Certificate
Oral examination, 20 min.

Prerequisites
None

T 7.5 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	Grading scale	Recurrence	Version
Oral examination	3	Grade to a third	Each winter term	2

Events					
WT 22/23	2117056	Airport logistics	2 SWS	Lecture / 🗣	Richter

Legend: 📱 Online, ❂ Blended (On-Site/Online), 🗣 On-Site, ✕ Cancelled

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 22/23, 2 SWS, Language: German, Open in study portal

Lecture (V)
On-Site

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.

Organizational issues
Termine: siehe ILIAS.

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

T 7.6 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	Grading scale	Recurrence	Version
Written examination	4	Grade to a third	Each winter term	1

Events					
WT 22/23	2133132	Sustainable Vehicle Drivetrains	2 SWS	Lecture / 🗣	Toedter
Exams					
ST 2022	76-T-MACH-105655	Sustainable Vehicle Drivetrains (Alternative Powertrain for Automobiles)			Toedter
WT 22/23	76-T-MACH-105655	Sustainable Vehicle Drivetrains			Toedter

Legend: 🖥 Online, 🧩 Blended (On-Site/Online), 🗣 On-Site, ✕ Cancelled

Competence Certificate
written exam

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

V Sustainable Vehicle Drivetrains — **Lecture (V) On-Site**
2133132, WS 22/23, 2 SWS, Open in study portal

Content
Sustainability

Environmental balance

Legislation

Alternative fuels

BEV

Fuel cell

Hybrid drives

T 7.7 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	Grading scale	Recurrence	Version
Oral examination	4	Grade to a third	Each summer term	1

Events					
ST 2022	2134150	Gas, lubricating oil and operating media analysis in drive train development	2 SWS	Lecture / 🗣	Gohl
Exams					
ST 2022	76--T-Mach-105173	Analysis of Exhaust Gas and Lubricating Oil in Combustion Engines			Gohl
WT 22/23	76-T-MACH-105173	Analysis of Exhaust Gas and Lubricating Oil in Combustion Engines			Koch

Legend: 🖥 Online, ⚙ Blended (On-Site/Online), 🗣 On-Site, ✕ Cancelled

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 Gas, lubricating oil and operating media analysis in drive train development

Lecture (V)
On-Site

2134150, SS 2022, 2 SWS, Language: German, Open in study portal

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

7.8 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	Grading scale	Recurrence	Version
Oral examination	4	Grade to a third	Each winter term	2

Competence Certificate
oral exam (20 min)

Prerequisites
None

T 7.9 Course: Atomistic Simulations and Molecular Dynamics [T-MACH-105308]

Responsible: Prof. Dr. Peter Gumbsch
Dr.-Ing. Johannes Schneider
Dr. Daniel Weygand

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	Grading scale	Recurrence	Version
Oral examination	4	Grade to a third	Each summer term	2

Events					
ST 2022	2181740	Atomistic simulations and molecular dynamics	3 SWS	Lecture / Practice (/ 🗣	Weygand, Gumbsch
Exams					
ST 2022	76T-MACH-105308	Atomistic Simulations and Molecular Dynamics			Weygand, Gumbsch
ST 2022	76-T-MACH-105308-W	Atomistic Simulations and Molecular Dynamics			Weygand, Gumbsch
WT 22/23	76T-MACH-105308	Atomistic Simulations and Molecular Dynamics			Weygand, Gumbsch

Legend: 🖥 Online, ⚙ Blended (On-Site/Online), 🗣 On-Site, × Cancelled

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 2022, 3 SWS, Language: English, Open in study portal

Lecture / Practice (VÜ)
On-Site

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 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

Organizational issues
Die Vorlesung wird auf Englisch angeboten!

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.

T 7.10 Course: Automated Manufacturing Systems [T-MACH-108844]

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

Part of: M-MACH-102589 - Major Field: Production Systems
M-MACH-102818 - Major Field: Vehicle Technology
M-MACH-102820 - Major Field: Mechatronics
M-MACH-102821 - Major Field: Technical Logistics

Type	Credits	Grading scale	Recurrence	Version
Oral examination	8	Grade to a third	Each summer term	1

Events					
ST 2022	2150904	Automated Manufacturing Systems	6 SWS	Lecture / Practice (/	Fleischer
Exams					
ST 2022	76-T-MACH-108844	Automated Manufacturing Systems			Fleischer
WT 22/23	76-T-MACH-108844	Automated Manufacturing Systems			Fleischer

Legend: Online, Blended (On-Site/Online), On-Site, Cancelled

Competence Certificate
oral exam (40 minutes)

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

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

V Automated Manufacturing Systems
2150904, SS 2022, 6 SWS, Language: German, Open in study portal

Lecture / Practice (VÜ)
Blended (On-Site/Online)

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

Organizational issues
Start: 21.04.2022

Vorlesungstermine dienstags 8:00 Uhr und donnerstags 8:00 Uhr, Übungstermine donnerstags 09:45 Uhr.
Bekanntgabe der konkreten Übungstermine erfolgt in der ersten Vorlesung.

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 7.11 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	Grading scale	Recurrence	Expansion	Language	Version
Written examination	8	Grade to a third	Each winter term	1 terms		3

Events					
WT 22/23	2113805	Automotive Engineering I	4 SWS	Lecture / 🗣	Gauterin, Unrau
WT 22/23	2113809	Automotive Engineering I	4 SWS	Lecture / 🗣	Gauterin, Gießler
Exams					
ST 2022	76-T-MACH-100092	Automotive Engineering			Gauterin, Unrau
WT 22/23	76-T-MACH-100092	Automotive Engineering			Unrau, Gauterin

Legend: 🖥 Online, ❖ Blended (On-Site/Online), 🗣 On-Site, ✕ Cancelled

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 22/23, 4 SWS, Language: German, Open in study portal

Lecture (V)
On-Site

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".

Organizational issues
Das Vorlesungsmaterial wird auf ILIAS bereitgestellt. Das ILIAS-Passwort erhalten Sie unter https://fast-web-01.fast.kit.edu/PasswoerterIlias/

Kann nicht mit der Veranstaltung [2113809] kombiniert werden.

Can not be combined with lecture [2113809].

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 22/23, 4 SWS, Language: English, Open in study portal	**Lecture (V)** **On-Site**

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".

Organizational issues

You will find the lecture material on ILIAS. To get the ILIAS password, KIT students refer to https://fast-web-01.fast.kit.edu/PasswoerterIlias/, students from eucor universities send an e-mail to martina.kaiser@kit.edu

Kann nicht mit LV Grundlagen der Fahrzeugtechnik I [2113805] kombiniert werden.

Can not be combined with lecture [2113805] Grundlagen der Fahrzeugtechnik I.

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 7.12 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	Grading scale	Recurrence	Version
Written examination	4	Grade to a third	Each summer term	1

Events					
ST 2022	2114835	Automotive Engineering II	2 SWS	Lecture / 🗣	Unrau
ST 2022	2114855	Automotive Engineering II	2 SWS	Lecture / 🧩	Gießler
Exams					
ST 2022	76-T-MACH-102117	Automotive Engineering II			Unrau, Gauterin
WT 22/23	76-T-MACH-102117	Automotive Engineering II			Unrau, Gauterin
WT 22/23	76T-MACH-102117-2	Automotive Engineering II			Gauterin, Unrau

Legend: 🖥 Online, 🧩 Blended (On-Site/Online), 🗣 On-Site, ✕ Cancelled

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

Lecture (V)
On-Site

2114835, SS 2022, 2 SWS, Language: German, Open in study portal

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.

Organizational issues
Das Vorlesungsmaterial wird auf ILIAS bereitgestellt. Das ILIAS-Passwort erhalten Sie unter https://fast-web-01.fast.kit.edu/PasswoerterIlias/

Kann nicht mit der Veranstaltung [2114855] kombiniert werden.

Can not be combined with lecture [2114855]

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 2022, 2 SWS, Language: English, Open in study portal

Lecture (V)
Blended (On-Site/Online)

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.

Organizational issues

You will find the lecture material on ILIAS. To get the ILIAS password, KIT students refer to https://fast-web-01.fast.kit.edu/PasswoerterIlias/, students from eucor universities send an e-mail to martina.kaiser@kit.edu

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 7.13 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	Grading scale	Recurrence	Version
Written examination	6	Grade to a third	Each summer term	2

Events					
ST 2022	2138340	Automotive Vision	3 SWS	Lecture / 🖥	Lauer, Fehler
Exams					
ST 2022	76-T-MACH-105218	Automotive Vision			Stiller, Lauer
WT 22/23	76-T-MACH-105218	Automotive Vision			Stiller, Lauer

Legend: 🖥 Online, Blended (On-Site/Online), On-Site, ✕ Cancelled

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 2022, 3 SWS, Language: English, Open in study portal

Lecture (V)
Online

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 7.14 Course: Bachelor's Thesis [T-MACH-109188]

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

Type	Credits	Grading scale	Recurrence	Version
Final Thesis	12	Grade to a third	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 have earned 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 7.15 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	Grading scale	Recurrence	Version
Written examination	7	Grade to a third	Each winter term	3

Events					
WT 22/23	2137301	Measurement and Control Systems	3 SWS	Lecture / 🗣	Stiller
WT 22/23	2137302	Measurement and Control Systems (Tutorial)	1 SWS	Practice / 🗣	Stiller, Fischer, Hauser
WT 22/23	3137020	Measurement and Control Systems	3 SWS	Lecture / 🗣	Stiller
WT 22/23	3137021	Measurement and Control Systems (Tutorial)	1 SWS	Practice / 🗣	Stiller, Fischer, Hauser
Exams					
ST 2022	76-T-MACH-104745	Basis of Measurement and Control Systems			Stiller
WT 22/23	76-T-MACH-104745	Basis of Measurement and Control Systems			Stiller

Legend: 🖥 Online, ⚙ Blended (On-Site/Online), 🗣 On-Site, ✕ Cancelled

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

2137301, WS 22/23, 3 SWS, Language: German, Open in study portal

Lecture (V)
On-Site

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**
3137020, WS 22/23, 3 SWS, Language: English, Open in study portal

Lecture (V)
On-Site

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 22/23, 1 SWS, Language: English, Open in study portal **On-Site**

Content
Tutorial for Measurement and Control Systems

T 7.16 Course: Basics of Manufacturing Technology [T-MACH-105219]

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

Part of: M-MACH-102549 - Manufacturing Processes

Type	Credits	Grading scale	Recurrence	Version
Written examination	4	Grade to a third	Each winter term	1

Events					
WT 22/23	2149658	Basics of Manufacturing Technology	2 SWS	Lecture / Practice (/	Schulze
Exams					
ST 2022	76-T-MACH-105219	Basics of Manufacturing Technology			Schulze
WT 22/23	76-T-MACH-105219	Fundamentals of Manufacturing Technology			Schulze

Legend: Online, Blended (On-Site/Online), On-Site, Cancelled

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
2149658, WS 22/23, 2 SWS, Language: German, Open in study portal

Lecture / Practice (VÜ)
Blended (On-Site/Online)

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

Organizational issues

Start: 26.10.2022

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

Responsible: Dr.-Ing. Martin Mittwollen
Dr.-Ing. 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	Grading scale	Recurrence	Version
Written examination	4	Grade to a third	Each winter term	1

Events					
WT 22/23	2117095	Basics of Technical Logistics I	3 SWS	Lecture / Practice (/	Mittwollen, Oellerich
Exams					
ST 2022	76-T-MACH-109919	Basics of Technical Logistics I			Mittwollen
ST 2022	76-T-MACH-109919-mPr	Basics of Technical Logistics I			Mittwollen
WT 22/23	76-T-MACH-109919	Basics of Technical Logistics I			Mittwollen

Legend: Online, Blended (On-Site/Online), On-Site, × Cancelled

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 I

2117095, WS 22/23, 3 SWS, Language: German, Open in study portal

Lecture / Practice (VÜ)
Blended (On-Site/Online)

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.

Organizational issues

Die Erfolgskontrolle erfolgt in Form einer schriftlichen oder mündlichen Prüfung (nach §4 (2), 1 bzw. 2SPO).

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

Es wird Kenntnis der Grundlagen der Technischen Mechanik vorausgesetzt.

Basics knowledge of technical mechanics is preconditioned.

Ergänzungsblätter, Präsentationen,Tafel.

Supplementary sheets, presentations, blackboard.

Präsenz: 48Std

Nacharbeit: 132Std

presence: 48h

rework: 132h

Literature

Empfehlungen in der Vorlesung / Recommendations during lessons

T 7.18 Course: Basics of Technical Logistics II [T-MACH-109920]

Responsible: Dr.-Ing. Maximilian Hochstein
Organisation: KIT Department of Mechanical Engineering

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

Type	Credits	Grading scale	Recurrence	Version
Written examination	6	Grade to a third	Each winter term	2

Events					
WT 22/23	2117098	Basics of Technical Logistics II	3 SWS	Lecture / Practice (/	Oellerich
Exams					
ST 2022	76-T-MACH-109920	Basics of Technical Logistics II			Oellerich, Hochstein, Mittwollen
ST 2022	76-T-MACH-109920-mPr	Basics of Technical Logistics II			Mittwollen, Oellerich, Hochstein
WT 22/23	76-T-MACH-109920	Basics of Technical Logistics II			Hochstein, Mittwollen, Oellerich

Legend: Online, Blended (On-Site/Online), On-Site, × Cancelled

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

Responsible: Maximilian Naumann
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	Grading scale	Recurrence	Version
Written examination	6	Grade to a third	Each winter term	2

Events					
WT 22/23	2138336	Behaviour Generation for Vehicles	3 SWS	Lecture / Blended	Werling, Naumann
Exams					
ST 2022	76-T-MACH-105367	Behaviour Generation for Vehicles			Stiller
WT 22/23	76-T-MACH-105367	Behaviour Generation for Vehicles			Stiller

Legend: Online, Blended (On-Site/Online), On-Site, Cancelled

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 22/23, 3 SWS, Language: German, Open in study portal

Lecture (V)
Blended (On-Site/Online)

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: 180 hours

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

T 7.20 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	Grading scale	Recurrence	Version
Completed coursework	4	pass/fail	Each summer term	1

Events					
ST 2022	2181708	Biomechanics: Design in Nature and Inspired by Nature	3 SWS	/ 🗣	Mattheck
Exams					
ST 2022	76-T-MACH-105651	Biomechanics: design in nature and inspired by nature			Mattheck

Legend: 📱 Online, ⚙ Blended (On-Site/Online), 🗣 On-Site, ✕ Cancelled

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, SS 2022, 3 SWS, Language: German, Open in study portal **On-Site**

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 7.21 Course: Boosting of Combustion Engines [T-MACH-105649]

Responsible: Dr.-Ing. Johannes Kech
Dr.-Ing. Heiko Kubach

Organisation: KIT Department of Mechanical Engineering

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

Type	Credits	Grading scale	Recurrence	Version
Oral examination	4	Grade to a third	Each summer term	1

Events					
ST 2022	2134153	Boosting of Combustion Engines	2 SWS	/ 🗣	Kech
WT 22/23	2134153	Boosting of Combustion Engines	2 SWS	/ 🗣	Kech

Legend: 🖥 Online, ❄ Blended (On-Site/Online), 🗣 On-Site, ✕ Cancelled

Competence Certificate
oral exam, 20 min

Prerequisites
none

T 7.22 Course: BUS-Controls [T-MACH-102150]

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

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102812 - Major Field: Powertrain Systems
M-MACH-102817 - Major Field: Information Technology
M-MACH-102820 - Major Field: Mechatronics

Type	Credits	Grading scale	Recurrence	Version
Oral examination	4	Grade to a third	Each summer term	2

Events					
ST 2022	2114080	Control of Mobile Machines	2 SWS	Lecture /	Geimer, Becker

Legend: Online, Blended (On-Site/Online), On-Site, Cancelled

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 Control of Mobile Machines

2114080, SS 2022, 2 SWS, Language: German, Open in study portal

Lecture (V)
Blended (On-Site/Online)

Content

- Basics of sensors, controls and control architectures in mobile machines
- Basics and functionalities of data communication in mobile machines (CAN-Bus, PROFIBUS, Ethernet, ...)
- Legal aspects and requirements (SIL-level, ...)
- Requirements for sensors for use in mobile machines
- Introduction to machine learning methods and their application for the control of mobile machines
- Overview of current research and developments in the field of agricultural robotics
- Implementation of a specific task within the exercise lessons
- The results of the semester task will be summarized in a short report as a pre-requisite for the exam.

Learning objectives

The students learn the theoretical basics of data communication as well as the architecture of control systems in mobile machines. Furthermore, they will be able to identify influences and general conditions during usage and derive practical and legal requirements for sensors and control systems. The students will learn methods of machine learning for control tasks in mobile machines as well as their architecture and the handling of training data. After participating in the exercise, they will be able to implement, train and validate a control system for a specific task.

Recommendations

Basic knowledge of electrical engineering and computer science is recommended. Initial programming knowledge, preferably in Python, is required. The number of participants is limited as hardware will be provided for the exercise. Prior registration is required, details will be announced on the web pages of the Institute of Vehicle Systems Engineering / Department of Mobile Machinery. In case of high registration numbers exceeding the capacities, a selection among all interested persons will take place according to qualification.

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

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.

AN-Bus-Technik einfach, anschaulich und praxisnah dargestellt; Poing: Franzis Verlag, 2002.

T 7.23 Course: BUS-Controls - Advance [T-MACH-108889]

Responsible: 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	Grading scale	Recurrence	Version
Completed coursework	0	pass/fail	Each summer term	1

Competence Certificate
Creation of control program

Prerequisites
none

T 7.24 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	Grading scale	Recurrence	Version
Completed coursework (practical)	2	pass/fail	Each term	2

Events					
ST 2022	2123357	CAD-NX training course	2 SWS	Practical course /	Ovtcharova, Mitarbeiter
WT 22/23	2123357	CAD-NX training course	2 SWS	Practical course /	Ovtcharova, Mitarbeiter
Exams					
ST 2022	76-T-MACH-102187	CAD-NX Training Course			Ovtcharova

Legend: Online, Blended (On-Site/Online), On-Site, Cancelled

Competence Certificate
Practical verification as academic achievement by working on a design task on the 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, SS 2022, 2 SWS, Language: German/English, Open in study portal

Practical course (P)
Blended (On-Site/Online)

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.

Organizational issues
Das Praktikum wird zum einen vorlesungsbegleitend sowie zum anderen als einwöchige Blockveranstaltung in der vorlesungsfreien Zeit angeboten. Weitere Informationen siehe ILIAS.

Literature
Praktikumsskript

V

CAD-NX training course

2123357, WS 22/23, 2 SWS, Language: German, Open in study portal

Practical course (P)
Blended (On-Site/Online)

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.

Organizational issues
Das Praktikum kann entweder vorlesungsbegleitend oder als einwöchige Blockveranstaltung in der vorlesungsfreien Zeit absolviert werden. Weitere Informationen siehe ILIAS.

Literature
Praktikumsskript

T 7.25 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	Grading scale	Recurrence	Version
Examination of another type	4	Grade to a third	Each term	2

Events					
ST 2022	2147175	CAE-Workshop	3 SWS	Block / 🗣	Albers, Mitarbeiter
WT 22/23	2147175	CAE-Workshop	3 SWS	Block / 🗣	Albers, Mitarbeiter
Exams					
ST 2022	76-T-MACH-105212	CAE-Workshop			Albers

Legend: 🖥 Online, ⚙ Blended (On-Site/Online), 🗣 On-Site, ✕ Cancelled

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, SS 2022, 3 SWS, Language: German, Open in study portal

Block (B)
On-Site

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: 88.5 h

Organizational issues
Wir empfehlen den Workshop ab dem 5. Semester.

Anmeldung erforderlich. Weitere Informationen siehe IPEK-Homepage.

Anwesenheitspflicht

Literature
Kursunterlagen werden in Ilias bereitgestellt.
Content is provided on Ilias.

V	**CAE-Workshop** 2147175, WS 22/23, 3 SWS, Language: German, Open in study portal	**Block (B)** **On-Site**

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: 88.5 h

Organizational issues
Wir empfehlen den Workshop ab dem 5. Semester.

Anmeldung erforderlich. Weitere Informationen siehe IPEK-Homepage.

Anwesenheitspflicht

Literature
Kursunterlagen werden in Ilias bereitgestellt.

Content is provided on Ilias.

T 7.26 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	Grading scale	Recurrence	Version
Completed coursework (practical)	2	pass/fail	Each term	2

Events					
ST 2022	2123358	CATIA CAD training course	2 SWS	Practical course / Blended	Ovtcharova, Mitarbeiter
WT 22/23	2123358	CATIA CAD training course	2 SWS	Practical course / Blended	Ovtcharova, Mitarbeiter
Exams					
ST 2022	76-T-MACH-102185	CATIA CAD Training Course			Ovtcharova

Legend: Online, Blended (On-Site/Online), On-Site, × Cancelled

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, SS 2022, 2 SWS, Language: German/English, Open in study portal

Practical course (P)
Blended (On-Site/Online)

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.

Organizational issues
Das Praktikum wird einerseits vorlesungsbegleitend sowie andererseits als einwöchige Blockveranstaltung in der vorlesungsfreien Zeit angeboten. Weitere Informationen siehe ILIAS.

Literature
Praktikumskript

V

CATIA CAD training course

2123358, WS 22/23, 2 SWS, Language: German, Open in study portal

Practical course (P)
Blended (On-Site/Online)

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.

Organizational issues
Das Praktikum kann vorlesungsbegleitend absolviert werden oder als einwöchige Blockveranstaltung in der vorlesungsfreien Zeit. Weitere Informationen siehe ILIAS.

Literature
Praktikumskript

T 7.27 Course: CO2-Neutral Combustion Engines and their Fuels I [T-MACH-111550]

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

Part of: M-MACH-102818 - Major Field: Vehicle Technology
M-MACH-102838 - Major Field: Energy Converting Engines

Type	Credits	Grading scale	Recurrence	Expansion	Version
Oral examination	4	Grade to a third	Each winter term	1 terms	1

Events					
WT 22/23	2133113	CO2-neutral combustion engines and their fuels I	4 SWS	Lecture / Practice (/	Koch
Exams					
WT 22/23	76-T-MACH-102194	CO2-neutral combustion engines and their fuels I			Kubach, Koch

Legend: Online, Blended (On-Site/Online), On-Site, ✕ Cancelled

Competence Certificate
oral examination, Duration: 25 min., no auxiliary means

Prerequisites
none

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

V CO2-neutral combustion engines and their fuels I
2133113, WS 22/23, 4 SWS, Language: German, Open in study portal

Lecture / Practice (VÜ)
On-Site

Content
Introduction, Presentation of IFKM
Working Principle
Characteristic Parameters
Engine Parts
Drive Train
Fuels
Gasoline Engines
Diesel Engines
Hydrogen Engines
Exhaust Gas Emissions

Organizational issues
Übungstermine Donnerstags nach Bekanntgabe in der Vorlesung

T 7.28 Course: CO2-Neutral Combustion Engines and their Fuels II [T-MACH-111560]

Responsible: Prof. Dr. Thomas Koch
Organisation: KIT Department of Mechanical Engineering
Part of: M-MACH-102818 - Major Field: Vehicle Technology
M-MACH-102838 - Major Field: Energy Converting Engines

Type	Credits	Grading scale	Recurrence	Version
Oral examination	5	Grade to a third	Each summer term	1

Events					
ST 2022	2134151	CO2-neutral combustion engines and their fuels II	3 SWS	Lecture / Practice (/ 🗣	Koch
Exams					
ST 2022	76-T-MACH-104609	Combustion Engines, Hydrogen Engines and CO2 neutral Fuels II			Koch, Kubach
WT 22/23	76-T-MACH-104609	Combustion Engines, Hydrogen Engines and CO2 neutral Fuels II			Kubach, Koch

Legend: 🖥 Online, ⚙ Blended (On-Site/Online), 🗣 On-Site, ✕ Cancelled

Competence Certificate
oral examination, duration: 25 minutes, no auxiliary means

Prerequisites
none

Recommendation
Fundamentals of Combustion Engines II helpful

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

V CO2-neutral combustion engines and their fuels II
2134151, SS 2022, 3 SWS, Language: German, Open in study portal

Lecture / Practice (VÜ)
On-Site

T 7.29 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	Grading scale	Recurrence	Version
Oral examination	6	Grade to a third	Each summer term	1

Events					
ST 2022	2138341	Cogitive Automobiles - Laboratory	3 SWS	/	Stiller, Lauer, Le Large
Exams					
ST 2022	76-T-MACH-105378	Cognitive Automobiles - Laboratory			Stiller

Legend: Online, Blended (On-Site/Online), On-Site, Cancelled

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 2022, 3 SWS, Language: German, Open in study portal **Blended (On-Site/Online)**

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 7.30 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

Type	Credits	Grading scale	Recurrence	Version
Oral examination	4	Grade to a third	Each winter term	1

Events					
WT 22/23	2133113	CO2-neutral combustion engines and their fuels I	4 SWS	Lecture / Practice (/ 🗣	Koch
Exams					
ST 2022	76-T-MACH-102194	CO2-neutral combustion engines and their fuels I			Koch, Kubach
WT 22/23	76-T-MACH-102194	CO2-neutral combustion engines and their fuels I			Kubach, Koch

Legend: 🖥 Online, ⚙ Blended (On-Site/Online), 🗣 On-Site, × Cancelled

Competence Certificate
oral examination, Duration: 25 min., no auxiliary means

Prerequisites
none

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

V CO2-neutral combustion engines and their fuels I

2133113, WS 22/23, 4 SWS, Language: German, Open in study portal

Lecture / Practice (VÜ)
On-Site

Content
Introduction, Presentation of IFKM

Working Principle

Characteristic Parameters

Engine Parts

Drive Train

Fuels

Gasoline Engines

Diesel Engines

Hydrogen Engines

Exhaust Gas Emissions

Organizational issues
Übungstermine Donnerstags nach Bekanntgabe in der Vorlesung

T 7.31 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	Grading scale	Recurrence	Version
Written examination	4	Grade to a third	Each summer term	2

Events					
ST 2022	2114053	Composite Manufacturing – Polymers, Fibers, Semi-Finished Products, Manufacturing Technologies	2 SWS	Lecture /	Henning
Exams					
ST 2022	76-T-MACH-105535	Composite Manufacturing - Polymers, Fibers, Semi-Finished Products, Manufacturing Technologies			Henning
WT 22/23	76-T-MACH-105535	Composite Manufacturing - Polymers, Fibers, Semi-Finished Products, Manufacturing Technologies			Henning

Legend: Online, Blended (On-Site/Online), On-Site, × Cancelled

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**
2114053, SS 2022, 2 SWS, Language: German, Open in study portal

Lecture (V)
Blended (On-Site/Online)

Content

<u>Physical connections of fiber reinforcement</u>

<u>Use and examples</u>
- Automotive construction
- Transport
- Energy and construction
- Sport and recreation

<u>Resins</u>
- Thermoplastics
- Duromeres

<u>Mechanisms of reinforcements</u>
- Glas fibers
- Carbon fibers
- Aramid fibers
- Natural fibers

<u>Semi-finished products - textiles</u>

<u>Process technologies - prepregs</u>

<u>Recycling of composites</u>

<u>**Aim of this lecture:**</u>

Students know different polymer resin materials and fiber materials and can deduce their character and use.

They understand the reinforcing effect of fibers in a matrix surrounding as well as the tasks of the single components in a compound. They know about the influence of the length of fibers, their mechanical characters and performance in a polymer matrix compound.

Student know the important industrial production processes for continuous and discontinuous reinforced polymer matrix compounds.

Organizational issues

Die Vorlesung wird online stattfinden. Wenn die Corona-Verordnung und die Infektionslage es zulässt evtl. auch in Präzenz. Dies entscheidet sich zu Beginn des Semesters.

The lecture will be online. If the Corona regulations and the infection situation permit, possibly also in attendance. This will be decided at the beginning of the semester.

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 7.32 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	Grading scale	Recurrence	Version
Oral examination	4	Grade to a third	Each summer term	1

Events					
ST 2022	2162246	Computational Dynamics	2 SWS	/ 🖥	Proppe
WT 22/23	2162246	Computational Dynamics	2 SWS	Lecture / 🖥	Proppe
Exams					
ST 2022	76-T-MACH-105349	Computational Dynamics			Proppe
WT 22/23	76-T-MACH-105349	Computational Dynamics			Proppe

Legend: 🖥 Online, Blended (On-Site/Online), On-Site, × Cancelled

Competence Certificate
oral exam, 30 min.

Prerequisites
none

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

V Computational Dynamics
2162246, SS 2022, 2 SWS, Language: German, Open in study portal

Online

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

Organizational issues
Fr., 15:45-17:15, Geb. 10.91, Grashof-Hörsaal

Literature
1. Ein Vorlesungsskript wird bereitgestellt!
2. M. Géradin, B. Rixen: Mechanical Vibrations, Wiley, Chichester, 1997

V Computational Dynamics
2162246, WS 22/23, 2 SWS, Language: German, Open in study portal

Lecture (V)
Online

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 7.33 Course: Computational Intelligence [T-MACH-105314]

Responsible: apl. Prof. Dr. Ralf Mikut
apl. Prof. Dr. 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	Grading scale	Recurrence	Version
Written examination	4	Grade to a third	Each winter term	1

Events					
WT 22/23	2105016	Computational Intelligence	2 SWS	Lecture /	Mikut, Reischl
Exams					
ST 2022	76-T-MACH-105314	Computational Intelligence			Mikut
WT 22/23	76-T-MACH-105314	Computational Intelligence			Mikut

Legend: Online, Blended (On-Site/Online), On-Site, Cancelled

Competence Certificate
Written exam (Duration: 1h)

Prerequisites
none

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

V Computational Intelligence
2105016, WS 22/23, 2 SWS, Language: German, Open in study portal

Lecture (V)
Blended (On-Site/Online)

Content
The students are able to apply the fundamental methods of computational intelligence (fuzzy logic, artificial neural networks, evolutionary algorithms, deep learning) 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
- deep learning

Learning objectives:

The students are able to apply the fundamental methods of computational intelligence (fuzzy logic, artificial neural networks, evolutionary algorithms, deep learning) 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 7.34 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	Grading scale	Recurrence	Version
Oral examination	4	Grade to a third	Each summer term	1

Events					
ST 2022	2162256	Computational Vehicle Dynamics	2 SWS	Lecture / 🖥	Proppe
WT 22/23	2162256	Computational Vehicle Dynamics	2 SWS	Lecture / 🖥	Proppe
Exams					
ST 2022	76-T-MACH-105350	Computational Vehicle Dynamics			Proppe

Legend: 🖥 Online, Blended (On-Site/Online), On-Site, × Cancelled

Competence Certificate
oral exam, 30 min.

Prerequisites
none

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

V Computational Vehicle Dynamics
2162256, SS 2022, 2 SWS, Language: German, Open in study portal

Lecture (V)
Online

Content
This course serves as an introduction into the computational modelling and simulation of technical system road/ vehicle. A method based perspective is taken which allows for a unified treatment of various kinds of vehicles. The vehicle model is obtained by dividing the system into functional subsystems and defining interfaces between these subsystems.

In the first part of the course, vehicle models will be developed based on models of the suspensions, the road, and the contact forces between road and vehicle. The focus of the second part of the course is on computational methods for linear and non-linear models of vehicle systems. The third part of the course discusses design criteria for stability, safety and ride comfort. Multibody dynamics simulations will be carried out using Matlab/ Simulink.

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

V Computational Vehicle Dynamics
2162256, WS 22/23, 2 SWS, Language: German, Open in study portal

Lecture (V)
Online

Content

This course serves as an introduction into the computational modelling and simulation of technical system road/ vehicle. A method based perspective is taken which allows for a unified treatment of various kinds of vehicles. The vehicle model is obtained by dividing the system into functional subsystems and defining interfaces between these subsystems.

In the first part of the course, vehicle models will be developed based on models of the suspensions, the road, and the contact forces between road and vehicle. The focus of the second part of the course is on computational methods for linear and non-linear models of vehicle systems. The third part of the course discusses design criteria for stability, safety and ride comfort. Multibody dynamics simulations will be carried out using Matlab/ Simulink.

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 7.35 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	Grading scale	Recurrence	Version
Written examination	6	Grade to a third	Each summer term	1

Events					
ST 2022	2121390	Computer Science for Engineers	4 SWS	Lecture / Practice (/	Ovtcharova, Elstermann
ST 2022	3121034	Computer Science for Engineers	4 SWS	Lecture / Practice (/	Ovtcharova, Elstermann
Exams					
ST 2022	76-T-MACH-105205	Computer Science for Engineers			Ovtcharova, Elstermann
WT 22/23	76-T-MACH-105205	Computer Science for Engineers - German			Ovtcharova, Elstermann

Legend: Online, Blended (On-Site/Online), On-Site, × Cancelled

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:

V Computer Science for Engineers
2121390, SS 2022, 4 SWS, Language: German, Open in study portal

Lecture / Practice (VÜ)
Blended (On-Site/Online)

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

3121034, SS 2022, 4 SWS, Language: English, Open in study portal

Lecture / Practice (VÜ)
On-Site

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 7.36 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	Grading scale	Recurrence	Version
Completed coursework (practical)	0	pass/fail	Each summer term	2

Events					
ST 2022	2121392	Computer Lab for Computer Science in Mechanical Engineering	2 SWS	/	Ovtcharova, Elstermann, Mitarbeiter
ST 2022	3121036	Computer Science for Engineers Lab Course	2 SWS	/	Ovtcharova, Elstermann
Exams					
ST 2022	76-T-MACH-105206	Computer Science for Engineers, Prerequisite			Ovtcharova, Elstermann

Legend: Online, Blended (On-Site/Online), On-Site, Cancelled

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 2022, 2 SWS, Language: German, Open in study portal **Online**

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.

Organizational issues
Wenn Poolräume nutzbar, dann Poolräume

Literature
Übungsblätter / exercise sheets

V Computer Science for Engineers Lab Course

3121036, SS 2022, 2 SWS, Language: English, Open in study portal **Online**

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.

Organizational issues
Wenn Präsenz möglich, dann ID-Raum Nutzung

Literature
Exercise sheets / Übungsblätter

T 7.37 Course: Constitution and Properties of Wearresistant Materials [T-MACH-102141]

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

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

Type	Credits	Grading scale	Recurrence	Version
Oral examination	4	Grade to a third	Each summer term	3

Events					
ST 2022	2194643	Constitution and Properties of Wear resistant materials	2 SWS	Lecture / 🧩	Ulrich
Exams					
ST 2022	76-T-MACH-102141	Constitution and Properties of Wearresistant Materials			Ulrich
WT 22/23	76-T-MACH-102141	Constitution and Properties of Wearresistant Materials			Ulrich

Legend: 🖥 Online, 🧩 Blended (On-Site/Online), 🗣 On-Site, ✕ Cancelled

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 2022, 2 SWS, Language: German, Open in study portal

Lecture (V)
Blended (On-Site/Online)

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

Organizational issues
Aufgrund der aktuellen Situation findet die Blockveranstaltung online in folgendem Zeitraum statt:

11.04.-13.04.2022: jeweils von 8:00-16:00 Uhr;

Ort: online per MS-Teams

Anmeldung verbindlich bis zum 08.04.2022 unter sven.ulrich@kit.edu.

Nach der Anmeldung wird Ihnen der Link zur Vorlesung per E-Mail am 08.04.2022 mitgeteilt.

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 7.38 Course: Continuum Mechanics of Solids and Fluids [T-MACH-110377]

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

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102582 - Major Field: Continuum Mechanics
M-MACH-102746 - Compulsory Elective Module

Type	Credits	Grading scale	Recurrence	Expansion	Version
Written examination	3	Grade to a third	Each winter term	1 terms	4

Events					
WT 22/23	2161252	Continuum mechanics of solids and fluids	2 SWS	Lecture / ✲	Böhlke, Frohnapfel
Exams					
WT 22/23	76-T-MACH-110377	Continuum mechanics of solids and fluids			Böhlke, Frohnapfel

Legend: Online, Blended (On-Site/Online), On-Site, Cancelled

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

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.

Annotation
Due to capacity reasons it is possible that not all students of this course can be admitted to the computer tutorials. Students of the bachelor's degree program in mechanical engineering who have chosen the Major Field Continuum Mechanics (SP-Nr 13) and students of the bachelor's degree program in material science and material technology will be admitted to the computer tutorials in any case.
If additional places are available in the computer tutorials for this course, these will be allocated according to the BSc average grade.

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

V Continuum mechanics of solids and fluids

2161252, WS 22/23, 2 SWS, Language: German, Open in study portal

Lecture (V)
Blended (On-Site/Online)

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 7.39 Course: Control Technology [T-MACH-105185]

Responsible: Hon.-Prof. Dr. 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	Grading scale	Recurrence	Version
Written examination	4	Grade to a third	Each summer term	2

Events					
ST 2022	2150683	Control Technology	2 SWS	Lecture /	Gönnheimer
Exams					
ST 2022	76-T-MACH-105185	Control Technology			Gönnheimer
WT 22/23	76-T-MACH-105185	Control Technology			Gönnheimer

Legend: Online, Blended (On-Site/Online), On-Site, × Cancelled

Competence Certificate
Written Exam (60 min)

Prerequisites
none

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

V Control Technology
2150683, SS 2022, 2 SWS, Language: German, Open in study portal

Lecture (V)
Blended (On-Site/Online)

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 7.40 Course: Data Analytics for Engineers [T-MACH-105694]

Responsible: Stefan Meisenbacher
apl. Prof. Dr. Ralf Mikut
apl. Prof. Dr. 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	Grading scale	Recurrence	Version
Written examination	5	Grade to a third	Each summer term	2

Events					
ST 2022	2106014	Data Analytics for Engineers	3 SWS	Lecture / Practice (/	Mikut, Reischl, Meisenbacher
Exams					
ST 2022	76-T-MACH-105694	Datenanalyse für Ingenieure			Mikut, Reischl
WT 22/23	76-T-MACH-105694	Data Analytics for Engineers			Mikut

Legend: Online, Blended (On-Site/Online), On-Site, Cancelled

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 2022, 3 SWS, Language: German, Open in study portal

Lecture / Practice (VÜ)
Blended (On-Site/Online)

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 7.41 Course: Data-Driven Algorithms in Vehicle Technology [T-MACH-112126]

Responsible: Dr. Stefan Scheubner
Organisation: KIT Department of Mechanical Engineering
Part of: M-MACH-102818 - Major Field: Vehicle Technology

Type	Credits	Grading scale	Recurrence	Expansion	Version
Written examination	4	Grade to a third	Each winter term	1 terms	1

Events					
WT 22/23	2113840	Data-Driven Algorithms in Vehicle Technology	2 SWS	Lecture / 🧩	Scheubner
Exams					
WT 22/23	7600001	Data-Driven Algorithms in Vehicle Technology			Scheubner

Legend: Online, Blended (On-Site/Online), On-Site, × Cancelled

Competence Certificate
Written Examination

Duration: 90 minutes

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

V Data-Driven Algorithms in Vehicle Technology
2113840, WS 22/23, 2 SWS, Language: English, Open in study portal

Lecture (V)
Blended (On-Site/Online)

Content
Course Syllabus: Data-Driven Algorithms in Vehicle Technology
Motivation for the Course: Nowadays, engineers often develop technical systems using a combination of hard- and software. This is true especially for modern passenger vehicle development. In a digitalized world, such developments are built on knowledge gained from relevant data sources, e.g. the vehicle sensors. Therefore, engineers in automobile technology need qualifications from data science to successfully create new functionalities in the cars. To prevent remaining purely theoretical, the algorithms in this course are explained using a real-world problem of “EV Routing”. Students have the opportunity to test methods in Python with frequent exercises presented.
Goal of the Course: Students have a basic understanding of data-driven algorithms such as Markov Models, Machine Learning or Monte-Carlo Methods. The approach for building data-driven models in automobile technology are known to students and they are able to test algorithms in the programming language “Python”. Furthermore, students have learnt how to analyse the algorithm performance.
Content:
1. Introduction to function development as well as the prerequisites for the course (e.g. Fundamentals for running Python code)
2. Fundamentals for EV Routing and relevant data sources
3. Parameter estimation and state classification algorithms to determine the current situation of the vehicle
4. Learning methods for driver behaviour
5. Forecast algorithms to predict future energy consumption of an electric vehicle

Organizational issues
Das Vorlesungsmaterial wird auf ILIAS bereitgestellt. Das ILIAS-Passwort erhalten Sie unter https://fast-web-01.fast.kit.edu/PasswoerterIlias/

Campus Ost, Geb. 70.04, Raum 219. Studierende müssen einen eigenen Laptop mitbringen.

T 7.42 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	Grading scale	Recurrence	Version
Oral examination	4	Grade to a third	Each winter term	1

Events					
WT 22/23	2113079	Design and Development of Mobile Machines	2 SWS	Lecture / 🗣	Geimer
Exams					
ST 2022	76-T-MACH-105311	Design and Development of Mobile Machines			Geimer
WT 22/23	76-T-MACH-105311	Design and Development of Mobile Machines			Geimer

Legend: 🖥 Online, ♲ Blended (On-Site/Online), 🗣 On-Site, ✕ Cancelled

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

2113079, WS 22/23, 2 SWS, Language: German, Open in study portal

Lecture (V)
On-Site

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 7.43 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	Grading scale	Recurrence	Version
Completed coursework	0	pass/fail	Each term	1

Exams			
ST 2022	76-T-MACH-108887	Design and Development of Mobile Machines - Advance	Geimer
WT 22/23	76-T-MACH-108887	Design and Development of Mobile Machines - Advance	Geimer

Competence Certificate
Preparation of semester report

Prerequisites
none

T 7.44 Course: Design and Optimization of Conventional and Electrified Automotive Transmissions [T-MACH-110958]

Responsible: Prof. Dr.-Ing. Albert Albers
Dr.-Ing. Hartmut Faust

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102812 - Major Field: Powertrain Systems
M-MACH-102818 - Major Field: Vehicle Technology

Type	Credits	Grading scale	Recurrence	Version
Oral examination	4	Grade to a third	Each summer term	1

Events					
ST 2022	2146208	Design and Optimization of Conventional and Electrified Automotive Transmissions	2 SWS	Lecture / 🗣	Faust
Exams					
ST 2022	76-T-MACH-105536	Design and Optimization of Conventional and Electrified Automotive Transmissions			Faust, Albers

Legend: 🖥 Online, ✲ Blended (On-Site/Online), 🗣 On-Site, ✕ Cancelled

Competence Certificate
oral exam (20 min)

Prerequisites
none

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

V Design and Optimization of Conventional and Electrified Automotive Transmissions

2146208, SS 2022, 2 SWS, Language: German, Open in study portal

Lecture (V)
On-Site

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)

Organizational issues

Die Vorlesung wird als Blockvorlesung, in voraussichtlich etwa 14-tägigen Rhythmus gehalten. Genaue Termine und weitere Infos: http://www.ipek.kit.edu/70_2819.php

Lernziele

Die Studenten erwerben das Wissen aus aktuellen Getriebe-, Hybrid- und reinen Elektroantriebs-Entwicklungen über …

- die Funktionsweise und Auslegung von konventionellen und elektrifizierten Fahrzeuggetrieben und deren Komponenten;
- Konstruktions- und Funktionsprinzipien der wichtigsten Komponenten von Handschalt-, Doppelkupplungs-, stufenlosen und Planetenautomat-Getrieben;
- komfortrelevante Zusammenhänge und Abhilfemaßnahmen;
- die Hybridisierung und Elektrifizierung der Triebstränge auf Basis bekannter Getriebetypen und mit speziellen sogenannten Dedicated Hybrid Transmissions (DHT) sowie Bewertung der Konzepte auf Systemebene.

T 7.45 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	Grading scale	Recurrence	Version
Oral examination	6	Grade to a third	Each winter term	2

Events					
WT 22/23	22527	Design of a Jet Engine Combustion Chamber	2 SWS	/ 🗣	Harth

Legend: 🖥 Online, ❂ Blended (On-Site/Online), 🗣 On-Site, ✕ Cancelled

Competence Certificate
The examination is an oral examination on lecture 22527 with a duration of 20 minutes.

Prerequisites
None

T 7.46 Course: Design with Plastics [T-MACH-105330]

Responsible: Dipl.-Ing. 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	Grading scale	Recurrence	Version
Oral examination	4	Grade to a third	Each summer term	1

Events					
ST 2022	2174571	Design with Plastics	2 SWS	Block / Blended	Liedel
Exams					
ST 2022	76-T-MACH-105330	Design with Plastics			Liedel

Legend: Online, Blended (On-Site/Online), On-Site, Cancelled

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 2022, 2 SWS, Language: German, Open in study portal

Block (B)
Blended (On-Site/Online)

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).

Organizational issues

Anmeldung unter Markus.Liedel@de.bosch.com

Literature

Materialien werden in der Vorlesung ausgegeben.
Literaturhinweise werden in der Vorlesung gegeben.

T 7.47 Course: Designing with numerical methods in product development [T-MACH-108719]

Responsible: Prof. Dr. Eckart Schnack
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102815 - Major Field: Engineering Design

Type	Credits	Grading scale	Recurrence	Version
Oral examination	4	Grade to a third	Each winter term	1

Events					
WT 22/23	2161229	Designing with numerical methods in product development	2 SWS	Lecture / 🗣	Schnack
Exams					
ST 2022	76-T-MACH-108719	Designing with numerical methods in product development			

Legend: 🖥 Online, ✲ Blended (On-Site/Online), 🗣 On-Site, ✕ Cancelled

Competence Certificate
Oral examination (duration: 20 min)

Prerequisites
None

Annotation
The lecture notes are made available via ILIAS.

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

V Designing with numerical methods in product development

Lecture (V)
On-Site

2161229, WS 22/23, 2 SWS, Language: German, Open in study portal

Content
Overview of the numeric process: finite difference methods, finite volume methods. Finite element methods. Boundary element method (BEM). Thermodynamic processes. Flow dynamic processes. Solid dynamics. Non-linear field behaviour. These methods are summarised at the end of the course, and a holistic concept for design processes is developed.

Organizational issues
Beginn ab 11.11.2021

Literature
Vorlesungsskript

T 7.48 Course: Development Methods of Technical Systems [T-MACH-111283]

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	Grading scale	Recurrence	Expansion	Version
Examination of another type	4	Grade to a third	Each term	1 terms	1

Events					
ST 2022	2121002	Development methods of technical systems	4 SWS	Project (P / 🗣	Ovtcharova, Maier
WT 22/23	2121002	Development methods of technical systems	4 SWS	Project (P / 🗣	Ovtcharova, Maier
Exams					
ST 2022	76-T-MACH-111283	Development Methods of Technical Systems			Ovtcharova
WT 22/23	76-T-MACH-111283	Development Methods of Technical Systems			Ovtcharova

Legend: Online, Blended (On-Site/Online), 🗣 On-Site, ✕ Cancelled

Competence Certificate
Graded examination of other type weighted 50% project documentation and 50% colloquium.

Prerequisites
None

Recommendation
None

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

V Development methods of technical systems

2121002, SS 2022, 4 SWS, Language: German/English, Open in study portal

Project (PRO)
On-Site

Content
Requirements, SysML, Modelica, FEM high performance computing, process modeling, VR/AR

Students can exemplarily:

- Collect requirements for large technical systems (e.b.: Helmholtz large-scale device KATRIN).
- Describe physical systems across domains with the modeling language Modelica and simulate the systems behavior.
- Generate simple FE meshes for simulations of structural mechanics.
- Perform general FEM analyses on mainframe computers and prepare and explain simulation results.
- As a team present the learned skills and document them continuously.

V Development methods of technical systems

2121002, WS 22/23, 4 SWS, Language: German/English, Open in study portal

Project (PRO)
On-Site

Content
Requirements, SysML, Modelica, FEM high performance computing, process modeling, VR/AR

Students can exemplarily:

- Collect requirements for large technical systems (e.b.: Helmholtz large-scale device KATRIN).
- Describe physical systems across domains with the modeling language Modelica and simulate the systems behavior.
- Generate simple FE meshes for simulations of structural mechanics.
- Perform general FEM analyses on mainframe computers and prepare and explain simulation results.
- As a team present the learned skills and document them continuously.

T 7.49 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
M-MACH-102818 - Major Field: Vehicle Technology
M-MACH-102838 - Major Field: Energy Converting Engines

Type	Credits	Grading scale	Recurrence	Version
Written examination	4	Grade to a third	Each summer term	1

Events					
ST 2022	2134155	Development of Hybrid Powertrains	2 SWS	Lecture / 🗣	Koch, Doppelbauer
Exams					
ST 2022	76-T-MACH-110817	Development of hybrid drivetrains			Koch

Legend: 🖥 Online, ⚙ Blended (On-Site/Online), 🗣 On-Site, ✕ Cancelled

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 2022, 2 SWS, Language: German, Open in study portal

Lecture (V)
On-Site

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 7.50 Course: Development of Oil-Hydraulic Powertrain Systems [T-MACH-105441]

Responsible: Dr.-Ing. 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	Grading scale	Recurrence	Version
Oral examination	4	Grade to a third	Each winter term	1

Events					
WT 22/23	2113072	Development of Oil-Hydraulic Powertrain Systems	2 SWS	Block /	Geerling
Exams					
WT 22/23	76-T-MACH-105441	Development of Oil-Hydraulic Powertrain Systems			Geimer

Legend: Online, Blended (On-Site/Online), On-Site, Cancelled

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 22/23, 2 SWS, Language: German, Open in study portal

Block (B)
Blended (On-Site/Online)

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

Organizational issues
siehe Homepage

T 7.51 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	Grading scale	Recurrence	Version
Written examination	4	Grade to a third	Each winter term	1

Events					
WT 22/23	2137309	Digital Control	2 SWS	Lecture / 🗣	Knoop, Hauser
Exams					
ST 2022	76-T-MACH-105317	Digital Control			Stiller
WT 22/23	76-T-MACH-105317	Digital Control			Stiller

Legend: 🖥 Online, Blended (On-Site/Online), 🗣 On-Site, ✕ Cancelled

Competence Certificate
written exam

60 min.

Prerequisites
none

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

V Digital Control
2137309, WS 22/23, 2 SWS, Language: German, Open in study portal

Lecture (V)
On-Site

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 7.52 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	Grading scale	Recurrence	Version
Oral examination	4	Grade to a third	Each winter term	1

Events					
WT 22/23	2113077	Drive Train of Mobile Machines	2 SWS	Lecture / 🗣	Geimer
WT 22/23	2113078	Übung zu 'Antriebsstrang mobiler Arbeitsmaschinen'	1 SWS	Practice / 🗣	Geimer, Herr
Exams					
ST 2022	76-T-MACH-105307	Drive Train of Mobile Machines			Geimer
WT 22/23	76-T-MACH-105307	Drive Train of Mobile Machines			Geimer

Legend: 🖥 Online, ⚙ Blended (On-Site/Online), 🗣 On-Site, ✕ Cancelled

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

2113077, WS 22/23, 2 SWS, Language: German, Open in study portal

Lecture (V)
On-Site

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 7.53 Course: Dynamic Systems of Technical Logistics [T-MACH-112113]

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

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

Type	Credits	Grading scale	Recurrence	Version
Oral examination	6	Grade to a third	Each summer term	1

Events					
ST 2022	2148605	Dynamic Systems of Technical Logistics	4 SWS	Lecture / Practice (/	Mittwollen
Exams					
ST 2022	76-T-MACH-112113	Dynamic Systems of Technical Logistics			Mittwollen

Legend: Online, Blended (On-Site/Online), On-Site, Cancelled

Competence Certificate
The assessment consists of an oral exam (approx. 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** (LV 2117095) preconditioned.

Knowledge out of **Basics of Technical Logistics-II** (LV 2117098) recommended.

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

V Dynamic Systems of Technical Logistics

2148605, SS 2022, 4 SWS, Language: German, Open in study portal

Lecture / Practice (VÜ)
Blended (On-Site/Online)

Content
Conveyor technology = motion = dynamics

Insight into the structure, mode of operation, dynamics and safety of materials handling equipment along the process chain of technical logistics from raw material extraction through processing, distribution, storage and order picking to shipping.
Bulk material mining, transport, handling, storage
Stability and tipping safety when turning, slewing, driving cranes
Overhead cranes - structure, dynamics, safety
Conveyors in material handling systems (belt, chain, AGV, EMS, ...)
Elevators - structure, dynamics, safety
Material flow systems - structure, basic elements, information flow
Storage and racking systems - structure, dynamics, order picking
Storage and retrieval systems - structure, dynamics, safety

Organizational issues
DSTL und DSTL-P sind zeitlich so gegliedert, dass zunächst unter Hinzunahme des Donnerstags-Zeitslots für das Projekt ausschließlich der Vorlesungsteil bis ca. Ende Juni gehalten wird. Der anschließende Zeitraum ist ausschließlich für die (optionale) Projektarbeit vorgesehen.

T 7.54 Course: Dynamic Systems of Technical Logistics - Project [T-MACH-112114]

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

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

Type	Credits	Grading scale	Recurrence	Version
Examination of another type	4	Grade to a third	Each summer term	1

Events					
ST 2022	2148606	Dynamic Systems of Technical Logistics - Project	2 SWS	Project (P /	Mittwollen
Exams					
ST 2022	76-T-MACH-112114	Dynamic Systems of Technical Logistics - Project			Mittwollen

Legend: Online, Blended (On-Site/Online), On-Site, Cancelled

Competence Certificate
Presentation of performed project and defense (30min) according to $4 (2), No. 3 of the examination regulation

Prerequisites
T-MACH-112113 (Dynamic Systems of Technical Logistics) must have been started.

Modeled Conditions
The following conditions have to be fulfilled:

1. The course T-MACH-112113 - Dynamic Systems of Technical Logistics must have been started.

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

V Dynamic Systems of Technical Logistics - Project
2148606, SS 2022, 2 SWS, Language: German, Open in study portal

Project (PRO)
Blended (On-Site/Online)

Content
Conveyor technology = motion = dynamics
Course content:
The knowledge acquired in the lecture DSTL will be extended and deepened together with the previous knowledge from GTL I/II in the context of an independent project work based on an application case from the current research and project work at IFL. Analyses, research, design work, calculations and simulations are used.

Organizational issues
DSTL und DSTL-P sind zeitlich so gegliedert, dass zunächst unter Hinzunahme des Donnerstags-Zeitslots für das Projekt ausschließlich der Vorlesungsteil bis ca. Ende Juni gehalten wird. Der anschließende Zeitraum ist ausschließlich für die (optionale) Projektarbeit vorgesehen.

T 7.55 Course: Dynamics of Electro-Mechanical Systems [T-MACH-111260]

Responsible: Philipp Altoé
Prof. Dr.-Ing. Alexander Fidlin

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	Grading scale	Expansion	Version
Written examination	5	Grade to a third	1 terms	2

Events					
ST 2022	2162210	Dynamics of electro-mechanical systems	2 SWS	Lecture / Blended	Fidlin, Römer
ST 2022	2162211	Dynamics of electro-mechanical systems (Tutorial)	2 SWS	Practice / Blended	Altoé, Fidlin, Römer
Exams					
ST 2022	76-T-MACH-111260	Dynamics of Electro-Mechanical Systems			Fidlin

Legend: Online, Blended (On-Site/Online), On-Site, Cancelled

Competence Certificate
Written exam, 180 minutes

Prerequisites
None

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

V Dynamics of electro-mechanical systems
2162210, SS 2022, 2 SWS, Language: German, Open in study portal

Lecture (V)
Blended (On-Site/Online)

Content
The lecture conveys two kinds of describing electro-mechanical systems. The first one (described shortly) is based on state and flow variables, the second one (which is in the focus of the course) is based on an energetic description and the Lagrange-Maxwell-Formalism. These methods are then applied in order to analyse the most important electro-mechanical systems. These include

- Dynamics of electro-mechanical converter and vibration exciters taking into account the load in resonance operation
- Dynamics of electrical machines taking into account the rotordynamic effects (imbalance, loss of stability, passage through resonance)
- Dynamics of piezo-electrical converters in sensor and actor operation

T 7.56 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	Grading scale	Recurrence	Version
Oral examination	5	Grade to a third	Each winter term	1

Events					
WT 22/23	2163111	Dynamics of the Automotive Drive Train	2 SWS	Lecture / 🗣	Fidlin
WT 22/23	2163112	Übungen zu Dynamik des Kfz-Antriebsstrangs	2 SWS	Practice	Fidlin, Gießler
Exams					
ST 2022	76-T-MACH-105226	Dynamics of the Automotive Drive Train			Fidlin
WT 22/23	76-T-MACH-105226	Dynamics of the Automotive Drive Train			Fidlin

Legend: 🖥 Online, ❂ Blended (On-Site/Online), 🗣 On-Site, ✕ Cancelled

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
2163111, WS 22/23, 2 SWS, Language: German, Open in study portal

Lecture (V)
On-Site

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
2163112, WS 22/23, 2 SWS, Language: German, Open in study portal

Practice (Ü)

Content
Exercises related to the lecture

T 7.57 Course: Electrical Engineering and Electronics [T-ETIT-109820]

Responsible: Prof. Dr. Martin Doppelbauer
Organisation: KIT Department of Electrical Engineering and Information Technology
Part of: M-ETIT-104801 - Electrical Engineering

Type	Credits	Grading scale	Recurrence	Version
Written examination	8	Grade to a third	Each winter term	1

Events					
WT 22/23	2306339	Electrical Engineering and Electronics foir Mechanical Engineers	4 SWS	Lecture /	Doppelbauer
WT 22/23	2306340	Electrical Engineering and Electronics foir Mechanical Engineers	2 SWS	Practice /	Hähnlein, Digel, Bremer
Exams					
ST 2022	7306351	Electrical Engineering and Electronics for Mechanical Engineers			Becker
WT 22/23	7306351	Electrical Engineering and Electronics for Mechanical Engineers			Doppelbauer

Legend: Online, Blended (On-Site/Online), On-Site, × Cancelled

Annotation
Exam will be held in german language

T 7.58 Course: Energy Efficient Intralogistic Systems [T-MACH-105151]

Responsible: Dr.-Ing. Meike Kramer
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	Grading scale	Recurrence	Version
Oral examination	4	Grade to a third	Each winter term	1

Events					
WT 22/23	2117500	Energy efficient intralogistic systems	2 SWS	Lecture / 🖥	Kramer, Schönung

Legend: 🖥 Online, Blended (On-Site/Online), On-Site, × Cancelled

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 22/23, 2 SWS, Language: German, Open in study portal

Lecture (V)
Online

Content
The content of course “Basics of Technical Logistics” should be knownn.

Organizational issues
Blockveranstaltung 2021/2022. Die Veranstaltung wird im Januar als Online Veranstaltung (Link wird im ILIAS Kurs bereitgestellt) stattfinden. Termine

12.01.2022: 16:00 - 18:00 Uhr

14.01.2022: 16:00 - 18:00 Uhr

17.01.2022: 16:00 - 19:00 Uhr

18.01.2022: 16:00 - 19:00 Uhr

21.01.2022: 16:00 - 19:00 Uhr

24.01.2022: 16:00 - 19:00 Uhr

26.01.2022: 16:00 - 19:00 Uhr

28.01.2022: 16:00 - 18:00 Uhr

31.01.2022: 16:00 - 18:00 Uhr (als Fragestunde)

Literature
Keine.

T 7.59 Course: Energy Systems I: Renewable Energy [T-MACH-105408]

Responsible: apl. Prof. Dr. Ron Dagan
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102816 - Major Field: Fundamentals of Energy Technology

Type	Credits	Grading scale	Recurrence	Version
Oral examination	4	Grade to a third	Each winter term	2

Events					
WT 22/23	2129901	Energy Systems I - Renewable Energy	3 SWS	Lecture / 🗣	Dagan
Exams					
ST 2022	76-T-MACH-105408	Energy Systems I: Renewable Energy			Dagan
WT 22/23	76-T-MACH-105408	Energy Systems I: Renewable Energy			Dagan

Legend: 🖥 Online, ⚙ Blended (On-Site/Online), 🗣 On-Site, × Cancelled

Competence Certificate
oral exam, approx. 1/2 hour

Prerequisites
none

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

V Energy Systems I - Renewable Energy

2129901, WS 22/23, 3 SWS, Language: German, Open in study portal

Lecture (V)
On-Site

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

Organizational issues
Die Veranstaltung wird nur online gehalten, falls durch Corona Einschränkungen vorgegeben werden.

T 7.60 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
M-MACH-102838 - Major Field: Energy Converting Engines

Type	Credits	Grading scale	Recurrence	Version
Completed coursework	4	pass/fail	Each summer term	1

Events					
ST 2022	2134001	Engine Laboratory	2 SWS	Practical course / 🗣	Wagner
Exams					
ST 2022	76-T-MACH-105337	Engine Laboratory			Koch

Legend: 🖥 Online, ⚙ Blended (On-Site/Online), 🗣 On-Site, × Cancelled

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

2134001, SS 2022, 2 SWS, Language: German, Open in study portal

Practical course (P)
On-Site

Organizational issues
voraussichtlich 1. vorlesungsfreie Woche im SS 2021. Wird auf der Homepage und in den Vorlesungen bekannt gegeben

Literature
Versuchsbeschreibungen

T 7.61 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
M-MACH-102818 - Major Field: Vehicle Technology

Type	Credits	Grading scale	Recurrence	Version
Oral examination	4	Grade to a third	Each summer term	1

Events					
ST 2022	2134137	Engine measurement techniques	2 SWS	Lecture / 🗣	Bernhardt
Exams					
ST 2022	76-T-MACH-105169	Engine Measurement Techniques			Koch
WT 22/23	76-T-MACH-105169	Engine Measurement Techniques			Koch

Legend: 🖥 Online, ⚙ Blended (On-Site/Online), 🗣 On-Site, ✕ Cancelled

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 2022, 2 SWS, Language: German, Open in study portal

Lecture (V)
On-Site

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 7.62 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	Grading scale	Recurrence	Version
Written examination	7	Grade to a third	Each winter term	2

Events					
WT 22/23	2161245	Engineering Mechanics I	3 SWS	Lecture /	Böhlke
WT 22/23	3161010	Engineering Mechanics I (Lecture)	3 SWS	Lecture /	Langhoff, Böhlke
Exams					
ST 2022	76-T-MACH-100282	Engineering Mechanics I			Böhlke, Langhoff
ST 2022	76-T-MACH-100282-englisch	Engineering Mechanics I			Böhlke, Langhoff
WT 22/23	76-T-MACH-100282	Engineering Mechanics I			Böhlke, Langhoff
WT 22/23	76-T-MACH-100282-englisch	Engineering Mechanics I			Böhlke, Langhoff

Legend: Online, Blended (On-Site/Online), On-Site, Cancelled

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 22/23, 3 SWS, Language: German, Open in study portal

Lecture (V)
Blended (On-Site/Online)

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 7.63 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	Grading scale	Recurrence	Version
Written examination	6	Grade to a third	Each summer term	2

Events					
ST 2022	2162250	Engineering Mechanics II	3 SWS	Lecture /	Böhlke, Langhoff
ST 2022	3162010	Engineering Mechanics II (Lecture)	3 SWS	Lecture /	Langhoff
Exams					
ST 2022	76-T-MACH-100283	Engineering Mechanics II			Böhlke, Langhoff
ST 2022	76-T-MACH-100283-englisch	Engineering Mechanics II			Böhlke, Langhoff
WT 22/23	76-T-MACH-100283	Engineering Mechanics II			Böhlke, Langhoff
WT 22/23	76-T-MACH-100283-englisch	Engineering Mechanics II			Böhlke, Langhoff

Legend: Online, Blended (On-Site/Online), On-Site, × Cancelled

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 2022, 3 SWS, Language: German, Open in study portal

Lecture (V)
Blended (On-Site/Online)

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 2022, 3 SWS, Language: English, Open in study portal

Lecture (V)
Blended (On-Site/Online)

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 7.64 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	Grading scale	Recurrence	Version
Written examination	10	Grade to a third	Each winter term	2

Events					
ST 2022	2162231	Engineering Mechanics IV	2 SWS	Lecture /	Proppe
ST 2022	3162012	Engineering Mechanics 4	2 SWS	Lecture /	Proppe
WT 22/23	2161203	Engineering Mechanics III	2 SWS	Lecture /	Fidlin
WT 22/23	3161012	Engineering Mechanics III (Lecture)	2 SWS	Lecture /	Römer
Exams					
ST 2022	76-T-MACH-105201	Engineering Mechanics III & IV			Seemann
WT 22/23	76-T-MACH-105201	Engineering Mechanics III & IV			Fidlin

Legend: Online, Blended (On-Site/Online), On-Site, Cancelled

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 IV
2162231, SS 2022, 2 SWS, Language: German, Open in study portal

Lecture (V)
Blended (On-Site/Online)

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 2022, 2 SWS, Language: English, Open in study portal

Lecture (V)
Blended (On-Site/Online)

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.

V	**Engineering Mechanics III** 2161203, WS 22/23, 2 SWS, Language: German, Open in study portal	**Lecture (V)** **On-Site**

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 22/23, 2 SWS, Language: English, Open in study portal	**Lecture (V)** **On-Site**

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.

T 7.65 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	Grading scale	Recurrence	Version
Completed coursework (written)	0	pass/fail	Each winter term	1

Events					
WT 22/23	2165502	Exercise course Technical Thermodynamics and Heat Transfer I	2 SWS	Practice /	Maas
WT 22/23	3165015	Technical Thermodynamics and Heat Transfer I (Tutorial)	2 SWS	Tutorial (/	Schießl, Maas
Exams					
ST 2022	76T-MACH-105204	Excercises in Technical Thermodynamics and Heat Transfer I			Maas
ST 2022	76-T-MACH-105204	Excercises in Technical Thermodynamics and Heat Transfer I			Maas, Schießl
WT 22/23	76-T-MACH-105204	Excercises in Technical Thermodynamics and Heat Transfer I			Maas, Schießl

Legend: Online, Blended (On-Site/Online), On-Site, Cancelled

Competence Certificate
Homework is mandatory.

T 7.66 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	Grading scale	Recurrence	Version
Completed coursework	0	pass/fail	Each summer term	1

Events					
ST 2022	2166556	Technical Thermodynamics and Heat Transfer II (Tutorial)	2 SWS	Practice /	Maas
ST 2022	3166033	Technical Thermodynamics and Heat Transfer II (Tutorial)	2 SWS	Practice /	Schießl, Maas
Exams					
ST 2022	76T-MACH-105288	Excercises in Technical Thermodynamics and Heat Transfer II			Maas, Schießl
WT 22/23	76-T-MACH-105288	Excercises in Technical Thermodynamics and Heat Transfer II			Maas, Schießl

Legend: Online, Blended (On-Site/Online), On-Site, Cancelled

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 2022, 2 SWS, Language: German, Open in study portal

Practice (Ü)
Blended (On-Site/Online)

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 7.67 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	Grading scale	Recurrence	Expansion	Version
Completed coursework	0	pass/fail	Each winter term	1 terms	1

Events					
WT 22/23	2181114	Tribology	5 SWS	Lecture / Practice (/	Dienwiebel, Scherge

Legend: Online, Blended (On-Site/Online), On-Site, Cancelled

Competence Certificate
successful solving of all exercises

Prerequisites
none

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

V Tribology

2181114, WS 22/23, 5 SWS, Language: German, Open in study portal

Lecture / Practice (VÜ)
On-Site

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 7.68 Course: Exercises for Materials Characterization [T-MACH-107685]

Responsible: Dr.-Ing. Jens Gibmeier
Prof. Dr. Reinhard Schneider

Organisation: KIT Department of Mechanical Engineering

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

Type	Credits	Grading scale	Recurrence	Version
Completed coursework	2	pass/fail	Each summer term	4

Events					
ST 2022	2174586	Materials Characterization	2 SWS	Lecture / 🗣️💻	Schneider, Gibmeier
Exams					
ST 2022	76-T-MACH-107685	Exercises for Materials Characterization			Gibmeier

Legend: 🖥 Online, 🗣️💻 Blended (On-Site/Online), 🗣 On-Site, ✕ Cancelled

Competence Certificate
Regular attendance

Prerequisites
T-MACH-110945 – Exercises for Materials Characterization has not been started

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

V Materials Characterization
2174586, SS 2022, 2 SWS, Language: German, Open in study portal

Lecture (V)
Blended (On-Site/Online)

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.

Organizational issues
Die Veranstaltung findet gem. der aktuell am KIT geltenden Corona-Regeln statt. Stand 11.04.2022 wird die Veranstatung in Präsenz durchgeführt. In jeden Fall bitten wir weiterhin um das Tragen einer Mund-Nasenbedeckung. Im Sommersemester wird die Veranstaltung in deutscher Spache abgehalten. Start der Veranstaltung (erste Vorlesung) ist am 26.04.2022.

The event will be held in accordance with the Corona rules currently in force at KIT. Status of 11.04.2022, the event will be held in presence. In any case, we still ask you to wear a nose and mouth covering. In the summer semester, the event will be held in German. The course (first lecture) will start on 26.04.2022.

Literature
Vorlesungsskript (wird zu Beginn der Veranstaltung ausgegeben).

Literatur wird zu Beginn der Veranstaltung bekanntgegeben.

T 7.69 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	Grading scale	Recurrence	Version
Oral examination	5	Grade to a third	Each summer term	1

Events					
ST 2022	2162225	Experimental Dynamics	3 SWS	Lecture / 🖥	Fidlin
ST 2022	2162228	Übungen zu Experimentelle Dynamik	2 SWS	Practice / 🖥	Fidlin, Genda
Exams					
ST 2022	76-T-MACH-105514	Experimental Dynamics			Fidlin

Legend: 🖥 Online, Blended (On-Site/Online), On-Site, ✕ Cancelled

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 2022, 3 SWS, Language: German, Open in study portal

Lecture (V)
Online

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 7.70 Course: Failure Analysis [T-MACH-105724]

Responsible: Prof. 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	Grading scale	Recurrence	Version
Oral examination	4	Grade to a third	Each winter term	2

Events					
WT 22/23	2182572	Failure Analysis	2 SWS	Lecture / 🗣	Greiner, Schneider
Exams					
ST 2022	76-T-MACH-105724	Failure Analysis			Schneider
WT 22/23	76-T-MACH-105724	Failure Analysis			Schneider, Greiner

Legend: 🖥 Online, ⚙ Blended (On-Site/Online), 🗣 On-Site, × Cancelled

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 22/23, 2 SWS, Open in study portal

Lecture (V)
On-Site

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 7.71 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	Grading scale	Recurrence	Version
Oral examination	4	Grade to a third	Each winter term	1

Events					
WT 22/23	2181711	Failure of structural materials: deformation and fracture	3 SWS	Lecture / Practice (/ 🗣	Gumbsch, Weygand
Exams					
ST 2022	76-T-MACH-102140	Failure of Structural Materials: Deformation and Fracture			Weygand, Gumbsch
WT 22/23	76-T-MACH-102140	Failure of Structural Materials: Deformation and Fracture			Weygand, Gumbsch, Kraft

Legend: 🖥 Online, ❄ Blended (On-Site/Online), 🗣 On-Site, ✕ Cancelled

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 22/23, 3 SWS, Language: German, Open in study portal

Lecture / Practice (VÜ)
On-Site

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.

Organizational issues
Übungstermine werden in der Vorlesung bekannt gegeben!

nach aktuellem Stand Präsenz

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

T 7.72 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	Grading scale	Recurrence	Version
Oral examination	4	Grade to a third	Each winter term	1

Events					
WT 22/23	2181715	Failure of Structural Materials: Fatigue and Creep	2 SWS	Lecture / 🗣	Gruber, Gumbsch
Exams					
ST 2022	76-T-MACH-102139	Failure of Structural Materials: Fatigue and Creep			Gruber, Gumbsch
WT 22/23	76-T-MACH-102139	Failure of Structural Materials: Fatigue and Creep			Gruber, Gumbsch

Legend: 📱 Online, ❖ Blended (On-Site/Online), 🗣 On-Site, × Cancelled

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: Fatigue and Creep

2181715, WS 22/23, 2 SWS, Language: German, Open in study portal

Lecture (V)
On-Site

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 7.73 Course: Fatigue of Materials [T-MACH-112106]

Responsible: Dr.-Ing. Stefan Guth
Organisation: KIT Department of Mechanical Engineering

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

Type	Credits	Grading scale	Recurrence	Version
Oral examination	4	Grade to a third	Each winter term	1

Events					
WT 22/23	2173586	Fatigue of Materials	2 SWS	Lecture /	Guth
Exams					
WT 22/23	76-T-MACH-112106	Fatigue of Materials			Guth

Legend: Online, Blended (On-Site/Online), On-Site, Cancelled

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 Materials

2173586, WS 22/23, 2 SWS, Language: German, Open in study portal

Lecture (V)
Blended (On-Site/Online)

Content

- Introduction: historical review and some fatigue damage cases
- Cyclic Stress Strain Behaviour
- Crack Initiation
- Crack Propagation
- Lifetime Behaviour under Cyclic Loading
- Fatigue of Notched Components
- Structural Durability
- Fatigue of composites and compound materials

learning objectives:

The students are able to recognise the deformation and the failure behaviour of 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 evaluate the cyclic strength behaviour of materials and components both qualitatively and quantitatively and know the procedures for the assessment of single-stage, multistage and stochastic cyclical loadings.

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 7.74 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	Grading scale	Recurrence	Version
Oral examination	4	Grade to a third	Each winter term	1

Events					
WT 22/23	2189911	Tutorial 'Flows and Heat Transfer in Energy Technology '	1 SWS	Practice / Blended	Cheng, Mitarbeiter

Legend: Online, Blended (On-Site/Online), On-Site, Cancelled

Competence Certificate
oral exam, 20 min

Prerequisites
none

T 7.75 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	Grading scale	Recurrence	Version
Written examination	8	Grade to a third	Each summer term	2

Events					
ST 2022	2154512	Fluid Mechanics I	3 SWS	Lecture / Practice (/	Frohnapfel
ST 2022	3154510	Fluid Mechanics I	3 SWS	Lecture / Practice (/	Frohnapfel
WT 22/23	2153512	Fluid Mechanics II	3 SWS	Lecture / Practice (/	Frohnapfel
WT 22/23	3153511	Fluid Mechanics II	3 SWS	Lecture / Practice (/	Frohnapfel
Exams					
ST 2022	76-T-MACH-105207	Fluid Mechanics (1+2)			Frohnapfel, Kriegseis
ST 2022	76-T-MACH-105207 engl.	Fluid Mechanics 1&2			Frohnapfel
WT 22/23	76-T-MACH-105207	Fluid Mechanics (1+2)			Frohnapfel
WT 22/23	76-T-MACH-105207 engl.	Fluid Mechanics 1&2			Frohnapfel

Legend: Online, Blended (On-Site/Online), On-Site, Cancelled

Competence Certificate
written exam 3 hours

Prerequisites
none

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

V Fluid Mechanics I

2154512, SS 2022, 3 SWS, Language: German, Open in study portal

Lecture / Practice (VÜ)
Blended (On-Site/Online)

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** 3154510, SS 2022, 3 SWS, Language: English, Open in study portal	**Lecture / Practice (VÜ)** **Blended (On-Site/Online)**

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 II** 2153512, WS 22/23, 3 SWS, Language: German, Open in study portal	**Lecture / Practice (VÜ)** **Blended (On-Site/Online)**

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 22/23, 3 SWS, Language: English, Open in study portal	**Lecture / Practice (VÜ)** **Blended (On-Site/Online)**

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

T 7.76 Course: Fluid Power Systems [T-MACH-102093]

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

Part of: M-MACH-102746 - Compulsory Elective Module
M-MACH-102838 - Major Field: Energy Converting Engines

Type	Credits	Grading scale	Recurrence	Version
Written examination	4	Grade to a third	Each winter term	2

Events					
WT 22/23	2114093	Fluid Technology	2 SWS	Lecture / 🗣	Geimer
Exams					
ST 2022	76-T-MACH-102093	Fluid Power Systems			Geimer
WT 22/23	76-T-MACH-102093	Fluid Power Systems			Geimer

Legend: 🖥 Online, ⚙ Blended (On-Site/Online), 🗣 On-Site, × Cancelled

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
2114093, WS 22/23, 2 SWS, Language: German, Open in study portal

Lecture (V)
On-Site

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 7.77 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	Grading scale	Recurrence	Version
Oral examination	4	Grade to a third	Each summer term	2

Events					
ST 2022	2174575	Foundry Technology	2 SWS	Lecture / Blended	Wilhelm
Exams					
ST 2022	76-T-MACH-105157	Foundry Technology			Wilhelm

Legend: Online, Blended (On-Site/Online), On-Site, Cancelled

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 2022, 2 SWS, Language: German, Open in study portal

Lecture (V)
Blended (On-Site/Online)

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).

Organizational issues

29.4.

13.5. und 20.5.

3.6. und 24.6.

8.7., 15.7., 22.7. und 29.7

Literature

Literaturhinweise werden in der Vorlesung gegeben

Reference to literature, documentation and partial lecture notes given in lecture

T 7.78 Course: Fuels and Lubricants for Engine Powertrains [T-MACH-111623]

Responsible: Hon.-Prof. Dr. 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	Grading scale	Recurrence	Version
Oral examination	4	Grade to a third	Each winter term	1

Events					
WT 22/23	2133108	Fuels and Lubricants for Combustion Engines	2 SWS	Lecture / 🗣	Kehrwald

Legend: 🖥 Online, ⚙ Blended (On-Site/Online), 🗣 On-Site, ✕ Cancelled

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

2133108, WS 22/23, 2 SWS, Language: German, Open in study portal

Lecture (V)
On-Site

Content
electric drives and fuel cell drives with the associated operating materials will also be presented

- Introduction, basics, primary energy and energy chains
- Illustrative chemistry of hydrocarbons
- Fossil fuels, exploration, processing, standards
- Operating materials not fossil, renewable, alternative
- Fuels, lubricants, coolants, AdBlue
- Laboratory analysis, testing, test benches and measurement technology
- Excursion to test fields for motorized drives from 0.5 to 3,500 kW

Literature
Skript

T 7.79 Course: Fundamentals for Design of Motor-Vehicle Bodies I [T-MACH-102116]

Responsible: Dipl.-Ing. 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	Grading scale	Recurrence	Version
Oral examination	2	Grade to a third	Each winter term	1

Events					
WT 22/23	2113814	Fundamentals for Design of Motor-Vehicles Bodies I	1 SWS	Lecture / 🗣	Bardehle
Exams					
ST 2022	76-T-MACH-102116	Fundamentals for Design of Motor-Vehicle Bodies I			Bardehle, Unrau
WT 22/23	76-T-MACH-102116	Fundamentals for Design of Motor-Vehicle Bodies I			Unrau, Bardehle

Legend: 🖥 Online, ❄ Blended (On-Site/Online), 🗣 On-Site, × Cancelled

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 22/23, 1 SWS, Language: German, Open in study portal

Lecture (V)
On-Site

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.

Organizational issues
Das Vorlesungsmaterial wird auf ILIAS bereitgestellt. Das ILIAS-Passwort erhalten Sie unter https://fast-web-01.fast.kit.edu/PasswoerterIlias/

CO, Geb. 70.04, Raum 219.

Termine und nähere Informationen: siehe Institutshomepage

Dates and further information will be published on the homepage of the institute

Literature

1. Automobiltechnische Zeitschrift ATZ, Friedr. Vieweg & Sohn Verlagsges. mbH, Wiesbaden
2. Automobil Revue, Bern (Schweiz)
3. Automobil Produktion, Verlag Moderne Industrie, Landsberg

T 7.80 Course: Fundamentals for Design of Motor-Vehicle Bodies II [T-MACH-102119]

Responsible: Dipl.-Ing. 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	Grading scale	Recurrence	Version
Oral examination	2	Grade to a third	Each summer term	1

Events					
ST 2022	2114840	Fundamentals for Design of Motor-Vehicles Bodies II	1 SWS	Lecture / 🗣	Bardehle
Exams					
ST 2022	76-T-MACH-102119	Fundamentals for Design of Motor-Vehicle Bodies II			Bardehle, Gauterin
WT 22/23	76-T-MACH-102119	Fundamentals for Design of Motor-Vehicle Bodies II			Bardehle

Legend: 🖥 Online, ⚙ Blended (On-Site/Online), 🗣 On-Site, ✕ Cancelled

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
2114840, SS 2022, 1 SWS, Language: German, Open in study portal

Lecture (V)
On-Site

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.

Organizational issues
Das Vorlesungsmaterial wird auf ILIAS bereitgestellt. Das ILIAS-Passwort erhalten Sie unter https://fast-web-01.fast.kit.edu/PasswoerterIlias/

Voraussichtliche Termine, nähere Informationen und evtl. Änderungen:

siehe Institutshomepage. Präsenzveranstaltung unter Vorbehalt der Pandemie-Entwicklung

Scheduled dates, further Information and possible changes of date:

see homepage of the institute.

Literature

1. Automobiltechnische Zeitschrift ATZ, Friedr. Vieweg & Sohn Verlagsges. mbH, Wiesbaden
2. Automobil Revue, Bern (Schweiz)
3. Automobil Produktion, Verlag Moderne Industrie, Landsberg

T 7.81 Course: Fundamentals in the Development of Commercial Vehicles [T-MACH-111389]

Responsible: Christof Weber
Organisation: KIT Department of Mechanical Engineering

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

Type	Credits	Grading scale	Recurrence	Expansion	Version
Oral examination	4	Grade to a third	see Annotations	2 terms	2

Events					
ST 2022	2114844	Fundamentals in the Development of Commercial Vehicles II	1 SWS	Lecture / Online	Weber
WT 22/23	2113812	Fundamentals in the Development of Commercial Vehicles I	1 SWS	Lecture / On-Site	Weber
Exams					
ST 2022	76T-MACH-111389	Fundamentals in the Development of Commercial Vehicles			Weber
WT 22/23	76T-MACH-111389	Fundamentals in the Development of Commercial Vehicles			Weber

Legend: Online, Blended (On-Site/Online), On-Site, × Cancelled

Competence Certificate
Oral group examination

Duration: appr. 30 minutes

Auxiliary means: none

Prerequisites
none

Annotation
Fundamentals in the Development of Commercial Vehicles I, WT

Fundamentals in the Development of Commercial Vehicles II, ST

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

V Fundamentals in the Development of Commercial Vehicles II
2114844, SS 2022, 1 SWS, Language: German, Open in study portal

Lecture (V)
Online

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.

Organizational issues

Das Vorlesungsmaterial wird auf ILIAS bereitgestellt. Das ILIAS-Passwort erhalten Sie unter https://fast-web-01.fast.kit.edu/PasswoerterIlias/

Vorlesung findet nochmals als digitale Veranstaltung über ILIAS statt. Genaue Termine, nähere Informationen und eventuelle Terminänderungen:

siehe Institutshomepage.

Literature

1.HILGERS, M.: Nutzfahrzeugtechnik lernen, Springer Vieweg, ISSN: 2510-1803

2.SCHITTLER, M.; HEINRICH, R.; KERSCHBAUM, W.: Mercedes-Benz Baureihe 500 – neue V-Motorengeneration für schwere Nutzfahrzeuge, MTZ 57 Nr. 9, S. 460 ff, 1996

3.Robert Bosch GmbH (Hrsg.): Bremsanalgen für Kraftfahrzeuge, VDI-Verlag, Düsseldorf, 1. Auflage, 1994

4.RUBI, V.; STRIFLER, P. (Hrsg. Institut für Kraftfahrwesen RWTH Aachen): Indiustrielle Nutzfahrzeugentwicklung, Schriftenreihe Automobiltechnik, 1993

5.TEUTSCH, R.; CHERUTI, R.; GASSER, R.; PEREIRA, M.; de SOUZA, A.; WEBER, C.: Fuel Efficiency Optimization of Market Specific Truck Applications, Proceedings of the 5th Commercial Vehicle Technology Symposium – CVT 2018

V Fundamentals in the Development of Commercial Vehicles I

2113812, WS 22/23, 1 SWS, Language: German, Open in study portal

Lecture (V)
On-Site

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.

Organizational issues

Das Vorlesungsmaterial wird auf ILIAS bereitgestellt. Das ILIAS-Passwort erhalten Sie unter https://fast-web-01.fast.kit.edu/PasswoerterIlias/

CO, Geb. 70.04, Raum 219. Termine und Nähere Informationen: siehe Institutshomepage

Dates and further information will be published on the homepage of the institute.

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 7.82 Course: Fundamentals of Automobile Development I [T-MACH-105162]

Responsible: Prof.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	Grading scale	Recurrence	Version
Written examination	2	Grade to a third	Each winter term	1

Events					
WT 22/23	2113810	Fundamentals of Automobile Development I	1 SWS	Lecture / 🗣	Frech
WT 22/23	2113851	Principles of Whole Vehicle Engineering I	1 SWS	Lecture / 🗣	Frech
Exams					
ST 2022	76-T-MACH-105162	Fundamentals of Automobile Development I			Frech, Unrau
WT 22/23	76-T-MACH-105162	Fundamentals of Automobile Development I			Frech, Unrau

Legend: 🖥 Online, ❖ Blended (On-Site/Online), 🗣 On-Site, × Cancelled

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
2113810, WS 22/23, 1 SWS, Language: German, Open in study portal

Lecture (V)
On-Site

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.

Organizational issues
Das Vorlesungsmaterial wird auf ILIAS bereitgestellt. Das ILIAS-Passwort erhalten Sie unter https://fast-web-01.fast.kit.edu/PasswoerterIlias/

Campus Ost, geb. 70.04., Raum 219

Termine und nähere Informationen finden Sie auf der Institutshomepage.

Kann nicht mit Lehrveranstaltung 2113851 kombiniert werden.

Date and further information will be published on the homepage of the institute.

Cannot be combined with lecture 2113851.

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

2113851, WS 22/23, 1 SWS, Language: English, Open in study portal

Lecture (V)
On-Site

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.

Organizational issues
You will find the lecture material on ILIAS. To get the ILIAS password, KIT students refer to https://fast-web-01.fast.kit.edu/PasswoerterIlias/

CO, Geb.70.04, Raum 219. Termine und nähere Informationen finden Sie auf der Institutshomepage.

Dats and further information will be published on the homepage of the institute.

Kann nicht mit Lehrveranstaltung 2113810 kombiniert werden

Cannot be combined with lecture 2113810.

Literature
Skript zur Vorlesung wird zu Beginn des Semesters ausgegeben

The scriptum will be provided during the first lessons

T 7.83 Course: Fundamentals of Automobile Development II [T-MACH-105163]

Responsible: Prof.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	Grading scale	Recurrence	Version
Written examination	2	Grade to a third	Each summer term	2

Events					
ST 2022	2114842	Fundamentals of Automobile Development II	1 SWS	Block / 🗣	Frech
ST 2022	2114860	Principles of Whole Vehicle Engineering II	1 SWS	/ 🗣	Frech
Exams					
ST 2022	76-T-MACH-105163	Fundamentals of Automobile Development II			Frech, Unrau
WT 22/23	76-T-MACH-105163	Fundamentals of Automobile Development II			Frech, Unrau

Legend: 🖥 Online, ⚙ Blended (On-Site/Online), 🗣 On-Site, ✕ Cancelled

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

2114842, SS 2022, 1 SWS, Language: German, Open in study portal

Block (B)
On-Site

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.

Organizational issues
Das Vorlesungsmaterial wird auf ILIAS bereitgestellt. Das ILIAS-Passwort erhalten Sie unter https://fast-web-01.fast.kit.edu/PasswoerterIlias/

Vorlesung findet als Blockvorlesung am Campus Ost, Geb. 70.04, Raum 219 statt. Termine werden über die Homepage bekannt gegeben.

Kann nicht mit der Veranstaltung [2114860] kombiniert werden.

Cannot be combined with lecture [2114860].

Literature
Skript zur Vorlesung ist über ILIAS verfügbar.

V **Principles of Whole Vehicle Engineering II**
2114860, SS 2022, 1 SWS, Language: English, Open in study portal **On-Site**

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.

Organizational issues
Kann nicht mit der Veranstaltung [2114842] kombiniert werden.

Cannot be combined with lecture [2114842].

Veranstaltung findet am Campus Ost, Geb. 70.04, Raum 219 statt. Genaue Termine entnehmen Sie bitte der Institushomepage.

Scheduled dates:

see homepage of the institute.

Literature
Das Skript zur Vorlesung ist über ILIAS verfügbar.

T 7.84 Course: Fundamentals of Catalytic Exhaust Gas Aftertreatment [T-MACH-105044]

Responsible: Prof. Dr. Olaf Deutschmann
Prof. Dr. Jan-Dierk Grunwaldt
Dr.-Ing. Heiko Kubach
Hon.-Prof. Dr. 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	Grading scale	Recurrence	Version
Oral examination	4	Grade to a third	Each summer term	1

Events					
ST 2022	2134138	Fundamentals of catalytic exhaust gas aftertreatment	2 SWS	Lecture / 🗣	Lox, Grunwaldt, Deutschmann
Exams					
ST 2022	76-T-MACH-105044	Fundamentals of Catalytic Exhaust Gas Aftertreatment			Lox
WT 22/23	76-T-MACH-105044	Fundamentals of Catalytic Exhaust Gas Aftertreatment			Lox

Legend: 🖥 Online, ❖ Blended (On-Site/Online), 🗣 On-Site, ✕ Cancelled

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

Lecture (V)
On-Site

2134138, SS 2022, 2 SWS, Language: German, Open in study portal

Organizational issues
Blockvorlesung, Termin und Ort werden auf der Homepage des IFKM und ITCP bekannt gegeben.

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 7.85 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
M-MACH-102816 - Major Field: Fundamentals of Energy Technology
M-MACH-102818 - Major Field: Vehicle Technology
M-MACH-102838 - Major Field: Energy Converting Engines

Type	Credits	Grading scale	Recurrence	Version
Oral examination	5	Grade to a third	Each winter term	1

Events					
WT 22/23	2133123	Fundamentals of Combustion Engine Technology	2 SWS	Lecture / 🗣	Kubach, Wagner, Toedter, Pfeil, Bernhardt, Velji
Exams					
ST 2022	76-T-MACH-105652	Fundamentals of Combustion Engine Technology			Kubach
ST 2022	76-T-MACH-105652(SP)	Fundamentals of Combustion Engine Technology			Kubach

Legend: 🖥 Online, ❂ Blended (On-Site/Online), 🗣 On-Site, ✕ Cancelled

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 22/23, 2 SWS, Language: German, Open in study portal

Lecture (V)
On-Site

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 7.86 Course: Fundamentals of Combustion I [T-MACH-105213]

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

Part of: M-MACH-102746 - Compulsory Elective Module
M-MACH-102838 - Major Field: Energy Converting Engines

Type	Credits	Grading scale	Recurrence	Version
Written examination	4	Grade to a third	Each winter term	1

Events					
WT 22/23	2165515	Fundamentals of Combustion I	2 SWS	Lecture / 🗣	Maas
WT 22/23	2165517	Fundamentals of Combustion I (Tutorial)	1 SWS	Practice / 🗣	Bykov
WT 22/23	3165016	Fundamentals of Combustion I	2 SWS	Lecture / 🗣	Maas
WT 22/23	3165017	Fundamentals of Combustion I (Tutorial)	1 SWS	Practice / 🗣	Bykov
Exams					
ST 2022	76-T-MACH-105213	Fundamentals of Combustion I			Maas
ST 2022	76-T-MACH-105464	Fundamentals of Combustion I			Maas

Legend: 🖥 Online, 🧩 Blended (On-Site/Online), 🗣 On-Site, ✕ Cancelled

Competence Certificate
Written exam, approx. 3 hours

Prerequisites
none

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

V Fundamentals of Combustion I
2165515, WS 22/23, 2 SWS, Language: German, Open in study portal

Lecture (V)
On-Site

Content

- Fundamental concepts and phenomena
- Experimental analysis of flames
- Conservation equations for laminar flat flames
- Chemical reactions
- Chemical kinetics mechanisms
- Laminar premixed flames
- Laminar diffusion flames
- Ignition processes
- NOx formation
- Formation of hydrocarbons and soot

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 22/23, 1 SWS, Language: German, Open in study portal

Practice (Ü)
On-Site

Literature

- Vorlesungsskript
- J. Warnatz; U. Maas; R.W. Dibble: Verbrennung, Springer, Heidelberg 1996

V **Fundamentals of Combustion I**

3165016, WS 22/23, 2 SWS, Language: English, Open in study portal

Lecture (V)
On-Site

Content

- Fundamental concepts and phenomena
- Experimental analysis of flames
- Conservation equations for laminar flat flames
- Chemical reactions
- Chemical kinetics mechanisms
- Laminar premixed flames
- Laminar diffusion flames
- Ignition processes
- NOx formation
- Formation of hydrocarbons and soot

Literature
Vorlesungsskript,

Buch Verbrennung - Physikalisch-Chemische Grundlagen, Modellbildung, Schadstoffentstehung, Autoren: U. Maas, J. Warnatz, R.W. Dibble, Springer-Lehrbuch, Heidelberg 1996

T 7.87 Course: Fundamentals of Combustion II [T-MACH-105325]

Responsible: Dr. Viatcheslav Bykov
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	Grading scale	Recurrence	Version
Oral examination	4	Grade to a third	Each summer term	2

Events					
ST 2022	2166538	Fundamentals of combustion II	2 SWS	Lecture / Blended	Maas
ST 2022	2166539	Übung zu Grundlagen der technischen Verbrennung II	1 SWS	Practice / Blended	Maas
ST 2022	3166550	Fundamentals of Combustion II	2 SWS	Lecture / Blended	Maas, Bykov, Straßacker
Exams					
ST 2022	76-T-MACH-105325	Fundamentals of Combustion II			Maas

Legend: Online, Blended (On-Site/Online), On-Site, Cancelled

Competence Certificate
Oral exam, approx. 20 min

Prerequisites
none

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

V Fundamentals of combustion II

2166538, SS 2022, 2 SWS, Language: German, Open in study portal

Lecture (V)
Blended (On-Site/Online)

Content

- Three dimensional Navier-Stokes equations for reacting flows
- Turbulent reactive flows
- Turbulent non-premixed flames
- Turbulent premixed flames
- Combustion of liquid and solid fuels
- Engine knock
- Thermodynamics of combustion processes
- Transport phenomena
- Effects of Combustion Processes on the Atmosphere

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 2022, 1 SWS, Language: German, Open in study portal

Practice (Ü)
Blended (On-Site/Online)

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

V **Fundamentals of Combustion II**
3166550, SS 2022, 2 SWS, Language: English, Open in study portal

Lecture (V)
Blended (On-Site/Online)

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
- Thermodynamics of combustion processes
- Transport phenomena
- Effects of Combustion Processes on the Atmosphere

Organizational issues
Time and location will be announced on the website and at the institute showcase.

Literature
Vorlesungsskript;

Buch Verbrennung - Physikalisch-Chemische Grundlagen, Modellbildung, Schadstoffentstehung, Autoren: U. Maas, J. Warnatz, R.W. Dibble, Springer-Lehrbuch; Heidelberg, Karlsruhe, Berkley 2006

T 7.88 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	Grading scale	Recurrence	Version
Written examination	8	Grade to a third	Each summer term	1

Events					
ST 2022	2130927	Fundamentals of Energy Technology	3 SWS	Lecture / Blended	Cheng, Badea
ST 2022	3190923	Fundamentals of Energy Technology	3 SWS	Lecture / Blended	Badea
Exams					
ST 2022	76-T-MACH-105220	Fundamentals of Energy Technology			Cheng, Badea
ST 2022	76-T-MACH-105220 Fundamentals of Energy Technology	Fundamentals of Energy Technology			Badea
WT 22/23	76-T-MACH-105220	Fundamentals of Energy Technology			Badea, Cheng

Legend: Online, Blended (On-Site/Online), On-Site, Cancelled

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 2022, 3 SWS, Language: German, Open in study portal

Lecture (V)
Blended (On-Site/Online)

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 2022, 3 SWS, Language: English, Open in study portal

Lecture (V)
Blended (On-Site/Online)

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 7.89 Course: Gasdynamics [T-MACH-105533]

Responsible: Dr.-Ing. Davide Gatti
Dr. Jochen Kriegseis

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	Grading scale	Recurrence	Version
Oral examination	4	Grade to a third	Each winter term	1

Exams			
ST 2022	76-T-MACH-105533	Gasdynamics	Magagnato

Competence Certificate
oral exam - 30 minutes

Prerequisites
none

T 7.90 Course: Gear Cutting Technology [T-MACH-102148]

Responsible: Dr.-Ing. Markus Klaiber
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	Grading scale	Recurrence	Version
Oral examination	4	Grade to a third	Each winter term	1

Events					
WT 22/23	2149655	Gear Technology	2 SWS	Lecture / Blended	Klaiber
Exams					
ST 2022	76-T-MACH-102148	Gear Cutting Technology			Klaiber
WT 22/23	76-T-MACH-102148	Gear Technology			Klaiber

Legend: Online, Blended (On-Site/Online), On-Site, Cancelled

Competence Certificate
Oral Exam (20 min)

Prerequisites
none

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

V Gear Technology

2149655, WS 22/23, 2 SWS, Language: German, Open in study portal

Lecture (V)
Blended (On-Site/Online)

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

Organizational issues
Start: 27.10.2022

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 7.91 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
M-MACH-102838 - Major Field: Energy Converting Engines

Type	Credits	Grading scale	Recurrence	Expansion	Version
Oral examination	4	Grade to a third	Each summer term	1 terms	1

Events					
ST 2022	2134154	Large Diesel and Gas Engines for Ship Propulsions	2 SWS	Lecture / 🗣	Weisser
Exams					
ST 2022	76-T-MACH-110816	Großdiesel- und -gasmotoren für Schiffsantriebe			Weisser

Legend: 🖥 Online, ⚙ Blended (On-Site/Online), 🗣 On-Site, × Cancelled

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

2134154, SS 2022, 2 SWS, Language: German, Open in study portal

Lecture (V)
On-Site

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 7.92 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	Grading scale	Recurrence	Version
Oral examination	4	Grade to a third	Each winter term	1

Events					
WT 22/23	2113807	Handling Characteristics of Motor Vehicles I	2 SWS	Lecture / 🗣	Unrau
Exams					
ST 2022	76-T-MACH-105152	Handling Characteristics of Motor Vehicles I			Unrau
WT 22/23	76-T-MACH-105152	Handling Characteristics of Motor Vehicles I			Unrau

Legend: 🖥 Online, ⚙ Blended (On-Site/Online), 🗣 On-Site, ✕ Cancelled

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 22/23, 2 SWS, Language: German, Open in study portal

Lecture (V)
On-Site

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.

Organizational issues
Das Vorlesungsmaterial wird auf ILIAS bereitgestellt. Das ILIAS-Passwort erhalten Sie unter https://fast-web-01.fast.kit.edu/PasswoerterIlias/

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 7.93 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	Grading scale	Recurrence	Version
Oral examination	4	Grade to a third	Each summer term	1

Events					
ST 2022	2114838	Handling Characteristics of Motor Vehicles II	2 SWS	Lecture / 🗣	Unrau
Exams					
ST 2022	76-T-MACH-105153	Handling Characteristics of Motor Vehicles II			Unrau
WT 22/23	76-T-MACH-105153	Handling Characteristics of Motor Vehicles II			Unrau

Legend: 🖥 Online, ⚙ Blended (On-Site/Online), 🗣 On-Site, ✕ Cancelled

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 2022, 2 SWS, Language: German, Open in study portal

Lecture (V)
On-Site

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.

Organizational issues
Das Vorlesungsmaterial wird auf ILIAS bereitgestellt. Das ILIAS-Passwort erhalten Sie unter https://fast-web-01.fast.kit.edu/PasswoerterIlias/

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 7.94 Course: Heat and Mass Transfer [T-MACH-105292]

Responsible: Prof. Dr. Ulrich Maas
Dr.-Ing. Chunkan Yu

Organisation: KIT Department of Mechanical Engineering

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

Type	Credits	Grading scale	Recurrence	Version
Written examination	4	Grade to a third	Each term	1

Events					
ST 2022	3122512	Heat and Mass Transfer	2 SWS	Lecture / Blended	Maas
WT 22/23	2165512	Heat and mass transfer	2 SWS	Lecture / On-Site	Maas
Exams					
ST 2022	76-T-MACH-105292	Heat and Mass Transfer			Maas

Legend: Online, Blended (On-Site/Online), On-Site, Cancelled

Competence Certificate
Written exam, approx. 3 h

Prerequisites
none

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

V Heat and Mass Transfer
3122512, SS 2022, 2 SWS, Language: English, Open in study portal

Lecture (V)
Blended (On-Site/Online)

Content

- Steady and unsteady heat transfer in homogenous materials; Plates, pipe sections and sperical shells
- Molecular diffusion in gases; analogies between heat conduction and mass diffusion
- Convective, forced heat transfer in pipes/channels and around plates and profiles.
- Convective mass transfer, heat-/mass transfer analogy
- Multi phase convective heat transfer (ceondensation, evaporation)
- Radiative heat transfer

Organizational issues
Bitte beachten Sie den Aushang.

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

V Heat and mass transfer
2165512, WS 22/23, 2 SWS, Language: German, Open in study portal

Lecture (V)
On-Site

Content

- Steady and unsteady heat transfer in homogenous materials; Plates, pipe sections and sperical shells
- Molecular diffusion in gases; analogies between heat conduction and mass diffusion
- Convective, forced heat transfer in pipes/channels and around plates and profiles.
- Convective mass transfer, heat-/mass transfer analogy
- Multi phase convective heat transfer (ceondensation, evaporation)
- Radiative heat transfer

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 7.95 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	Grading scale	Recurrence	Version
Written examination	4	Grade to a third	Each winter term	2

Events					
WT 22/23	2109035	Human Factors Engineering I: Ergonomics	2 SWS	Lecture / Blended	Deml
Exams					
ST 2022	76-T-MACH-105518	Human Factors Engineering I			Deml
WT 22/23	76-T-MACH-105518	Human Factors Engineering I			Deml

Legend: Online, Blended (On-Site/Online), On-Site, Cancelled

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 22/23, 2 SWS, Language: German, Open in study portal

Lecture (V)
Blended (On-Site/Online)

Content
The course "Human Factors Engineering I: Ergonomics" takes place in the first half of the semester, **until 2022/12/22**, on Wednesday and Thursday.

In the second half of the semester, **beginning with 2022/12/28**, 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).

Organizational issues
Die Veranstaltung "Arbeitswissenschaft I: Ergonomie" findet in der ersten Hälfte des Semesters, **bis zum 22.12.2022** am Mittwoch und Donnerstag statt.

In der zweiten Hälfte des Semesters, **ab dem 28.12.2022** findet die Veranstaltung "Arbeitswissenschaft II: Arbeitsorganisation" am Mittwoch und Donnerstag statt.

- schriftliche Prüfung

- Die Vorlesung hat einen Arbeitsaufwand von 120 h (=4 LP).

Mit einer gültigen KIT-E-Mail-Adresse können Sie das Passwort bei elisabeth.schlund@kit.edu schriftlich erfragen.

Literature
Die Kursmaterialien stehen auf ILIAS zum Download zur Verfügung.

T 7.96 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	Grading scale	Recurrence	Version
Written examination	4	Grade to a third	Each winter term	3

Events					
WT 22/23	2109036	Human Factors Engineering II: Work Organisation	2 SWS	Lecture /	Deml
Exams					
ST 2022	76-T-MACH-105519	Human Factors Engineering II			Deml
WT 22/23	76-T-MACH-105519	Human Factors Engineering II			Deml

Legend: Online, Blended (On-Site/Online), On-Site, Cancelled

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 22/23, 2 SWS, Language: German, Open in study portal

Lecture (V)
Blended (On-Site/Online)

Content

The course "Human Factors Engineering I: Ergonomics" takes place in the first half of the semester, **until 2022/12/22**, on Wednesday and Thursday.

In the second half of the semester, **beginning with 2022/12/28**, the course "Human Factors Engineering II: Work Organisation" takes place on Wednesday and Thursday.

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.

Organizational issues

Die Veranstaltung "Arbeitswissenschaft I: Ergonomie" findet in der ersten Hälfte des Semesters, **bis zum 22.12.2022**, am Mittwoch und Donnerstag statt.

In der zweiten Hälfte des Semesters, **ab dem 28.12.2022** findet die Veranstaltung "Arbeitswissenschaft II: Arbeitsorganisation" am Mittwoch und Donnerstag statt.

- schriftliche Prüfung

- Die Vorlesung hat einen Arbeitsaufwand von 120 h (=4 LP).

Mit einer gültigen KIT-E-Mail-Adresse können Sie das Passwort bei elisabeth.schlund@kit.edu schriftlich erfragen.

Literature

Die Kursmaterialien stehen auf ILIAS zum Download zur Verfügung.

T 7.97 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	Grading scale	Recurrence	Version
Written examination	6	Grade to a third	Each summer term	2

Events					
ST 2022	24659	Human-Computer-Interaction	2 SWS	Lecture / 🖥	Beigl
Exams					
ST 2022	7500048	Human-Machine-Interaction			Beigl
WT 22/23	7500076	Human-Machine-Interaction			Beigl

Legend: 🖥 Online, Blended (On-Site/Online), On-Site, ✕ Cancelled

Modeled Conditions
The following conditions have to be fulfilled:

1. The course T-INFO-106257 - Human-Machine-Interaction Pass must have been passed.

T 7.98 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	Grading scale	Recurrence	Version
Completed coursework	0	pass/fail	Each summer term	1

Events					
ST 2022	2400095	Human-Computer-Interaction	1 SWS	Practice / 🖥	Beigl, Pescara
ST 2022	24659	Human-Computer-Interaction	2 SWS	Lecture / 🖥	Beigl
Exams					
ST 2022	7500121	Human-Machine-Interaction			Beigl

Legend: 🖥 Online, Blended (On-Site/Online), On-Site, x Cancelled

T 7.99 Course: Hybrid and Electric Vehicles [T-ETIT-100784]

Responsible: Prof. Dr. Martin Doppelbauer
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	Grading scale	Recurrence	Version
Written examination	4	Grade to a third	Each winter term	1

Events					
WT 22/23	2306321	Hybrid and Electric Vehicles	2 SWS	Lecture / Blended	Doppelbauer
WT 22/23	2306323	Tutorial for 2306323 Hybrid and Electric Vehicles	1 SWS	Practice / Blended	Doppelbauer
Exams					
ST 2022	7306321	Hybrid and Electric Vehicles			Doppelbauer
WT 22/23	7306321	Hybrid and Electric Vehicles			Doppelbauer

Legend: Online, Blended (On-Site/Online), On-Site, Cancelled

Prerequisites
none

T 7.100 Course: Hydraulic Fluid Machinery [T-MACH-105326]

Responsible: Dr. Balazs Pritz

Organisation: KIT Department of Mechanical Engineering
Institute of Thermal Turbomachinery

Part of: M-MACH-102816 - Major Field: Fundamentals of Energy Technology
M-MACH-102838 - Major Field: Energy Converting Engines

Type	Credits	Grading scale	Recurrence	Version
Oral examination	8	Grade to a third	Each summer term	1

Events					
ST 2022	2157432	Hydraulic Fluid Machinery	4 SWS	Lecture / 🗣	Pritz
Exams					
ST 2022	76-T-MACH-105326	Hydraulic Fluid Machinery			Pritz
ST 2022	76-T-MACH-105326-Wdh	Hydraulic Fluid Machinery for second attempt			Pritz
WT 22/23	76-T-MACH-105326	Hydraulic Fluid Machinery			Pritz

Legend: 🖥 Online, Blended (On-Site/Online), 🗣 On-Site, ✕ Cancelled

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 2022, 4 SWS, Language: German, Open in study portal

Lecture (V)
On-Site

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

Recommendations:

3154510 – Fluid Mechanics I

3153511 – Fluid Mechanics II

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 7.101 Course: Hydrogen and reFuels - Energy Conversion in Combustion Engines [T-MACH-111585]

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

Part of: M-MACH-102818 - Major Field: Vehicle Technology
M-MACH-102838 - Major Field: Energy Converting Engines

Type	Credits	Grading scale	Recurrence	Expansion	Version
Oral examination	4	Grade to a third	Each winter term	1 terms	1

Events					
WT 22/23	2134155	Hydrogen and reFuels - Energy Conversion in Combustion Engines	2 SWS	Lecture / 🗣	Koch
Exams					
ST 2022	76-T-MACH-105564	Hydrogen and reFuels - Energy Conversion in Combustion Engines			Koch, Kubach

Legend: 🖥 Online, ⚙ Blended (On-Site/Online), 🗣 On-Site, ✕ Cancelled

Competence Certificate
oral exam, appr. 25 minutes, no auxillary means

Prerequisites
none

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

V Hydrogen and reFuels - Energy Conversion in Combustion Engines

2134155, WS 22/23, 2 SWS, Language: German, Open in study portal

Lecture (V)
On-Site

Content
New types of CO2-neutral fuels such as gaseous hydrogen but also liquid synthetic fuels often place specific requirements on engine systems that differ significantly from operation with conventional fuels. These special aspects of engine energy conversion are dealt with in this lecture.

Introduction

Thermodynamics of combustion engines

Fundamentals

gas exchange

Flow field

Wall heat losses

Combustion in gasoline engines

Pressure Trace Analysis

Combustion in Diesel engines

Specific Topics of Hydrogen Combsution

Waste heat recovery

T 7.102 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	Grading scale	Recurrence	Version
Examination of another type	4	Grade to a third	Each term	2

Events					
ST 2022	2123900	I4.0 Systems platform	4 SWS	Project (P / 🗣	Ovtcharova, Maier
WT 22/23	2123900	I4.0 Systems platform	4 SWS	Project (P / 🗣	Ovtcharova, Maier
Exams					
ST 2022	76-T-MACH-106457	I4.0 Systems platform			Ovtcharova
WT 22/23	76-T-MACH-106457	I4.0 Systems platform			Ovtcharova

Legend: 🖥 Online, ⚙ Blended (On-Site/Online), 🗣 On-Site, ✕ Cancelled

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, SS 2022, 4 SWS, Language: German, Open in study portal

Project (PRO)
On-Site

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, WS 22/23, 4 SWS, Language: German, Open in study portal

Project (PRO)
On-Site

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 7.103 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
M-MACH-102838 - Major Field: Energy Converting Engines

Type	Credits	Grading scale	Version
Oral examination	4	Grade to a third	1

Events					
WT 22/23	2133125	Ignition systems	2 SWS	Lecture / 🗣	Toedter
Exams					
ST 2022	76-T-MACH-105985	Ignition systems			Toedter
WT 22/23	76-T-MACH-105985	Ignition systems			Koch

Legend: 🖥 Online, Blended (On-Site/Online), 🗣 On-Site, ✕ Cancelled

Competence Certificate
oral exam, 20 min

Prerequisites
none

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

V Ignition systems

2133125, WS 22/23, 2 SWS, Language: German, Open in study portal

Lecture (V)
On-Site

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

T 7.104 Course: Industrial Aerodynamics [T-MACH-105375]

Responsible: Prof. Dr.-Ing. Bettina Frohnapfel
Dr.-Ing. Stefan Kröber

Organisation: KIT Department of Mechanical Engineering

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

Type	Credits	Grading scale	Recurrence	Version
Oral examination	4	Grade to a third	Each winter term	1

Events					
WT 22/23	2153425	Industrial aerodynamics	2 SWS	/	Kröber, Frohnapfel

Legend: Online, Blended (On-Site/Online), On-Site, Cancelled

Competence Certificate
oral exam - 30 minutes

Prerequisites
none

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

V Industrial aerodynamics

2153425, WS 22/23, 2 SWS, Language: German, Open in study portal

Blended (On-Site/Online)

Content
This compact lecture deals with flows and aeroacoustics with significance in vehicle development. A special focus is set on the optimization of external vehicle aerodynamics and the presentation of modern industrial wind tunnel technology. The second major thematic block includes both, aeroacoustic basics principles and practical examples of aeroacoustics, especially in the field of automotive technology. These fields are explained in their phenomenology, the corresponding theories are discussed and the tools for measurement and simulation are introduced and demonstrated. This lecture focusses on industry relevant methods for analyses and descriptions of forces, aeroacoustic sound fields, flow structures and turbulence. In addition, an overview of numerical methods for industrial applications is given. The integration and interconnection of the methods in the development processes are discussed exemplary.
An excursion to the Mercedes-Benz AG wind tunnel and the research and development centers is planned.

- Introduction
- Aerodynamics of bluff bodies
- Industrial flow measurement techniques and modern wind tunnel technology
- Overview of flow simulation in automotive industry
- Vehicle aerodynamics
- Passenger comfort of roadsters and cabriolets
- Soiling of road vehicles
- Aeroacoustics: basic principles and practical examples of aeroacoustics, especially in the field of automotive technology including aeroacoustic measurement techniques and numerical methods

Students can describe the different properties of aerodynamics and aeroacoustics of vehicles flows. They are qualified to analyze external flows around the vehicles and aeroacoustic sound fields of vehicles.

Organizational issues
Blockvorlesung - Anmeldung erfolgt über ILIAS, max. Teilnehmerzahl ist 20 Studierende.

Literature
Vorlesungsskript

T 7.105 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	Grading scale	Recurrence	Version
Examination of another type	3	Grade to a third	Each term	2

Events					
ST 2022	2122014	Information Engineering	2 SWS	Seminar / Blended	Ovtcharova, Mitarbeiter
Exams					
ST 2022	76-T-MACH-102209	Information Engineering			Ovtcharova

Legend: Online, Blended (On-Site/Online), On-Site, Cancelled

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 2022, 2 SWS, Language: German/English, Open in study portal

Seminar (S)
Blended (On-Site/Online)

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.

Organizational issues
Siehe ILIAS-Kurs

Literature
Themenspezifische Literatur

T 7.106 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	Grading scale	Recurrence	Version
Oral examination	6	Grade to a third	Each winter term	1

Exams			
ST 2022	7500011	Information Processing in Sensor Networks	Hanebeck, Pfaff
WT 22/23	7500030	Information Processing in Sensor Networks	Pfaff

T 7.107 Course: Information Systems and Supply Chain Management [T-MACH-102128]

Responsible: Dr.-Ing. 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	Grading scale	Recurrence	Version
Written examination	3	Grade to a third	Each summer term	3

Events					
ST 2022	2118094	Information Systems in Logistics and Supply Chain Management	2 SWS	Lecture / 🖥	Kilger
Exams					
ST 2022	76-T-MACH-102128	Information Systems and Supply Chain Management			Kilger

Legend: 🖥 Online, Blended (On-Site/Online), On-Site, ✕ Cancelled

Competence Certificate
The success control takes place in form of a written examination (60 min) during the semester break (according to §4(2), 1 SPO). If the number of participants is low, an oral examination (according to §4 (2), 2 SPO) may also be offered.

Prerequisites
none

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

V Information Systems in Logistics and Supply Chain Management

2118094, SS 2022, 2 SWS, Language: German, Open in study portal

Lecture (V)
Online

Literature
Stadtler, Kilger: Supply Chain Management and Advanced Planning, Springer, 4. Auflage 2008

T 7.108 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	Grading scale	Recurrence	Version
Oral examination	4	Grade to a third	Each summer term	2

Events					
ST 2022	2121001	Integrated Information Systems for engineers	3 SWS	Lecture / Practice (/	Ovtcharova, Elstermann
WT 22/23	2121001	Integrated Information Systems for engineers	3 SWS	Lecture / Practice (/	Ovtcharova, Elstermann
Exams					
ST 2022	76-T-MACH-102083	Integrated Information Systems for Engineers			Ovtcharova, Elstermann

Legend: Online, Blended (On-Site/Online), On-Site, Cancelled

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 2022, 3 SWS, Language: German, Open in study portal

Lecture / Practice (VÜ)
On-Site

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

V Integrated Information Systems for engineers
2121001, WS 22/23, 3 SWS, Language: German, Open in study portal

Lecture / Practice (VÜ)
On-Site

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 7.109 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	Grading scale	Recurrence	Version
Oral examination	8	Grade to a third	Each summer term	2

Events					
ST 2022	2150660	Integrated Production Planning in the Age of Industry 4.0	6 SWS	Lecture / Practice (/	Lanza
Exams					
ST 2022	76-T-MACH-108849	Integrated Production Planning in the Age of Industry 4.0			Lanza
ST 2022	76-T-MACH-108849-Wdh	Integrated Production Planning in the Age of Industry 4.0			Lanza
WT 22/23	76-T-MACH-108849	Integrated Production Planning in the Age of Industry 4.0			Lanza

Legend: Online, Blended (On-Site/Online), On-Site, × Cancelled

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
2150660, SS 2022, 6 SWS, Language: German, Open in study portal

Lecture / Practice (VÜ)
Blended (On-Site/Online)

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 (PPS, process simulation as a validation tool, planning of conveyor technology and storage systems for linking production and IT systems in the I4.0 factory)
- Preparation and monitoring of implementation
- Start-up and series support

The lecture contents are complemented by numerous current practical examples with a strong Industry 4.0 reference. Aspects of sustainability are anchored in all units and thus basic knowledge of sustainable production planning is taught. 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 to new problems.
- are able to analyze and evaluate the suitability of the methods, procedures and techniques 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.
- know the basic features of sustainable production planning and can apply underlying knowledge.

Workload:

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

Organizational issues
Vorlesungstermine dienstags 14.00 Uhr und donnerstags 14.00 Uhr, Übungstermine donnerstags 15.45 Uhr. Bekanntgabe der konkreten Übungstermine erfolgt in der ersten Vorlesung

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 7.110 Course: Integrative Strategies in Production and Development of High Performance Cars [T-MACH-105188]

Responsible: 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	Grading scale	Recurrence	Version
Written examination	4	Grade to a third	Each summer term	1

Events					
ST 2022	2150601	Integrative Strategies in Production and Development of High Performance Cars	2 SWS	Lecture /	Schlichtenmayer
WT 22/23	2150601	Integrative Strategies in Production and Development of High Performance Cars	2 SWS	Lecture /	Schlichtenmayer
Exams					
ST 2022	76-T-MACH-105188	Integrative Strategies in Production and Development of High Performance Cars			Schlichtenmayer
WT 22/23	76-T-MACH-105188	Integrative Strategies in Production and Development of High Performance Cars			Schlichtenmayer

Legend: Online, Blended (On-Site/Online), On-Site, Cancelled

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

2150601, SS 2022, 2 SWS, Language: German, Open in study portal

Lecture (V)
Blended (On-Site/Online)

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/).

V	**Integrative Strategies in Production and Development of High Performance Cars** 2150601, WS 22/23, 2 SWS, Language: German, Open in study portal	**Lecture (V)** **Blended (On-Site/Online)**

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

Organizational issues
Die LV wird einmalig im WS 2022/23 als Ersatz für die Absage im SS 2022 angeboten.
Im SS 2023 findet die LV wieder regulär statt.

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 7.111 Course: Intellectual Property Rights and Strategies in Industrial Companies [T-MACH-105442]

Responsible: Prof. Dr.-Ing. Albert Albers
Prof. Dr.-Ing. Sven Matthiesen
Dipl.-Ing. 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	Grading scale	Recurrence	Version
Oral examination	4	Grade to a third	Each term	1

Events					
ST 2022	2147160	Patents and Patentstrategies in innovative companies	2 SWS	/ 🖥	Zacharias
WT 22/23	2147161	Intellectual Property Rights and Strategies in Industrial Companies	2 SWS	Block / 🗣	Zacharias
Exams					
ST 2022	76-T-MACH-105442	Intellectual Property Rights and Strategies in Industrial Companies			Zacharias, Albers

Legend: 🖥 Online, Blended (On-Site/Online), 🗣 On-Site, ✕ Cancelled

Competence Certificate
oral exam (ca. 20 min)

Prerequisites
none

Recommendation
None

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

V Patents and Patentstrategies in innovative companies

2147160, SS 2022, 2 SWS, Language: German, Open in study portal

Online

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

V **Intellectual Property Rights and Strategies in Industrial Companies** **Block (B) On-Site**
2147161, WS 22/23, 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

Organizational issues
Weitere Informationen siehe IPEK-Homepage.

https://www.ipek.kit.edu/2976_2858.php

T 7.112 Course: Introduction into Mechatronics [T-MACH-100535]

Responsible: Moritz Böhland
apl. Prof. Dr. Markus Reischl

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102746 - Compulsory Elective Module
M-MACH-102820 - Major Field: Mechatronics

Type	Credits	Grading scale	Recurrence	Version
Written examination	6	Grade to a third	Each winter term	2

Events					
WT 22/23	2105011	Introduction into Mechatronics	3 SWS	Lecture /	Reischl, Böhland
Exams					
ST 2022	76-T-MACH-100535	Introduction into Mechatronics			Reischl
WT 22/23	76-T-MACH-100535	Introduction into Mechatronics			Reischl

Legend: Online, Blended (On-Site/Online), On-Site, × Cancelled

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 22/23, 3 SWS, Language: German, Open in study portal

Lecture (V)
Blended (On-Site/Online)

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 7.113 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	Grading scale	Recurrence	Version
Oral examination	6	Grade to a third	Each winter term	1

Events					
WT 22/23	2125757	Introduction to Ceramics	3 SWS	Lecture / 🗣	Hoffmann
Exams					
ST 2022	76-T-MACH-100287	Introduction to Ceramics			Hoffmann, Schell, Wagner
WT 22/23	76-T-MACH-100287	Introduction to Ceramics			Hoffmann, Schell, Wagner

Legend: 🖥 Online, ⚙ Blended (On-Site/Online), 🗣 On-Site, ✕ Cancelled

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 22/23, 3 SWS, Language: German, Open in study portal

Lecture (V)
On-Site

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 7.114 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
M-MACH-102746 - Compulsory Elective Module

Type	Credits	Grading scale	Recurrence	Version
Written examination	3	Grade to a third	Each summer term	3

Events					
ST 2022	2154533	Introduction to Computational Fluid Dynamics	2 SWS	Lecture / 🖥	Stroh, Frohnapfel
Exams					
ST 2022	76-T-MACH-110362	Introduction to Computational Fluid Dynamics			Stroh

Legend: 🖥 Online, Blended (On-Site/Online), On-Site, × Cancelled

Competence Certificate
written 90min

Prerequisites
Passing the "Tutorial Introduction to Computational Fluid Dynamics" (T-MACH-111033) is prerequisite for taking part in the exam.

Modeled Conditions
The following conditions have to be fulfilled:

1. The course T-MACH-111033 - Tutorial Introduction to Computational Fluid Dynamics must have been passed.

Annotation
Knowledge of the contents of the courses "Continuum Mechanics of Solid and Fluids" and "Mathematical Methods of Continuum Mechanics" as well as the corresponding tutorials is expected.

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

V Introduction to Computational Fluid Dynamics

2154533, SS 2022, 2 SWS, Language: German, Open in study portal

Lecture (V)
Online

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.

Organizational issues
Die Kenntnis der Vorlesungsinhalte "Kontinuumsmechanik der Festkörper und Fluide" sowie "Mathematische Methoden der Kontinuumsmechanik" wird vorausgesetzt.

Literature
Wird in der Vorlesung bekannt gegeben.

T 7.115 Course: Introduction to High Temperature Materials [T-MACH-111258]

Responsible: Prof. Dr.-Ing. Bronislava Gorr
Organisation: KIT Department of Mechanical Engineering

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

Type	Credits	Grading scale	Recurrence	Version
Oral examination	4	Grade to a third	Each summer term	1

Events					
ST 2022	2194724	Introduction to High Temperature Materials	2 SWS	Lecture / 🗣	Gorr
Exams					
ST 2022	76-T-MACH-111258	Introduction to High Temperature Materials			Gorr

Legend: 🖥 Online, ⚙ Blended (On-Site/Online), 🗣 On-Site, ✕ Cancelled

Competence Certificate
oral examination (ca. 30 Minuten)

Prerequisites
none

Recommendation
Knowledge from the basic materials science lecture

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

V Introduction to High Temperature Materials
2194724, SS 2022, 2 SWS, Language: German, Open in study portal

Lecture (V)
On-Site

Content
Oral examination (about 30 min)

Teaching content:

- Applications and requirements for high temperature materials
- High temperature corrosion (thermodynamics, oxidation kinetics, oxidation of alloys, protection of high temperature materials)
- Creep (creep curve, creep mechanisms, creep of solid-solution strengthened materials, creep of particle hardened alloys, life time prediction)
- Fatigue (fundamentals, life time prediction)
- Thermo-mechanical fatigue
- High-temperature materials (Ni-, Fe-, Co- Ti-based alloys, ODS materials)

Qualification targets:

The students acquire fundamental knowledge about high temperature corrosion, creep, high temperature fatigue and thermomechanical fatigue as well as resulting failure mechanisms.

Recommendations:

Basic course in materials science and engineering

Organizational issues
Anmeldung verbindlich bis zum 14.04.2022 unter bronislava.gorr@kit.edu

Literature

- Bürgel: Handbuch Hochtemperaturwerkstofftechnik, 3. Auflage, Vieweg, 2006
- Rösler, H. Harders, M. Bäker: Mechanisches Verhalten der Werkstoffe, 2. Auflage, Teubner, 2006
- J. Young, High temperature oxidation and corrosion of metals, Elsevier, 2008
- Skript in elektronischer Form verfügbar.

T 7.116 Course: Introduction to 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	Grading scale	Recurrence	Version
Written examination	5	Grade to a third	Each summer term	2

Events					
ST 2022	2162235	Introduction to Multibody Dynamics	3 SWS	Lecture / Blended	Römer
Exams					
ST 2022	76-T-MACH-105209	Introduction to Multibody Dynamics			Seemann
WT 22/23	76-T-MACH-105209	Introduction into the Multi-Body Dynamics			Seemann

Legend: Online, Blended (On-Site/Online), On-Site, Cancelled

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 to Multibody Dynamics
2162235, SS 2022, 3 SWS, Language: German, Open in study portal

Lecture (V)
Blended (On-Site/Online)

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 7.117 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	Grading scale	Recurrence	Version
Oral examination	7	Grade to a third	Each winter term	1

Events					
WT 22/23	2162247	Introduction to Nonlinear Vibrations	2 SWS	Lecture / 🗣	Fidlin
WT 22/23	2162248	Introduction into the nonlinear vibrations (Tutorial)	2 SWS	Practice / 🗣	Fidlin, Fischer
Exams					
ST 2022	76-T-MACH-105439	Introduction to Nonlinear Vibrations			Fidlin

Legend: 🖥 Online, ⚙ Blended (On-Site/Online), 🗣 On-Site, ✕ Cancelled

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 22/23, 2 SWS, Language: German, Open in study portal

Lecture (V)
On-Site

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)

2162248, WS 22/23, 2 SWS, Language: German, Open in study portal

Practice (Ü)
On-Site

Content
Exercises related to the lecture

T 7.118 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	Grading scale	Recurrence	Version
Oral examination	4	Grade to a third	Each winter term	1

Events					
WT 22/23	2189903	Introduction to Nuclear Energy	2 SWS	Lecture /	Cheng

Legend: Online, Blended (On-Site/Online), On-Site, Cancelled

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 22/23, 2 SWS, Language: German, Open in study portal

Lecture (V)
Blended (On-Site/Online)

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 7.119 Course: Introduction to Numerical Fluid Dynamics [T-MACH-105515]

Responsible: Dr. Balazs Pritz
Organisation: KIT Department of Mechanical Engineering
Institute of Thermal Turbomachinery
Part of: M-MACH-102838 - Major Field: Energy Converting Engines

Type	Credits	Grading scale	Recurrence	Version
Completed coursework	4	pass/fail	Each winter term	1

Events					
WT 22/23	2157444	Introduction to numerical fluid dynamics	2 SWS	Practical course / 🗣	Pritz
Exams					
ST 2022	76-T-MACH-105515	Introduction to Numerical Fluid Dynamics			Pritz
WT 22/23	76-T-MACH-105515	Introduction to Numerical Fluid Dynamics			Pritz

Legend: 🖥 Online, Blended (On-Site/Online), 🗣 On-Site, × Cancelled

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 22/23, 2 SWS, Language: German, Open in study portal

Practical course (P)
On-Site

Content
The lab gives an overview of the application of computational fluid dynamics (CFD). At the end of the course the students will be able to perform CFD calculations independently.

In the lab, the components of the cycle of computational fluid dynamics are worked through. In the first instance moderately complicated geometries will be generated and meshed. After the configuration and running the calculation, the results are presented and evaluated in a visualization software. While in the first part of the course these steps are worked out under guidance, calculation cycles are carried out independently in the second part. The test cases are discussed in detail and allow to strengthen the affinity to the fluid dynamics.

Content:

1. Brief introduction into Linux
2. Mesh generation with ICEMCFD
3. Data visualisation and interpretation with Tecplot
4. Handling of the flow solver SPARC
5. Self-designed calculation: flat plate
6. Introduction to unsteady calculations: flow around a circular cylinder

Regular attendance: 22,5 hours
Self-study: 97,5 hours

Lecture notes/handouts are offered.

Learning objectives:

Students

- know the three components of CFD: mesh generation, calculation and evaluation.
- will be able to create simple geometries and generate mesh.
- can set up and carry out simulations.
- know the ways of evaluating the results and the possibilities of flow visualization.
- know how to analyze flow situations.

Literature
Praktikumsskript

T 7.120 Course: Introduction to the Finite Element Method [T-MACH-105320]

Responsible: Prof. Dr.-Ing. Thomas Böhlke
Dr.-Ing. Tom-Alexander Langhoff

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102582 - Major Field: Continuum Mechanics
M-MACH-102746 - Compulsory Elective Module

Type	Credits	Grading scale	Recurrence	Version
Written examination	3	Grade to a third	Each summer term	4

Events					
ST 2022	2162282	Introduction to the Finite Element Method	2 SWS	Lecture / Blended	Langhoff, Böhlke
Exams					
ST 2022	76-T-MACH-105320	Introduction to the Finite Element Method			Böhlke, Langhoff

Legend: Online, Blended (On-Site/Online), On-Site, Cancelled

Competence Certificate
written exam (90 min)

prerequisites: passing the corresponding "Tutorial to Introduction to the Finite element method" (T-MACH-110330)

Prerequisites
Passing the "Tutorial to Introduction to the Finite element method" (T-MACH-110330) is a prerequisite for taking part in the exam.

Modeled Conditions
The following conditions have to be fulfilled:

1. The course T-MACH-110330 - Tutorial Introduction to the Finite Element Method must have been passed.

Annotation
Knowledge of the contents of the courses "Continuum Mechanics of Solids and Fluids" and "Mathematical Methods of Continuum Mechanics" as well as the corresponding tutorials are expected

Due to capacity reasons it is possible that not all students of this course can be admitted to the computer tutorials. Students of the bachelor's degree program in mechanical engineering who have chosen the Major Field Continuum Mechanics (SP-Nr 13) will be admitted to the computer tutorials in any case.
If additional places are available in the computer tutorials for this course, these will be allocated according to the BSc average grade.

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

V Introduction to the Finite Element Method

2162282, SS 2022, 2 SWS, Language: German, Open in study portal

Lecture (V)
Blended (On-Site/Online)

Content

- introduction and motivation, elements of tensor calculus
- Discrete FEM: systems of bars and springs
- Formulations of boundary value problems (1D)
- Approximations in FEM
- FEM for scalar and vector-valued field problems
- Solution methods for linear systems of equations

Literature

- Fish, J., Belytschko, T.: A First Course in Finite Elements, Wiley 2007
- Jung, M., Langer, U.: Methode der finiten Elemente für Ingenieure: Eine Einführung in die numerischen Grundlagen und Computersimulation, Teubner 2013
- Braess, D.: Finite Elemente -- Theorie, schnelle Löser und Anwendungen in der Elastizitätstheorie, Springer 2013
- Gustafsson, B.: Fundamentals of Scientific Computing, Springer 2011

T 7.121 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	Grading scale	Recurrence	Version
Oral examination	4	Grade to a third	Each summer term	3

Events					
ST 2022	2118184	IT-Fundamentals of Logistics: Opportunities for Digital Transformation	2 SWS	Lecture / Blended	Thomas
Exams					
ST 2022	76-T-MACH-105187	IT-Fundamentals of Logistics			Furmans, Mittwollen, Thomas

Legend: Online, Blended (On-Site/Online), On-Site, Cancelled

Competence Certificate
The success control takes place in form of a written examination during the semester break (according to §4(2), 1 SPO). If the number of participants is low, an oral examination (according to §4 (2), 2 SPO) may also be offered.

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

2118184, SS 2022, 2 SWS, Language: German, Open in study portal

Lecture (V)
Blended (On-Site/Online)

T 7.122 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	Grading scale	Recurrence	Version
Completed coursework	4	pass/fail	Each winter term	1

Events					
WT 22/23	2137306	Lab Computer-aided methods for measurement and control	3 SWS	Practical course / 🗣	Stiller, Immel
Exams					
WT 22/23	76-T-MACH-105341	Lab Computer-Aided Methods for Measurement and Control			Stiller

Legend: 🖥 Online, ⚙ Blended (On-Site/Online), 🗣 On-Site, ✕ Cancelled

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 22/23, 3 SWS, Language: German, Open in study portal

Practical course (P)
On-Site

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 7.123 Course: Laboratory Exercise in Energy Technology [T-MACH-105331]

Responsible: Prof. Dr.-Ing. Hans-Jörg Bauer
Prof. Dr. Ulrich Maas
Dr.-Ing. Heinrich Wirbser

Organisation: KIT Department of Mechanical Engineering

Institute of Thermal Turbomachinery

Part of: M-MACH-102816 - Major Field: Fundamentals of Energy Technology

Type	Credits	Grading scale	Recurrence	Version
Completed coursework	4	pass/fail	Each term	1

Events					
ST 2022	2171487	Laboratory Exercise in Energy Technology	3 SWS	Practical course / 🗣	Bauer, Maas, Bykov, Schießl
WT 22/23	2171487	Laboratory Exercise in Energy Technology	3 SWS	Practical course / 🗣	Bauer, Maas, Bykov
Exams					
ST 2022	76-T-MACH-105331	Laboratory Exercise in Energy Technology			Bauer, Maas, Wirbser
WT 22/23	76-T-MACH-105331	Laboratory Exercise in Energy Technology			Bauer, Maas, Wirbser

Legend: 🖥 Online, ⚙ Blended (On-Site/Online), 🗣 On-Site, × Cancelled

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, SS 2022, 3 SWS, Language: German/English, Open in study portal

Practical course (P)
On-Site

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

Organizational issues
Information zum Lehrlabor finden Sie auf der Instituts-homepage

V	**Laboratory Exercise in Energy Technology** 2171487, WS 22/23, 3 SWS, Language: German/English, Open in study portal	**Practical course (P)** **On-Site**

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 7.124 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	Grading scale	Recurrence	Version
Completed coursework	4	pass/fail	Each term	2

Events					
ST 2022	2183640	Laboratory "Laser Materials Processing"	3 SWS	Practical course /	Schneider, Pfleging
WT 22/23	2183640	Laboratory "Laser Materials Processing"	3 SWS	Practical course /	Schneider, Pfleging
Exams					
ST 2022	76-T-MACH-102154	Laboratory Laser Materials Processing			Schneider
WT 22/23	76-T-MACH-102154	Laboratory Laser Materials Processing			Schneider

Legend: Online, Blended (On-Site/Online), On-Site, Cancelled

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, SS 2022, 3 SWS, Language: German, Open in study portal

Practical course (P)
Blended (On-Site/Online)

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.

Organizational issues
Die Praktikumsplätze für das Sommersemester 2022 sind bereits ausgebucht!

Anmeldung per Email an johannes.schneider@kit.edu

Das Praktikum findet semesterbegleitend in Kleingruppen am IAM-CMS (CS) bzw. IAM-AWP (CN) statt!

Die Termine werden zu Beginn des Semesters bekannt gegeben.

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

V **Laboratory "Laser Materials Processing"**
2183640, WS 22/23, 3 SWS, Language: German, Open in study portal

Practical course (P)
Blended (On-Site/Online)

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.

Organizational issues
Maximal 12 Teilnehmer/innen!
Aktuell sind nur noch wenige Plätze zu vergeben! Registrierung möglich per Email an johannes.schneider@kit.edu
Praktikum findet in Kleingruppen semesterbegleitend (dienstags bzw. mittwochs, ganztägig) bzw. als Blockpraktikum auf dem Campus Nord am IAM-AWP (Geb. 681) und auf dem Campus Süd am IAM-CMS (Geb. 30.48) statt!

Termine werden mit den Teilnehmern/innen direkt abgestimmt.

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

T 7.125 Course: Laboratory Mechatronics [T-MACH-105370]

Responsible: Prof. Dr. Veit Hagenmeyer
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	Grading scale	Recurrence	Version
Completed coursework	4	pass/fail	Each winter term	4

Events					
WT 22/23	2105014	Laboratory mechatronics	3 SWS	Practical course / 🗣	Fidlin, Hagenmeyer, Böhland, Stiller, Chen, Orth, Immel
Exams					
ST 2022	76-T-MACH-105370	Laboratory Mechatronics			Hagenmeyer, Seemann, Stiller

Legend: Online, Blended (On-Site/Online), On-Site, × Cancelled

Competence Certificate
The laboratory course is offered exclusively as ungraded course work. The assessment consists of a group colloquium at the beginning of the individual specialization phases (Part 1). In addition, a robot control system for a pick-and-place task must be successfully implemented in the group phase (Part 2).

Prerequisites
None

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

V Laboratory mechatronics
2105014, WS 22/23, 3 SWS, Language: German, Open in study portal

Practical course (P)
On-Site

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

Organizational issues
Das Praktikum ist anmeldepflichtig.

Die Anmeldungsmodalitäten-/fristen werden auf https://www.iai.kit.edu/Pruefungen.php bekannt gegeben.
Siehe Internet / Aushang Raum 033 EG, im Gebäude 40.32.

Literature
Materialien zum Mechatronik-Praktikum

Manuals for the laboratory course on Mechatronics

T 7.126 Course: Laboratory Production Metrology [T-MACH-108878]

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

Part of: M-MACH-102589 - Major Field: Production Systems
M-MACH-102820 - Major Field: Mechatronics

Type	Credits	Grading scale	Recurrence	Version
Examination of another type	4	Grade to a third	Each summer term	2

Events					
ST 2022	2150550	Laboratory Production Metrology	3 SWS	Practical course / 🗣	Lanza, Stamer
Exams					
ST 2022	76-T-MACH-108878	Laboratory Production Metrology			Lanza, Häfner

Legend: 🖥 Online, ⚙ Blended (On-Site/Online), 🗣 On-Site, ✕ Cancelled

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 2022, 3 SWS, Language: German, Open in study portal

Practical course (P)
On-Site

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

Organizational issues
Die Lehrveranstaltung findet stets dienstags nachmittags statt.

Aus organisatorischen Gründen ist die Teilnehmerzahl für die Lehrveranstaltung begrenzt. Infolgedessen wird ein Auswahlprozess stattfinden. Die Bewerbung erfolgt über die Homepage des wbk (http://www.wbk.kit.edu/studium-und-lehre.php).

The course always takes place on Tuesdays in the afternoon.

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).

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 7.127 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	Grading scale	Recurrence	Version
Oral examination	4	Grade to a third	Each summer term	2

Events					
ST 2022	2182642	Laser in automotive engineering	2 SWS	Lecture / 🗣	Schneider
Exams					
ST 2022	76-T-MACH-105164	Laser in Automotive Engineering			Schneider
WT 22/23	76-T-MACH-105164	Laser in Automotive Engineering			Schneider

Legend: 🖥 Online, ⚙ Blended (On-Site/Online), 🗣 On-Site, × Cancelled

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 2022, 2 SWS, Language: German, Open in study portal

Lecture (V)
On-Site

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 7.128 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	Grading scale	Recurrence	Version
Oral examination	4	Grade to a third	Each summer term	1

Events					
ST 2022	2110017	Leadership and Conflict Management (in German)	2 SWS	Lecture / 🗣	Hatzl
Exams					
ST 2022	76-T-MACH-105440	Leadership and Conflict Management			Deml, Hatzl

Legend: 🖥 Online, 🧩 Blended (On-Site/Online), 🗣 On-Site, ✕ Cancelled

Competence Certificate
oral exam (approx. 30 min)

Prerequisites
none

Annotation
This lecture will also be offered once in winter term 20/21.

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

V Leadership and Conflict Management (in German)
2110017, SS 2022, 2 SWS, Language: German, Open in study portal

Lecture (V)
On-Site

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 7.129 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	Grading scale	Recurrence	Version
Oral examination	4	Grade to a third	Each winter term	1

Events					
WT 22/23	2145184	Leadership and Product Development	2 SWS	Lecture / 🗣	Ploch

Legend: 🖥 Online, ❈ Blended (On-Site/Online), 🗣 On-Site, ✕ Cancelled

Competence Certificate
oral exam (approx. 20 min)

Prerequisites
none

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

V Leadership and Product Development

2145184, WS 22/23, 2 SWS, Language: German, Open in study portal

Lecture (V)
On-Site

Content
Overview of leadership theories and their application

Selected management instruments and their use in organizations

Communication and leadership

change management

Management development and MD programmes

Assessment centres and management audits

Teamwork, team development and team roles

Coaching as an instrument of modern leadership

Intercultural competence and cross-cultural leadership

Management and ethics, corporate governance

Practical exercises and examples to deepen selected contents

Organizational issues
Vorlesungsanmeldung und Informationen zur Veranstaltung werden im ILIAS Kurs zur Verfügung gestellt.

Weitere Information siehe IPEK-Homepage

Literature
Vorlesungsumdruck

T 7.130 Course: Lightweight Constructions with Fiber-Reinforced-Polymers – Theory and Practice [T-MACH-110954]

Responsible: Prof. Dr.-Ing. Luise Kärger
Dr.-Ing. Wilfried Liebig

Organisation: KIT Department of Mechanical Engineering

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

Type	Credits	Grading scale	Recurrence	Version
Oral examination	4	Grade to a third	Each winter term	1

Events					
WT 22/23	2113110	Lightweight constructions with fiber-reinforced-polymers – theory and practice	4 SWS	Lecture / Practice (/	Kärger, Liebig
Exams					
WT 22/23	76-T-MACH-110954	Lightweight constructions with fiber-reinforced-polymers – theory and practice			Liebig, Kärger

Legend: Online, Blended (On-Site/Online), On-Site, Cancelled

Competence Certificate
oral exam (about 25 minutes)

Prerequisites
none

Recommendation

- Materials of Lightweight Construction
- Structural Analysis of Composite Laminates
- Composite Manufacturing - Polymers, Fibers, Semi-Finished Products, Manufacturing Technologies

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

V Lightweight constructions with fiber-reinforced-polymers – theory and practice

Lecture / Practice (VÜ)
On-Site

2113110, WS 22/23, 4 SWS, Language: German, Open in study portal

Content
The cooperative educational concept of the FAST-LBT and IAM-WK give students an understanding of theory and practice for lightweight constructing with fiber-reinforced-polymers. Students solve an engineering lightweight task in small groups (max. 4 p.), for example the construction of an optimal bending beam under certain space and weight conditions. Various Materials (fibers, resins, foams, etc.) as well as relevant material data are provided and can be used any arbitrary combination. In a first step, students develop a theoretical solution and verify it simulative. Therefore, an introductory basic lecture teaches the mechanics and simulations techniques of fiber-reinforced-polymers. In a second step the students manufacture specimens based on their theoretical solution at the IAM-WK. The specimens are then tested on bending machines. The students gain knowledge about fiber-reinforced-polymers (materials, manufacturing, manufacturing effects, restrictions, etc.) and structural analysis simulations (modelling, simplifications, assumptions, material models, etc.) as well as material characterization and testing. Building on the basic lecture the knowledge is gained autonomously by solving realistic practice relevant tasks. The main topics are:

- Basics of Lightweight strategies
- Basics of fiber-reinforced-polymers
- Basics of FEM-simulations with anisotropic material systems
- Simulative part analysis
- Manufacturing of fiber-reinforced-polymers
- Mechanical testing

Learning Objectives: Students will be able to name and explain lightweight designstrategies. They are familiar with typical fiber and matrix materials and their function in fiber composite materials. They will be familiar with the operating principle of a sandwich composite with foam core and will be able to describe and justify typical deformation and stress curves. They can name characteristic mechanical parameters and manufacturing processes. For the numerical analysis of FRP components, the students know simple laminate theories, they can set up a finite element model in Abaqus, select suitable finite elements, evaluate the simulation results and derive conclusions for improving the load-bearing effect. Students know the main steps and boundary conditions for manual fabrication and mechanical testing of fiber composite sandwich structures and can apply them in practice.

T 7.131 Course: Lightweight Engineering Design [T-MACH-105221]

Responsible: Prof. Dr.-Ing. Albert Albers
Prof. Dr.-Ing. 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	Grading scale	Recurrence	Version
Written examination	4	Grade to a third	Each summer term	2

Events					
ST 2022	2146190	Lightweight Engineering Design	2 SWS	Lecture / 🗣	Albers, Burkardt
Exams					
ST 2022	76-T-MACH-105221	Lightweight Engineering Design			Albers, Burkardt
WT 22/23	76-T-MACH-105221	Lightweight Engineering Design			Albers, Burkardt

Legend: 🖥 Online, ⚙ Blended (On-Site/Online), 🗣 On-Site, ✕ Cancelled

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 2022, 2 SWS, Language: German, Open in study portal

Lecture (V)
On-Site

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.

Organizational issues
Vorlesungsfolien können über die eLearning-Plattform ILIAS bezogen werden.

Die Prüfungsart wird gemäß der Prüfungsordnung zu Vorlesungsbeginn angekündigt:

- Schriftliche Prüfung: 90 min Prüfungsdauer
- Mündliche Prüfung: 20 min Prüfungsdauer
- Erlaubte Hilfsmittel: keine

Medien: Beamer

Arbeitsbelastung:

- Präsenzzeit: 21 h
- Selbststudium: 99 h

Lecture slides are available via eLearning-Platform ILIAS.

The type of examination (written or oral) will be announced at the beginning of the lecture:

- written examination: 90 min duration
- oral examination: 20 min duration
- auxiliary means: None

Media: Beamer

Workload:

- regular attendance: 21 h
- self-study: 99 h

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 7.132 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	Grading scale	Recurrence	Version
Written examination	5	Grade to a third	Each summer term	1

Events					
ST 2022	2161224	Machine Dynamics	2 SWS	Lecture /	Proppe
ST 2022	2161225	Machine Dynamics (Tutorial)	1 SWS	Practice /	Proppe, Fischer
WT 22/23	2161224	Machine Dynamics	2 SWS	Lecture /	Proppe
Exams					
ST 2022	76-T-MACH-105210	Machine Dynamics			Proppe
WT 22/23	76-T-MACH-105210	Machine Dynamics			Proppe

Legend: Online, Blended (On-Site/Online), On-Site, Cancelled

Competence Certificate
written exam, 180 min.

Prerequisites
none

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

V Machine Dynamics
2161224, SS 2022, 2 SWS, Language: German/English, Open in study portal

Lecture (V)
Online

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 2022, 1 SWS, Language: English, Open in study portal

Practice (Ü)
Blended (On-Site/Online)

Content
Exercises related to the lecture

V Machine Dynamics
2161224, WS 22/23, 2 SWS, Language: English, Open in study portal

Lecture (V)
Online

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

T 7.133 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	Grading scale	Recurrence	Version
Oral examination	4	Grade to a third	Each winter term	1

Events					
ST 2022	2162220	Machine Dynamics II	2 SWS	Lecture / 🖥	Proppe
WT 22/23	2162220	Machine Dynamics II	2 SWS	Lecture / 🖥	Proppe
Exams					
ST 2022	76-T-MACH-105224	Machine Dynamics II			Proppe
WT 22/23	76-T-MACH-105224	Machine Dynamics II			Proppe

Legend: 🖥 Online, Blended (On-Site/Online), On-Site, ✕ Cancelled

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, SS 2022, 2 SWS, Language: German/English, Open in study portal

Lecture (V)
Online

Content
Students are able to develop and analyze detailed models in machine dynamics that encompass continuum models, fluid structure interaction, and stability analyses.

hydrodynamic bearings

• rotating shafts in hydrodynamic bearings

• belt drives

• virbation of turbine blades

Literature
R. Gasch, R. Nordmann, H. Pfützner: Rotordynamik, Springer, 2006

V Machine Dynamics II

2162220, WS 22/23, 2 SWS, Language: English, Open in study portal

Lecture (V)
Online

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 7.134 Course: Machine Tools and High-Precision Manufacturing Systems [T-MACH-110962]

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	Grading scale	Recurrence	Version
Oral examination	8	Grade to a third	Each winter term	1

Events					
WT 22/23	2149910	Machine Tools and High-Precision Manufacturing Systems	6 SWS	Lecture / Practice (/	Fleischer
Exams					
ST 2022	76-T-MACH-110962	Machine Tools and High-Precision Manufacturing Systems			Fleischer
WT 22/23	76-T-MACH-110962	Machine Tools and High-Precision Manufacturing Systems			Fleischer

Legend: Online, Blended (On-Site/Online), On-Site, × Cancelled

Competence Certificate
Oral exam (40 minutes)

Prerequisites
T-MACH-102158 - Machine Tools and Industrial Handling must not be commenced.
T-MACH-109055 - Machine Tools and Industrial Handling must not be commenced.
T-MACH-110963 - Machine Tools and High-Precision Manufacturing Systems must not be commenced.

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

V Machine Tools and High-Precision Manufacturing Systems

2149910, WS 22/23, 6 SWS, Language: German, Open in study portal

Lecture / Practice (VÜ)
Blended (On-Site/Online)

Content
The lecture gives an overview of the construction, use and application of machine tools and high-precision manufacturing systems. In the course of the lecture a well-founded and practice-oriented knowledge for the selection, design and evaluation of machine tools and high-precision manufacturing systems is conveyed. First, the main components of the systems are systematically explained and their design principles as well as the integral system design are discussed. Subsequently, the use and application of machine tools and high-precision manufacturing systems 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 and artificial intelligence.
Guest lectures from industry round off the lecture with insights into practice.

The individual topics are:

- Structural components of dynamic manufacturing Systems
- Feed axes: High-precision positioning
- Spindles of cutting machine Tools
- Peripheral Equipment
- Machine control unit
- Metrological Evaluation
- Maintenance strategies and condition Monitoring
- Process Monitoring
- Development process for machine tools and high-precision manufacturing Systems
- Machine examples

Learning Outcomes:

The students …

- are able to assess the use and application of machine tools and high-precision manufacturing systems and to differentiate between them in terms of their characteristics and design.
- can describe and discuss the essential elements of machine tools and high-precision manufacturing systems (frame, main spindle, feed axes, peripheral equipment, control unit).
- are able to select and dimension the essential components of machine tools and high-precision manufacturing systems.
- are capable of selecting and evaluating machine tools and high-precision manufacturing systems according to technical and economic criteria.

Workload:

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

Organizational issues
Start: 24.10.2022

Vorlesungstermine montags und mittwochs, Übungstermine donnerstags.
Bekanntgabe der konkreten Übungstermine erfolgt in der ersten Vorlesung.

Lectures on Mondays and Wednesdays, tutorial on Thursdays.
The tutorial dates will announced in the first lecture.

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 7.135 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	Grading scale	Recurrence	Version
Written examination	8	Grade to a third	Each winter term	2

Events					
WT 22/23	2137308	Machine Vision	4 SWS	Lecture / Practice (/	Lauer, Kinzig
Exams					
ST 2022	76-T-MACH-105223	Machine Vision			Stiller, Lauer
WT 22/23	76-T-MACH-105223	Machine Vision			Stiller, Lauer

Legend: Online, Blended (On-Site/Online), On-Site, Cancelled

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 22/23, 4 SWS, Language: English, Open in study portal

Lecture / Practice (VÜ)
On-Site

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 7.136 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

Institute of Thermal Turbomachinery

Part of: M-MACH-102566 - Machines and Processes

Type	Credits	Grading scale	Recurrence	Version
Written examination	7	Grade to a third	Each term	2

Events					
ST 2022	3134140	Machines and Processes	4 SWS	Lecture / Practice (/ 🗣	Bauer, Maas, Kubach, Pritz
WT 22/23	2185000	Machines and Processes	4 SWS	Lecture / Practice (/ 🗣	Bauer, Kubach, Maas, Pritz
Exams					
ST 2022	76-T-MACH-105208	Machines and Processes			Kubach, Bauer, Maas, Pritz
ST 2022	76-T-MACH-105208e	Machines and Processes			Kubach, Bauer, Maas, Pritz
WT 22/23	76-T-MACH-105208	Machines and Processes			Kubach, Maas, Bauer

Legend: 🖥 Online, ⚙ Blended (On-Site/Online), 🗣 On-Site, ✕ Cancelled

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 22/23, 4 SWS, Language: German, Open in study portal

Lecture / Practice (VÜ)
On-Site

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 7.137 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

Institute of Thermal Turbomachinery

Part of: M-MACH-102566 - Machines and Processes

Type	Credits	Grading scale	Recurrence	Version
Completed coursework	0	pass/fail	Each term	1

Events					
ST 2022	2187000	Machines and Processes (Lab Course)	1 SWS	Practical course / 🗣	Bauer, Kubach, Maas, Pritz
WT 22/23	2187000	Machines and Processes	1 SWS	Practical course / 🗣	Bauer, Kubach, Pritz, Schmidt, Bykov
Exams					
ST 2022	76-T-MACH-105232	Machines and Processes, Prerequisite			Kubach, Bauer, Maas, Pritz

Legend: 🖥 Online, ⚙ Blended (On-Site/Online), 🗣 On-Site, ✕ Cancelled

Competence Certificate
successful completed training course

Prerequisites
none

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

V Machines and Processes (Lab Course)

2187000, SS 2022, 1 SWS, Language: German, Open in study portal

Practical course (P)
On-Site

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.

V **Machines and Processes**
2187000, WS 22/23, 1 SWS, Open in study portal

Practical course (P)
On-Site

Content
Lab Course Experiment

T 7.138 Course: Manufacturing Technology [T-MACH-102105]

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

Part of: M-MACH-102589 - Major Field: Production Systems
M-MACH-102815 - Major Field: Engineering Design

Type	Credits	Grading scale	Recurrence	Version
Written examination	8	Grade to a third	Each winter term	3

Events					
WT 22/23	2149657	Manufacturing Technology	6 SWS	Lecture / Practice (/	Schulze
Exams					
ST 2022	76-T-MACH-102105	Manufacturing Technology			Schulze
WT 22/23	76-T-MACH-102105	Manufacturing Technology			Schulze

Legend: Online, Blended (On-Site/Online), On-Site, Cancelled

Competence Certificate
Written Exam (180 min)

Prerequisites
none

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

V Manufacturing Technology
2149657, WS 22/23, 6 SWS, Language: German, Open in study portal

Lecture / Practice (VÜ)
Blended (On-Site/Online)

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

Organizational issues
Start: 24.10.2022

Vorlesungstermine montags und dienstags, Übungstermine mittwochs.
Bekanntgabe der konkreten Übungstermine erfolgt in der ersten Vorlesung.

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 7.139 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	Grading scale	Recurrence	Version
Examination of another type	9	Grade to a third	Each winter term	3

Events					
WT 22/23	2117051	Material flow in logistic systems	15 SWS	Others (sons / 🗣	Furmans, Fleischmann, Köhler
Exams					
WT 22/23	76-T-MACH-102151	Material Flow in Logistic Systems			Furmans

Legend: 🖥 Online, ⚙ Blended (On-Site/Online), 🗣 On-Site, ✕ Cancelled

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 22/23, 15 SWS, Language: German, Open in study portal

Others (sonst.)
On-Site

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, 7. Auflage 2019

Description:

This course is seperated into 5 topic blocks which are structured in the following parts:

- self-study phase

- exercise

- plenary

- case study (group work)

- colloquium

- review of case study

The groups for the case study will be formed at the beginning of the course (first week). 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 on 26th of October 2022. In this session, the teaching concept of "Materialfluss in Logistiksysteme" is explained and outstanding issues are clarified.

The course registration including the group allocation with ILIAS is mandatory. The registration will be open for several days after the introductory session (registration duration: 26.10.2022 14:00 Uhr - 01.11.2022 14:00 Uhr)

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 7.140 Course: Materials Characterization [T-MACH-107684]

Responsible: Dr.-Ing. Jens Gibmeier
Prof. Dr. Reinhard Schneider

Organisation: KIT Department of Mechanical Engineering

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

Type	Credits	Grading scale	Recurrence	Version
Oral examination	4	Grade to a third	Each summer term	4

Events					
ST 2022	2174586	Materials Characterization	2 SWS	Lecture /	Schneider, Gibmeier
Exams					
ST 2022	76-T-MACH-107684	Materials Characterization			Gibmeier
WT 22/23	76-T-MACH-107684	Materials Characterization			Gibmeier

Legend: Online, Blended (On-Site/Online), On-Site, × Cancelled

Competence Certificate
Oral exam, about 25 minutes

Prerequisites
Successful participation in Übungen zu Werkstoffanalytik is the condition for the admittance to the oral exam in Werkstoffanalytik.

T-MACH-110945 – Exercises for Materials Characterization has not been started.

T-MACH-110946 – Materials Characterization has not been started.

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, SS 2022, 2 SWS, Language: German, Open in study portal

Lecture (V)
Blended (On-Site/Online)

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.

Organizational issues
Die Veranstaltung findet gem. der aktuell am KIT geltenden Corona-Regeln statt. Stand 11.04.2022 wird die Veranstatung in Präsenz durchgeführt. In jeden Fall bitten wir weiterhin um das Tragen einer Mund-Nasenbedeckung. Im Sommersemester wird die Veranstaltung in deutscher Spache abgehalten. Start der Veranstaltung (erste Vorlesung) ist am 26.04.2022.

The event will be held in accordance with the Corona rules currently in force at KIT. Status of 11.04.2022, the event will be held in presence. In any case, we still ask you to wear a nose and mouth covering. In the summer semester, the event will be held in German. The course (first lecture) will start on 26.04.2022.

Literature

Vorlesungsskript (wird zu Beginn der Veranstaltung ausgegeben).

Literatur wird zu Beginn der Veranstaltung bekanntgegeben.

T 7.141 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	Grading scale	Recurrence	Version
Oral examination	4	Grade to a third	Each summer term	1

Events					
ST 2022	2174574	Materials of Lightweight Construction	2 SWS	Lecture / Blended	Liebig
Exams					
ST 2022	76-T-MACH-105211	Materials of Lightweight Construction			Liebig

Legend: Online, Blended (On-Site/Online), On-Site, Cancelled

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 of Lightweight Construction
2174574, SS 2022, 2 SWS, Language: German, Open in study portal

Lecture (V)
Blended (On-Site/Online)

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).

Examination:

Oral examination, Duration approx. 25 min

Literature

Literaturhinweise, Unterlagen und Teilmanuskript in der Vorlesung

T 7.142 Course: Materials Recycling and Sustainability [T-MACH-110937]

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	Grading scale	Recurrence	Version
Oral examination	4	Grade to a third	Each summer term	2

Events					
ST 2022	2173520	Materials Recycling and Sustainability	2 SWS	Lecture / 🧩	Liebig
Exams					
ST 2022	76-T-MACH-110937	Materials Recycling and Sustainability			Liebig
WT 22/23	76-T-MACH-110937	Materials Recycling and Sustainability			Liebig

Legend: 🖥 Online, 🧩 Blended (On-Site/Online), 🗣 On-Site, ✕ Cancelled

Competence Certificate
oral exam (about 25 min.)

Prerequisites
none

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

V Materials Recycling and Sustainability
2173520, SS 2022, 2 SWS, Language: German, Open in study portal

Lecture (V)
Blended (On-Site/Online)

Content
The lecture series is organised in two main topics: On the one hand, fundamentals of sustainability are explained and it is shown how to tread more sustainable paths in materials science and mechanical engineering. On the other hand, separation and recycling processes for all common classes of materials are presented and discussed. It is shown how recycling fosters a holistic and sustainable perspective on material processing and use.

1. legal bases and historical background
2. climate change, ecology and material flows
3. sustainability in general
4. product responsibility, recyclable design and planned obsolescence
5. general and legal bases of recycling
6. material separation, sorting and processing
7. recycling of metals
8. recycling of polymers and composites
9. recycling of everyday materials
10. alternative materials and alternative design concepts
11. materials for renewable energy sources

Organizational issues
Die LV wird ab SS 2022 jeweils im SS stattfinden.

Literature
Skript wird in der Vorlesung ausgegeben

T 7.143 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	Grading scale	Recurrence	Version
Oral examination	8	Grade to a third	Each winter term	2

Events					
WT 22/23	2173553	Materials Science and Engineering III	4 SWS	Lecture /	Heilmaier, Guth
WT 22/23	2173554	Exercises in Materials Science and Engineering III	1 SWS	Practice /	Heilmaier, Kauffmann
Exams					
ST 2022	76-T-MACH-105301	Materials Science III			Heilmaier, Guth
WT 22/23	76-T-MACH-105301	Materials Science III			Heilmaier, Guth

Legend: Online, Blended (On-Site/Online), On-Site, Cancelled

Competence Certificate
Oral exam, about 35 minutes

Prerequisites
T-MACH-110818 - Plasticity of Metals and Intermetallics has not been started

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

V Materials Science and Engineering III

2173553, WS 22/23, 4 SWS, Language: German, Open in study portal

Lecture (V)
Blended (On-Site/Online)

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

Organizational issues
Die erste Vorlesung findet am 27.10.2022 um 14.00 Uhr im Redtenbacher-Hörsaal statt.

Literature
Vorlesungsskript; Übungsaufgaben; Bhadeshia, H.K.D.H. & Honeycombe, R.W.K.
Steels – Microstructure and Properties
CIMA Publishing, 3. Auflage, 2006

T 7.144 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	Grading scale	Recurrence	Version
Oral examination	11	Grade to a third	Each winter term	2

Events					
ST 2022	2174560	Materials Science and Engineering II for mach, phys	3 SWS	Lecture /	Heilmaier, Pundt
ST 2022	2174563	Exercises in Materials Science and Engineering II for mach, phys	1 SWS	Practice /	Heilmaier, Kauffmann
ST 2022	3174015	Materials Science and Engineering II (Lecture)	3 SWS	Lecture /	Gibmeier
ST 2022	3174026	Materials Science and Engineering II (Tutorials)	1 SWS	Practice /	Gibmeier, Mitarbeiter
WT 22/23	2173550	Materials Science and Engineering I for mach, phys	4 SWS	Lecture /	Pundt, Kauffmann
WT 22/23	2173552	Exercises in Materials Science and Engineering I for mach, phys	1 SWS	Practice /	Pundt, Kauffmann
WT 22/23	3173008	Materials Science and Engineering I (Lecture)	4 SWS	Lecture /	Gibmeier
WT 22/23	3173009	Materials Science and Engineering I (Tutorial)	1 SWS	Practice /	Gibmeier
Exams					
ST 2022	76-T-MACH-105145	Materials Science I, II			Heilmaier, Pundt
ST 2022	76-T-MACH-105145-2	Materials Science I, II			Heilmaier, Pundt
ST 2022	76-T-MACH-105145-English	Materials Science I & II (Exam in English)			Heilmaier, Gibmeier
ST 2022	76-T-MACH-105145-Re-English	Materials Science I & II (Re-exam in English)			Gibmeier, Heilmaier
ST 2022	76-T-MACH-105145-W	Materials Science I & II			Heilmaier, Pundt
WT 22/23	76-T-MACH-105145	Materials Science I, II			Heilmaier, Pundt
WT 22/23	76-T-MACH-105145-English	Materials Science I & II			Heilmaier, Pundt, Gibmeier

Legend: Online, Blended (On-Site/Online), On-Site, Cancelled

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 II for mach, phys** 2174560, SS 2022, 3 SWS, Language: German, Open in study portal	**Lecture (V)** **Blended (On-Site/Online)**

Content
Topics:

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.

Organizational issues
Weitere Informationen zu dieser Veranstaltung finden Sie hier: https://www.iam.kit.edu/wk/lehre.php

Literature
Vorlesungsskript, Vorlesungsvideos, Übungsblätter, Übungsvideos

Weiterführende Informationen gibt es hier:

J. F. Shackelford: „Werkstofftechnologie für Ingenieure. Grundlagen - Prozesse - Anwendungen", Pearson Studium (2005)
https://services.bibliothek.kit.edu/primo/start.php?recordid=KITSRC117341509

A. Rösler, H. Harders, M. Bäker: „Mechanisches Verhalten der Werkstoffe", Springer Vieweg (2016)
http://dx.doi.org/10.1007/978-3-658-13795-3 (frei im KIT-Netz erhältlich)

G. Gottstein: „Materialwissenschaft und Werkstofftechnik: Physikalische Grundlagen", Springer (2014)
http://dx.doi.org/10.1007/978-3-642-36603-1 (frei im KIT-Netz erhältlich)

J. Freudenberger: „Skript zur Vorlesung Physikalische Werkstoffeigenschaften", IFW Dresden (2004)
https://www.ifw-dresden.de/de/ifw-institutes/ikm/lectures/vorlesungsskript-physikalische-werkstoffeigenschaften (frei zugänglich)

V Exercises in Materials Science and Engineering II for mach, phys

2174563, SS 2022, 1 SWS, Language: German, Open in study portal

Practice (Ü)
Blended (On-Site/Online)

Content
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 on Materials Science and Engineering II

Organizational issues
Weitere Informationen finden Sie hier: https://www.iam.kit.edu/wk/lehre.php

Literature
Vorlesungsskript, Vorlesungsvideos, Übungsblätter, Übungsvideos

Weiterführende Informationen gibt es hier:

J. F. Shackelford: „Werkstofftechnologie für Ingenieure. Grundlagen - Prozesse - Anwendungen“, Pearson Studium (2005)
https://services.bibliothek.kit.edu/primo/start.php?recordid=KITSRC117341509

G. Gottstein: „Materialwissenschaft und Werkstofftechnik: Physikalische Grundlagen“, Springer (2014)
http://dx.doi.org/10.1007/978-3-642-36603-1 (frei über die KIT-Lizenz abrufbar)

J. Freudenberger: „Skript zur Vorlesung Physikalische Werkstoffeigenschaften“, IFW Dresden (2004)
http://www.ifw-dresden.de/institutes/imw/lectures/pwe

P. Haasen: „Physikalische Metallkunde“, Cambridge University Press (2003)
http://services.bibliothek.kit.edu/primo/start.php?recordid=KITSRC309606810

R.W. Cahn, P. Haasen (Editoren): „Physical Metallurgy“, Serie, North Holland (1996)
http://services.bibliothek.kit.edu/primo/start.php?recordid=KITSRC052463656

D. A. Porter, K. Easterling: „Phase Transformation in Metals and Alloys“, Chapman & Hall (2009)
http://services.bibliothek.kit.edu/primo/start.php?recordid=KITSRC27759961X

E. Hornbogen, H. Warlimont: „Metalle: Struktur und Eigenschaften von Metallen und Legierungen“, Springer (2016)
http://dx.doi.org/10.1007/978-3-662-47952-0 (frei über die KIT-Lizenz abrufbar)

E. Hornbogen, G. Eggeler, E. Werner: „Werkstoffe: Aufbau und Eigenschaften von Keramik-, Metall-, Polymer- und Verbundwerkstoffen“, Springer (2012)
http://dx.doi.org/10.1007/978-3-642-22561-1 (frei über die KIT-Lizenz abrufbar)

H.-J. Bargel, G. Schulze: „Werkstoffkunde“, Springer (2012)
http://dx.doi.org/10.1007/978-3-642-17717-0 (frei über die KIT-Lizenz abrufbar)

J. Rösler, H. Harders, M. Bäker: „Mechanisches Verhalten der Werkstoffe“, Springer Vieweg (2016)
http://dx.doi.org/10.1007/978-3-658-13795-3 (frei über die KIT-Lizenz abrufbar)

V Materials Science and Engineering II (Lecture)

3174015, SS 2022, 3 SWS, Language: English, Open in study portal

Lecture (V)
Blended (On-Site/Online)

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.

Organizational issues
The event will be held in accordance with the Corona rules currently in force at KIT. In any case, we still ask you to wear a nose and mouth covering.

The course (first lecture) will start on 26.04.2022.

Literature
Vorlesungsskript; Übungsaufgabenblätter;

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

V	**Materials Science and Engineering II (Tutorials)** 3174026, SS 2022, 1 SWS, Language: English, Open in study portal	**Practice (Ü)** **Blended (On-Site/Online)**

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

V	**Materials Science and Engineering I for mach, phys** 2173550, WS 22/23, 4 SWS, Language: German, Open in study portal	**Lecture (V)** **On-Site**

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; Videos, Übungsaufgabenblätter.

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

Skolaut, W., Maschinenbau (Ein Lehrbuch für das ganze Bachelor-Studium), Springer, Heidelberg 2014

Gottstein, G., Physikalische Grundlagen der Materialkunde, 3 Aufl., Springer Verlag, Berlin, 2007

V	**Exercises in Materials Science and Engineering I for mach, phys** 2173552, WS 22/23, 1 SWS, Language: German, Open in study portal	**Practice (Ü)** **Blended (On-Site/Online)**

Content
Example exercises

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 I

workload:

Regular attendance: 21 h, self studies: 21 h

Literature
Vorlesungsskript zu WK1

V Materials Science and Engineering I (Lecture)

3173008, WS 22/23, 4 SWS, Language: English, Open in study portal

Lecture (V)
Blended (On-Site/Online)

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.

Organizational issues
The event will be held in accordance with the Corona rules currently in force at KIT. In any case, we still ask you to wear a nose and mouth covering.

The course (first lecture) will start on 25.10.2022.

Literature
Vorlesungsskript; Übungsaufgabenblätter;

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

V **Materials Science and Engineering I (Tutorial)**
3173009, WS 22/23, 1 SWS, Language: English, Open in study portal

Practice (Ü)
Blended (On-Site/Online)

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:

Organizational issues
information please see entries under ´lecture´

Literature
see lecture notes

T 7.145 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	Grading scale	Recurrence	Version
Completed coursework (practical)	3	pass/fail	Each summer term	1

Events					
ST 2022	2174597	Experimental Lab Course in Material Science	3 SWS	Practical course /	Wagner, Heilmaier, Pundt, Dietrich, Guth
ST 2022	3174016	Materials Science and Engineering Lab Course	3 SWS	Practical course /	Gibmeier, Heilmaier, Pundt
Exams					
ST 2022	76-T-MACH-105146	Materials Science, Lab Course			Heilmaier, Pundt

Legend: Online, Blended (On-Site/Online), On-Site, Cancelled

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

2174597, SS 2022, 3 SWS, Language: German, Open in study portal

Practical course (P)
Blended (On-Site/Online)

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

Organizational issues
Blockveranstaltung. Infos durch Aushang am IAM-WK und in der VL WK II. Anmeldung erforderlich.

Literature
Praktikumsskriptum

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

V	**Materials Science and Engineering Lab Course** 3174016, SS 2022, 3 SWS, Language: English, Open in study portal	**Practical course (P)** **Blended (On-Site/Online)**

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

Organizational issues
Registration required. Note announcements (MSE lecture and IAM-WK bulletin board)

Literature
Praktikumsskriptum

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

T 7.146 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	Grading scale	Recurrence	Expansion	Version
Written examination	4	Grade to a third	Each winter term	1 terms	1

Events					
WT 22/23	2161254	Mathematical Methods in Continuum Mechanics	2 SWS	Lecture / ✿	Böhlke
Exams					
WT 22/23	76-T-MACH-110836	Mathematical Methods in Continuum Mechanics			Böhlke

Legend: Online, Blended (On-Site/Online), On-Site, × Cancelled

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 22/23, 2 SWS, Language: German, Open in study portal

Lecture (V)
Blended (On-Site/Online)

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 7.147 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	Grading scale	Recurrence	Expansion	Version
Written examination	4	Grade to a third	Each winter term	1 terms	1

Events					
WT 22/23	2161254	Mathematical Methods in Continuum Mechanics	2 SWS	Lecture / Blended	Böhlke
Exams					
WT 22/23	76-T-MACH-110375	Mathematical Methods in Continuum Mechanics			Böhlke

Legend: Online, Blended (On-Site/Online), On-Site, Cancelled

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 22/23, 2 SWS, Language: German, Open in study portal

Lecture (V)
Blended (On-Site/Online)

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 7.148 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	Grading scale	Recurrence	Version
Written examination	6	Grade to a third	Each winter term	2

Events					
ST 2022	2161206	Mathematical Methods in Dynamics	2 SWS	Lecture / 🖥	Proppe
WT 22/23	2161206	Mathematical Methods in Dynamics	2 SWS	Lecture / 🗣	Proppe
WT 22/23	2161207	Übungen zu Mathematische Methoden der Dynamik	1 SWS	Practice / 🗣	Proppe, Bitner
Exams					
ST 2022	76-T-MACH-105293	Mathematical Methods in Dynamics			Proppe
WT 22/23	76-T-MACH-105293	Mathematical Methods in Dynamics			Proppe

Legend: 🖥 Online, Blended (On-Site/Online), 🗣 On-Site, × Cancelled

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, SS 2022, 2 SWS, Language: German, Open in study portal

Lecture (V)
Online

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

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

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

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

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	**Mathematical Methods in Dynamics** 2161206, WS 22/23, 2 SWS, Language: German, Open in study portal	**Lecture (V)** **On-Site**

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 22/23, 1 SWS, Language: German, Open in study portal	**Practice (Ü)** **On-Site**

Content
Excercises related to the lecture

T 7.149 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	Grading scale	Recurrence	Version
Written examination	6	Grade to a third	Each summer term	1

Events					
ST 2022	2154432	Mathematical Methods in Fluid Mechanics	4 SWS	Lecture / Practice (/ 🗘	Frohnapfel, Gatti
ST 2022	2154433	Tutorial in Mathematical Methods of Fluid Mechanics	1 SWS	Practice / 🗘	Frohnapfel
ST 2022	2154540	Mathematical Methods in Fluid Mechanics	4 SWS	Lecture / Practice (/ 🗘	Gatti, Frohnapfel
Exams					
ST 2022	76-T-MACH-105295	Mathematical Methods in Fluid Mechanics			Frohnapfel, Gatti
ST 2022	76-T-MACH-105295 (engl.)	Mathematical Methods in Fluid Mechanics			Gatti, Frohnapfel
WT 22/23	76-T-MACH-105295	Mathematical Methods in Fluid Mechanics			Frohnapfel
WT 22/23	76-T-MACH-105295 (engl.)	Mathematical Methods in Fluid Mechanics			Frohnapfel, Gatti

Legend: Online, 🗘 Blended (On-Site/Online), On-Site, × Cancelled

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

2154432, SS 2022, 4 SWS, Language: German, Open in study portal

Lecture / Practice (VÜ)
Blended (On-Site/Online)

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 2022, 1 SWS, Language: German, Open in study portal

Practice (Ü)
Blended (On-Site/Online)

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 2022, 4 SWS, Language: English, Open in study portal

Lecture / Practice (VÜ)
Blended (On-Site/Online)

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 7.150 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	Grading scale	Recurrence	Version
Written examination	6	Grade to a third	Each summer term	2

Events					
ST 2022	2162241	Mathematical methods of vibration theory	2 SWS	Lecture /	Fidlin
ST 2022	2162242	Mathematical methods of vibration theory (Tutorial)	2 SWS	Practice /	Fidlin, Schröders
Exams					
ST 2022	76-T-MACH-105294	Mathematical Methods of Vibration Theory			Fidlin, Seemann
WT 22/23	76-T-MACH-105294	Mathematical Methods of Vibration Theory			Fidlin

Legend: Online, Blended (On-Site/Online), On-Site, Cancelled

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
2162241, SS 2022, 2 SWS, Language: German, Open in study portal

Lecture (V)
Blended (On-Site/Online)

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)
2162242, SS 2022, 2 SWS, Language: German, Open in study portal

Practice (Ü)
Blended (On-Site/Online)

Content
Seven tutorials with examples of the contents of the course

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

T 7.151 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	Grading scale	Recurrence	Version
Written examination	4	Grade to a third	Each summer term	1

Events					
ST 2022	2138326	Measurement II	2 SWS	Lecture / 🗣	Stiller, Bieder
Exams					
ST 2022	76-T-MACH-105335	Measurement II			Stiller

Legend: 🖥 Online, ⚙ Blended (On-Site/Online), 🗣 On-Site, ✕ Cancelled

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 2022, 2 SWS, Language: German, Open in study portal

Lecture (V)
On-Site

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 7.152 Course: Mechanical Design I and II [T-MACH-105286]

Responsible: Prof. Dr.-Ing. Sven Matthiesen
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102573 - Mechanical Design

Type	Credits	Grading scale	Recurrence	Version
Written examination	5	Grade to a third	Each winter term	3

Events					
ST 2022	2146178	Mechanical Design II	2 SWS	Lecture / 🗣	Albers, Matthiesen
ST 2022	3146017	Mechanical Design II Lecture	2 SWS	Lecture / 🗣	Albers, Burkardt
WT 22/23	2145178	Mechanical Design I	2 SWS	Lecture / 🗣	Albers, Matthiesen
WT 22/23	3145186	Mechanical Design I (Lecture)	2 SWS	Lecture / ⧉	Albers, Burkardt
Exams					
ST 2022	76-T-MACH-105286	Mechanical Design I & II			Albers, Matthiesen
ST 2022	76T-MACH-105286_EN	Mechanical Design I & II (english)			Albers, Matthiesen

Legend: 🖥 Online, ⧉ Blended (On-Site/Online), 🗣 On-Site, ✕ Cancelled

Competence Certificate
written exam, graded, duration: 90 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 II

2146178, SS 2022, 2 SWS, Language: German, Open in study portal

Lecture (V)
On-Site

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 2022, 2 SWS, Language: English, Open in study portal
Lecture (V)
On-Site

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.

Organizational issues
Lecture takes place on Do, 15:45 - 17:15, 11.10 in Engelbert-Arnold-Hörsaal (EAS)

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)

V **Mechanical Design I**
2145178, WS 22/23, 2 SWS, Language: German, Open in study portal
Lecture (V)
On-Site

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 22/23, 2 SWS, Language: English, Open in study portal
Lecture (V)
Blended (On-Site/Online)

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

T 7.153 Course: Mechanical Design I, Prerequisites [T-MACH-105282]

Responsible: Prof. Dr.-Ing. Sven Matthiesen
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102573 - Mechanical Design

Type	Credits	Grading scale	Recurrence	Version
Completed coursework	1	pass/fail	Each winter term	2

Events					
WT 22/23	2145185	Tutorials Mechanical Design I	1 SWS	Practice / 🗣	Albers, Matthiesen, Mitarbeiter
WT 22/23	3145187	Mechanical Design I (Tutorial)	2 SWS	Practice / 🧩	Albers, Burkardt
Exams					
WT 22/23	76-T-MACH-105282	Mechanical Design I			Albers, Matthiesen

Legend: 🖥 Online, 🧩 Blended (On-Site/Online), 🗣 On-Site, ✕ Cancelled

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 22/23, 1 SWS, Language: German, Open in study portal

Practice (Ü)
On-Site

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

V Mechanical Design I (Tutorial)

3145187, WS 22/23, 2 SWS, Language: English, Open in study portal

Practice (Ü)
Blended (On-Site/Online)

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

T 7.154 Course: Mechanical Design II, Prerequisites [T-MACH-105283]

Responsible: Prof. Dr.-Ing. Sven Matthiesen
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102573 - Mechanical Design

Type	Credits	Grading scale	Recurrence	Version
Completed coursework	1	pass/fail	Each summer term	3

Events					
ST 2022	2146185	Tutorials Mechanical Design II	2 SWS	Practice / 🗣	Albers, Matthiesen, Mitarbeiter
ST 2022	3146018	Mechanical Design II Tutorials	2 SWS	Practice / 🗣	Albers, Mitarbeiter
Exams					
ST 2022	76-T-MACH-105283	Mechanical Design II			Albers, Matthiesen

Legend: 🖥 Online, ⚙ Blended (On-Site/Online), 🗣 On-Site, ✕ Cancelled

Competence Certificate
Successful completion of a design task is required to pass the prerequisite.

Prerequisites
None

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

V Tutorials Mechanical Design II

2146185, SS 2022, 2 SWS, Language: German, Open in study portal

Practice (Ü)
On-Site

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 2022, 2 SWS, Language: English, Open in study portal

Practice (Ü)
On-Site

Content
Bearings

Sealings

Design

Bolted Connections

Organizational issues
Tutorials take place on Fr, 11:30 - 13:00, in 30.35 Hochspannungstechnik-Hörsaal (HSI)

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 7.155 Course: Mechanical Design III and IV [T-MACH-104810]

Responsible: Prof. Dr.-Ing. Sven Matthiesen
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102573 - Mechanical Design

Type	Credits	Grading scale	Recurrence	Version
Written examination	11	Grade to a third	Each term	3

Events					
ST 2022	2146177	Mechanical Design IV	2 SWS	Lecture / 🗣	Albers, Matthiesen
ST 2022	3146020	Mechanical Design IV Lecture	2 SWS	Lecture / 🗣	Albers, Burkardt
WT 22/23	2145151	Mechanical Design III	2 SWS	Lecture / 🗣	Albers, Matthiesen, Düser, Mitarbeiter
WT 22/23	3145016	Mechanical Design III (Lecture)	2 SWS	Lecture / 🗣	Albers, Burkardt
Exams					
ST 2022	76-T-MACH-104810	Mechanical Design III & IV			Albers, Matthiesen
ST 2022	76-T-MACH-104810_EN	Mechanical Design III & IV (english)			Albers, Matthiesen

Legend: 🖥 Online, Blended (On-Site/Online), 🗣 On-Site, ✕ Cancelled

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 Mechanical Design III, Tutorial and Mechanical Design IV, Tutorial.

Modeled Conditions
You have to fulfill one of 2 conditions:

1. The course T-MACH-110955 - Mechanical Design III, Tutorial must have been passed.
2. The course T-MACH-110956 - Mechanical Design IV, Tutorial must have been passed.

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

V **Mechanical Design III** — **Lecture (V) On-Site**
2145151, WS 22/23, 2 SWS, Language: German, 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)

V

Mechanical Design III (Lecture)

3145016, WS 22/23, 2 SWS, Language: English, Open in study portal

Lecture (V)
On-Site

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 7.156 Course: Mechanical Design III, Tutorial [T-MACH-110955]

Responsible: Prof. Dr.-Ing. Sven Matthiesen
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102573 - Mechanical Design

Type	Credits	Grading scale	Recurrence	Version
Completed coursework	1	pass/fail	Each winter term	1

Events					
WT 22/23	2145153	Tutorials Mechanical Design III	2 SWS	Practice / 🗣	Albers, Matthiesen, Düser, Mitarbeiter
WT 22/23	2145154	Mechanical Design III Workshop	1 SWS	Practical course / 🗣	Albers, Matthiesen, Düser, Albers Assistenten
WT 22/23	3145017	Mechanical Design III (Tutorial)	2 SWS	Practice / 🗣	Albers, Burkardt
WT 22/23	3145018	Mechanical Design III (Workshop)	1 SWS	/ 🗣	Albers, Burkardt
Exams					
WT 22/23	76-T-MACH-110955	Mechanical Design III, Constructing with Team			Albers, Matthiesen, Düser

Legend: 🖥 Online, 🧩 Blended (On-Site/Online), 🗣 On-Site, ✕ Cancelled

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 22/23, 2 SWS, Language: German, Open in study portal

Practice (Ü)
On-Site

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 22/23, 1 SWS, Open in study portal

Practical course (P)
On-Site

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)**
3145017, WS 22/23, 2 SWS, Language: English, Open in study portal

Practice (Ü)
On-Site

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 22/23, 1 SWS, Language: English, Open in study portal

On-Site

Organizational issues
Termine siehe Lehrveranstaltung 2145154

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 7.157 Course: Mechanical Design IV, Tutorial [T-MACH-110956]

Responsible: Prof. Dr.-Ing. Sven Matthiesen
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102573 - Mechanical Design

Type	Credits	Grading scale	Recurrence	Version
Completed coursework	1	pass/fail	Each summer term	1

Events					
ST 2022	2146184	Tutorials Mechanical Design IV	1 SWS	Practice / 🗣	Albers, Matthiesen, Mitarbeiter
ST 2022	2146187	Workshop 'Mechanical Design IV'	1 SWS	/ 🗣	Albers, Matthiesen, Mitarbeiter
ST 2022	3146021	Mechanical Design IV Tutorials	1 SWS	Practice / 🗣	Albers, Mitarbeiter
ST 2022	3146022	Mechanical Design IV Workshop	1 SWS	/ 🗣	Albers, Mitarbeiter
Exams					
ST 2022	76-T-MACH-105285	Mechanical Design IV, tutorial			Albers, Matthiesen

Legend: Online, Blended (On-Site/Online), 🗣 On-Site, × Cancelled

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 Workshop
3146022, SS 2022, 1 SWS, Language: English, Open in study portal **On-Site**

Organizational issues
Registration required, information on the IPEK website.

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 7.158 Course: Mechanics and Strength of Polymers [T-MACH-105333]

Responsible: Hon.-Prof. Dr. Bernd-Steffen von Bernstorff
Organisation: KIT Department of Mechanical Engineering

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

Type	Credits	Grading scale	Recurrence	Version
Oral examination	4	Grade to a third	Each winter term	2

Events					
WT 22/23	2173580	Mechanics and Strengths of Polymers	2 SWS	Lecture / 🗣	von Bernstorff

Legend: 🖥 Online, ⚙ Blended (On-Site/Online), 🗣 On-Site, ✕ Cancelled

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 22/23, 2 SWS, Language: German, Open in study portal

Lecture (V)
On-Site

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).

Organizational issues
berndvonbernstorff@t-online.de

Literature
Literaturliste, spezielle Unterlagen und ein Teilmanuskript werden in der Vorlesung ausgegeben

T 7.159 Course: Mechanics in Microtechnology [T-MACH-105334]

Responsible: Prof. Dr. Christian Greiner
Dr. Patric Gruber

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102820 - Major Field: Mechatronics

Type	Credits	Grading scale	Recurrence	Version
Oral examination	4	Grade to a third	Each winter term	1

Events					
WT 22/23	2181710	Mechanics in Microtechnology	2 SWS	Lecture / 🗣	Gruber, Greiner
Exams					
ST 2022	76-T-MACH-105334	Mechanics in Microtechnology			Gruber, Greiner
WT 22/23	76-T-MACH-105334	Mechanics in Microtechnology			Gruber, Greiner

Legend: 🖥 Online, 🧩 Blended (On-Site/Online), 🗣 On-Site, ✕ Cancelled

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 22/23, 2 SWS, Language: German, Open in study portal

Lecture (V)
On-Site

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

T 7.160 Course: Metallographic Lab Class [T-MACH-105447]

Responsible: Prof. Dr.-Ing. Martin Heilmaier
Dr.-Ing. Fabian Mühl

Organisation: KIT Department of Mechanical Engineering

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

Type	Credits	Grading scale	Recurrence	Version
Completed coursework	4	pass/fail	Each term	2

Events					
ST 2022	2175590	Metallographic Lab Class	3 SWS	Practical course / 🗣	Heilmaier, Kauffmann
WT 22/23	2175590	Metallographic Lab Class	3 SWS	Practical course / 🧩	Kauffmann
Exams					
ST 2022	76-T-MACH-105447	Metallographic Lab Class			Heilmaier, Kauffmann
WT 22/23	76-T-MACH-105447	Metallographic Lab Class			Heilmaier, Kauffmann

Legend: 🖥 Online, 🧩 Blended (On-Site/Online), 🗣 On-Site, ✕ Cancelled

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:

V Metallographic Lab Class
2175590, SS 2022, 3 SWS, Language: German, Open in study portal

Practical course (P)
On-Site

Content

Organizational issues
Anmeldung erfolgt bis spätestens 24.04.2022 vor dem Beginn des Sommersemesters durch eine Mail mit Angabe von Name, Immatrikulations-Nr., Studiengang, Semester, Anrechnung als Fachpraktikum, Laborpraktikum oder Schwerpunkt an alexander.kauffmann@kit.edu. Das Praktikum ist kapazitätsbegrenzt. Das Praktikum hat folgende Bestandteile: (i) Online-Test in ILIAS, (ii) 4 bis 5 Versuchstage in Präsenz oder Online sowie (iii) Einzelprotokoll mit spezifischen Auswerteaufgaben zu den Tätigkeiten im Labor.

Weitere Informationen zu dieser Veranstaltung finden Sie hier: https://www.iam.kit.edu/wk/lehre.php

Literature
Praktikumsskript

Weiterführende Informationen gibt es hier:

G. Gottstein: „Materialwissenschaft und Werkstofftechnik: Physikalische Grundlagen“, Springer (2014)
http://dx.doi.org/10.1007/978-3-642-36603-1 (frei über die KIT-Lizenz abrufbar)

J. Freudenberger: „Skript zur Vorlesung Physikalische Werkstoffeigenschaften“, IFW Dresden (2004)
https://www.ifw-dresden.de/de/ifw-institutes/ikm/lectures/vorlesungsskript-physikalische-werkstoffeigenschaften

P. Haasen: „Physikalische Metallkunde“, Cambridge University Press (2003)
http://services.bibliothek.kit.edu/primo/start.php?recordid=KITSRC309606810

R.W. Cahn, P. Haasen (Editoren): „Physical Metallurgy“, Serie, North Holland (1996)
http://services.bibliothek.kit.edu/primo/start.php?recordid=KITSRC052463656

D. A. Porter, K. Easterling: „Phase Transformation in Metals and Alloys“, Chapman & Hall (2009)
http://services.bibliothek.kit.edu/primo/start.php?recordid=KITSRC27759961X

E. Hornbogen, H. Warlimont: „Metalle: Struktur und Eigenschaften von Metallen und Legierungen“, Springer (2016)
http://dx.doi.org/10.1007/978-3-662-47952-0 (frei über die KIT-Lizenz abrufbar)

E. Hornbogen, G. Eggeler, E. Werner: „Werkstoffe: Aufbau und Eigenschaften von Keramik-, Metall-, Polymer- und Verbundwerkstoffen“, Springer (2012)
http://dx.doi.org/10.1007/978-3-642-22561-1 (frei über die KIT-Lizenz abrufbar)

H.-J. Bargel, G. Schulze: „Werkstoffkunde“, Springer (2012)
http://dx.doi.org/10.1007/978-3-642-17717-0 (frei über die KIT-Lizenz abrufbar)

J. Rösler, H. Harders, M. Bäker: „Mechanisches Verhalten der Werkstoffe“, Springer Vieweg (2016)
http://dx.doi.org/10.1007/978-3-658-13795-3 (frei über die KIT-Lizenz abrufbar)

V **Metallographic Lab Class**
2175590, WS 22/23, 3 SWS, Language: German, Open in study portal

Practical course (P)
Blended (On-Site/Online)

Content
The lab course deals with the practical application of metallographic procedures, e.g. starting from sample extraction to light optical (LOM) and scanning electron microscopy (SEM). The preparation of metallographic samples takes up to two lab days. LOM and SEM analyses are performed on another two days. All results are carefully registered by the students and discussed in a spearate session. Finally, the students can independently apply their theoretical and practical knowledge by the preparation and analysis of industrial relevant metallic materials. The content of the lab course will be documented in the form of individual protocols by the students.

Before starting with the lab course, the students need to prepare the fundamentals that are tested in an online test. Lecture notes as starting point are provided.

Learning objectives:

The students can perform standard metallographic preparation routines as well as qualitative and quantitative microstructure analysis. The students are able to interpret microstructures and the correlations of microstructural constituent and processing and properties of metallic materials.

Prerequisites:

Materials Science and Engineering I and II or Materials Physics und Metals

Arbeitsaufwand:

on-site: 25 h
private studies: 95 h

Organizational issues
Anmeldung erfolgt bis spätestens 30.10.2022 durch eine Mail mit Angabe von Name, Immatrikulations-Nr., Studiengang, Semester an alexander.kauffmann@kit.edu. Das Praktikum ist kapazitätsbegrenzt. Das Praktikum hat folgende Bestandteile: (i) Online-Test in ILIAS, (ii) 5 bis 7 Versuchstage in Präsenz sowie (iii) Einzelprotokoll mit spezifischen Auswerteaufgaben zu den Tätigkeiten im Labor.

Weitere Informationen zu dieser Veranstaltung finden Sie hier: https://www.iam.kit.edu/wk/lehre.php

Literature
Praktikumsskript

Weiterführende Informationen gibt es hier:

G. Gottstein: „Materialwissenschaft und Werkstofftechnik: Physikalische Grundlagen“, Springer (2014)
http://dx.doi.org/10.1007/978-3-642-36603-1 (frei über die KIT-Lizenz abrufbar)

J. Freudenberger: „Skript zur Vorlesung Physikalische Werkstoffeigenschaften“, IFW Dresden (2004)
https://www.ifw-dresden.de/de/ifw-institutes/ikm/lectures/vorlesungsskript-physikalische-werkstoffeigenschaften

P. Haasen: „Physikalische Metallkunde“, Cambridge University Press (2003)
http://services.bibliothek.kit.edu/primo/start.php?recordid=KITSRC309606810

R.W. Cahn, P. Haasen (Editoren): „Physical Metallurgy“, Serie, North Holland (1996)
http://services.bibliothek.kit.edu/primo/start.php?recordid=KITSRC052463656

D. A. Porter, K. Easterling: „Phase Transformation in Metals and Alloys“, Chapman & Hall (2009)
http://services.bibliothek.kit.edu/primo/start.php?recordid=KITSRC27759961X

E. Hornbogen, H. Warlimont: „Metalle: Struktur und Eigenschaften von Metallen und Legierungen“, Springer (2016)
http://dx.doi.org/10.1007/978-3-662-47952-0 (frei über die KIT-Lizenz abrufbar)

E. Hornbogen, G. Eggeler, E. Werner: „Werkstoffe: Aufbau und Eigenschaften von Keramik-, Metall-, Polymer- und Verbundwerkstoffen“, Springer (2012)
http://dx.doi.org/10.1007/978-3-642-22561-1 (frei über die KIT-Lizenz abrufbar)

H.-J. Bargel, G. Schulze: „Werkstoffkunde“, Springer (2012)
http://dx.doi.org/10.1007/978-3-642-17717-0 (frei über die KIT-Lizenz abrufbar)

J. Rösler, H. Harders, M. Bäker: „Mechanisches Verhalten der Werkstoffe“, Springer Vieweg (2016)
http://dx.doi.org/10.1007/978-3-658-13795-3 (frei über die KIT-Lizenz abrufbar)

T 7.161 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	Grading scale	Recurrence	Version
Oral examination	4	Grade to a third	Each summer term	1

Events					
ST 2022	2142897	Microenergy Technologies	2 SWS	Lecture /	Kohl
Exams					
ST 2022	76-T-MACH-105557	Microenergy Technologies			Kohl

Legend: Online, Blended (On-Site/Online), On-Site, Cancelled

Competence Certificate
Oral examination (30 Min.)

Prerequisites
none

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

V Microenergy Technologies
2142897, SS 2022, 2 SWS, Language: English, Open in study portal

Lecture (V)
Blended (On-Site/Online)

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 7.162 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	Grading scale	Recurrence	Version
Written examination	5	Grade to a third	Each term	3

Events					
ST 2022	2183703	Modelling and Simulation	2+1 SWS	Lecture / Practice (/ 🖥	Nestler, August
WT 22/23	2183703	Numerical methods and simulation techniques	3 SWS	Lecture / Practice (/ 🖥	Nestler, August
Exams					
ST 2022	76-T-MACH-100300	Modelling and Simulation			Nestler
WT 22/23	76-T-MACH-100300	Modelling and Simulation			Nestler, August

Legend: 🖥 Online, Blended (On-Site/Online), On-Site, ✕ Cancelled

Competence Certificate
Successful participation in the computer internship (ungraded) and written exam, 90 min (graded)

Prerequisites
none

Recommendation
preliminary knowlegde in mathematics, physics and materials science

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

V Modelling and Simulation

2183703, SS 2022, 2+1 SWS, Language: German, Open in study portal

Lecture / Practice (VÜ)
Online

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

Organizational issues
Die Termine für die Übungen werden in der Vorlesung und im Ilias bekannt gegeben.

Literature

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

V	**Numerical methods and simulation techniques** 2183703, WS 22/23, 3 SWS, Language: German, Open in study portal	**Lecture / Practice (VÜ)** **Online**

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

Organizational issues
Termine für Rechnerübungen werden in der Vorlesung bekannt gegeben!

Literature

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

T 7.163 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	Grading scale	Recurrence	Version
Oral examination	5	Grade to a third	Each winter term	2

Events					
WT 22/23	2183702	Modelling of Microstructures	3 SWS	Lecture / Practice (/ 🖥	August, Nestler
Exams					
ST 2022	76-T-MACH-105303	Modelling of Microstructures			August, Nestler, Weygand
WT 22/23	76-T-MACH-105303	Modelling of Microstructures			August, Weygand, Nestler

Legend: 🖥 Online, Blended (On-Site/Online), On-Site, × Cancelled

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 22/23, 3 SWS, Language: German, Open in study portal

Lecture / Practice (VÜ)
Online

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

T 7.164 Course: Modern Control Concepts I [T-MACH-105539]

Responsible: apl. Prof. Dr. Lutz Groell
apl. Prof. Dr. Jörg Matthes

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102820 - Major Field: Mechatronics

Type	Credits	Grading scale	Recurrence	Version
Written examination	4	Grade to a third	Each summer term	1

Events					
ST 2022	2105024	Modern Control Concepts I	2 SWS	Lecture /	Matthes, Groell
ST 2022	2106020	Tutorial on Modern Control Concepts I	2 SWS	Practice /	Matthes
Exams					
ST 2022	76-T-MACH-105539	Modern Control Concepts I			Matthes
WT 22/23	76-T-MACH-105539	Modern Control Concepts I			Matthes

Legend: Online, Blended (On-Site/Online), On-Site, Cancelled

Competence Certificate
Written exam (Duration: 1 h)

Prerequisites
none

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

V Modern Control Concepts I

2105024, SS 2022, 2 SWS, Language: German, Open in study portal

Lecture (V)
Blended (On-Site/Online)

Literature

- Aström, K.-J., Murray, R.M.: Feedback Systems, 2012
- Rugh, W.: Linear System Theory. Prentice Hall, 1996

V Tutorial on Modern Control Concepts I

2106020, SS 2022, 2 SWS, Language: German, Open in study portal

Practice (Ü)
Online

Content
Learning Content:

1. Introduction (system classes, nomenclature)
2. Equilibria
3. Linearization (software based, Hartman-Grobman-Theorem)
4. Parameter identification of linear dynamic models (SISO+MIMO)
5. PID-controller (realization, design-hints, Anti-Windup-mechanisms)
6. Conzept of 2DOF-Controllers (structure, reference signal design)
7. State space (geometric view)
8. Controller with state feedback and integrator expansion
   (LQ-design, Eigenvalue placement, decoupling design)
9. Observer (LQG-design, disturbance observer, reduced observer)

Recommendations:

Attendance of the following lectures is reccomendet:

- Grundlagen der Mess- und Regelungstechnik

Alternatively: Comparable courses of the faculty of electrical engineering

Literature

- Aström, K.-J., Murray, R.M.: Feedback Systems, 2012
- Rugh, W.: Linear System Theory. Prentice Hall, 1996

T 7.165 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	Grading scale	Recurrence	Version
Written examination	4	Grade to a third	Each winter term	3

Events					
WT 22/23	2141865	Novel actuators and sensors	2 SWS	Lecture / 🗣	Kohl, Sommer
Exams					
WT 22/23	76-T-MACH-102152	Novel Actuators and Sensors			Kohl, Sommer

Legend: 🖥 Online, ⚙ Blended (On-Site/Online), 🗣 On-Site, ✕ Cancelled

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 22/23, 2 SWS, Language: German, Open in study portal

Lecture (V)
On-Site

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 7.166 Course: Numerical Fluid Mechanics [T-MACH-105338]

Responsible: Dr.-Ing. Davide Gatti
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	Grading scale	Recurrence	Version
Oral examination	4	Grade to a third	Each winter term	3

Events					
WT 22/23	2153441	Numerical Fluid Mechanics	4 SWS	Lecture / Practice (/	Gatti, Frede
Exams					
ST 2022	76T-Mach-105338	Numerical Fluid Mechanics			Gatti, Frohnapfel
WT 22/23	76T-Mach-105338	Numerical Fluid Mechanics			Gatti, Frohnapfel

Legend: Online, Blended (On-Site/Online), On-Site, Cancelled

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 22/23, 4 SWS, Language: German, Open in study portal

Lecture / Practice (VÜ)
Blended (On-Site/Online)

Content
The course covers the following topics:

1. basic equations of computational fluid dynamics
2. main discretization methods for fluid mechanics problems, with focus on finite differences and finite volumes
3. boundary and initial conditions
4. mesh generation and mesh treatment
6. solution algorithms for linear and nonlinear systems of equations
7. solution strategies for the incompressible Navier-Stokes equations
8. introduction to the solution of the compressible Navier-Stokes equations
9. examples of numerical simulation in practice

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 7.167 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	Grading scale	Recurrence	Version
Written examination	6	Grade to a third	Each summer term	2

Events					
ST 2022	2313737	Photovoltaics	3 SWS	Lecture / 🗣	Powalla, Lemmer
ST 2022	2313738	Tutorial 2313737 Photovoltaik	1 SWS	Practice / 🗣	Powalla, Lemmer
Exams					
ST 2022	7313737	Photovoltaics			Powalla, Lemmer
WT 22/23	7313737	Photovoltaics			Powalla, Lemmer

Legend: 🖥 Online, 🧩 Blended (On-Site/Online), 🗣 On-Site, ✕ Cancelled

Prerequisites
"M-ETIT-100524 - Solar Energy" must not have started.

T 7.168 Course: Physical and Chemical Principles of Nuclear Energy in View of Reactor Accidents and Back-End of Nuclear Fuel Cycle [T-MACH-105537]

Responsible: apl. Prof. Dr. Ron Dagan
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102816 - Major Field: Fundamentals of Energy Technology

Type	Credits	Grading scale	Recurrence	Version
Oral examination	4	Grade to a third	Each winter term	3

Events					
WT 22/23	2189906	Physical and chemical principles of nuclear energy in view of reactor accidents and back-end of nuclear fuel cycle	1 SWS	Lecture / 🗣	Dagan, Metz
Exams					
ST 2022	76-T-MACH-105537	Physical and Chemical Principles of Nuclear Energy in View of Reactor Accidents and Back-End of Nuclear Fuel Cycle			Dagan
WT 22/23	76-T-MACH-105537	Physical and Chemical Principles of Nuclear Energy in View of Reactor Accidents and Back-End of Nuclear Fuel Cycle			Dagan

Legend: 🖥 Online, ⚙ Blended (On-Site/Online), 🗣 On-Site, ✕ Cancelled

Competence Certificate
oral exam, approx. 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)
On-Site

2189906, WS 22/23, 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.

Organizational issues
Die Veranstaltung wird nur online gehalten, falls durch Corona Einschränkungen vorgegeben werden.

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 7.169 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	Grading scale	Recurrence	Version
Oral examination	5	Grade to a third	Each winter term	3

Events					
WT 22/23	2181612	Physical basics of laser technology	3 SWS	Lecture / Practice (/ 🗣	Schneider
Exams					
ST 2022	76-T-MACH-102102	Physical Basics of Laser Technology			Schneider
WT 22/23	76-T-MACH-102102	Physical Basics of Laser Technology			Schneider

Legend: 🖥 Online, 🧩 Blended (On-Site/Online), 🗣 On-Site, ✕ Cancelled

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 22/23, 3 SWS, Language: German, Open in study portal

Lecture / Practice (VÜ)
On-Site

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.

- 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.

Organizational issues
Termine für die Übung werden in der Vorlesung bekannt gegeben!

Literature
F. K. Kneubühl, M. W. Sigrist: Laser, 2008, Vieweg+Teubner

T. Graf: Laser - Grundlagen der Laserstrahlerzeugung 2015, Springer Vieweg

R. Poprawe: Lasertechnik für die Fertigung, 2005, Springer

H. Hügel, T. Graf: Laser in der Fertigung, 2014, Springer Vieweg

J. Eichler, H.-J. Eichler: Laser - Bauformen, Strahlführung, Anwendungen, 2015, Springer

W. T. Silfvast: Laser Fundamentals, 2004, Cambridge University Press

W. M. Steen: Laser Material Processing, 2010, Springer

T 7.170 Course: Physics for Engineers [T-MACH-100530]

Responsible: Prof. Dr. Martin Dienwiebel
Prof. Dr. Peter Gumbsch
apl. Prof. Dr. Alexander Nesterov-Müller
Dr. Daniel Weygand

Organisation: KIT Department of Mechanical Engineering

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

Type	Credits	Grading scale	Recurrence	Version
Written examination	5	Grade to a third	Each summer term	1

Events					
ST 2022	2142890	Physics for Engineers	4 SWS	Lecture / Practice (/ 🗣	Weygand, Dienwiebel, Nesterov-Müller, Gumbsch
Exams					
ST 2022	76-T-MACH-100530	Physics for Engineers			Gumbsch, Weygand, Nesterov-Müller, Dienwiebel

Legend: 📱 Online, 🧩 Blended (On-Site/Online), 🗣 On-Site, ✕ Cancelled

Competence Certificate
written exam 90 min

Prerequisites
none

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

V **Physics for Engineers** — **Lecture / Practice (VÜ) On-Site**
2142890, SS 2022, 4 SWS, Language: German, Open in study portal

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 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)
self-study: 105 hours

The assessment consists of a written exam (90 minutes) (following §4(2), 1 of the examination regulation).

Organizational issues
Kontakt: daniel.weygand@kit.edu

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 7.171 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	Grading scale	Recurrence	Version
Examination of another type	4	Grade to a third	Each term	3

Events					
ST 2022	2121357	PLM-CAD Workshop	4 SWS	Project (P / 🗣	Ovtcharova, Mitarbeiter
WT 22/23	2121357	PLM-CAD Workshop	4 SWS	Project (P / 🗣	Ovtcharova, Mitarbeiter
Exams					
ST 2022	76-T-MACH-102153	PLM-CAD Workshop			Ovtcharova
WT 22/23	76-T-MACH-102153	PLM-CAD Workshop			Ovtcharova

Legend: 🖥 Online, ⚙ Blended (On-Site/Online), 🗣 On-Site, ✕ Cancelled

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, SS 2022, 4 SWS, Language: German, Open in study portal

Project (PRO)
On-Site

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.

Organizational issues
Siehe Homepage zur Lehrveranstaltung

Literature
Workshop-Unterlagen / workshop materials

V PLM-CAD Workshop
2121357, WS 22/23, 4 SWS, Language: German, Open in study portal

Project (PRO)
On-Site

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 7.172 Course: Polymer Engineering I [T-MACH-102137]

Responsible: Dr.-Ing. Wilfried Liebig
Organisation: KIT Department of Mechanical Engineering

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

Type	Credits	Grading scale	Recurrence	Version
Oral examination	4	Grade to a third	Each winter term	1

Events					
WT 22/23	2173590	Polymer Engineering I	2 SWS	Lecture / Blended	Liebig
Exams					
ST 2022	76-T-MACH-102137	Polymer Engineering I			Liebig
WT 22/23	76-T-MACH-102137	Polymer Engineering I			Liebig

Legend: Online, Blended (On-Site/Online), On-Site, Cancelled

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 22/23, 2 SWS, Language: German, Open in study portal

Lecture (V)
Blended (On-Site/Online)

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 7.173 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	Grading scale	Recurrence	Version
Written examination	4	Grade to a third	Each summer term	2

Events					
ST 2022	2146180	Powertrain Systems Technology A: Automotive Systems	2 SWS	Lecture / 🗣	Albers, Ott
Exams					
ST 2022	76-T-MACH-105233	Powertrain Systems Technology A: Automotive Systems			Albers, Ott
WT 22/23	76-T-MACH-105233	Powertrain Systems Technology A: Automotive Systems			Albers, Ott

Legend: 🖥 Online, 🧩 Blended (On-Site/Online), 🗣 On-Site, × Cancelled

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 2022, 2 SWS, Language: German, Open in study portal

Lecture (V)
On-Site

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 7.174 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	Grading scale	Recurrence	Version
Written examination	4	Grade to a third	Each winter term	2

Events					
WT 22/23	2145150	Powertrain Systems Technology B: Stationary Machinery	2 SWS	Lecture / 🗣	Albers, Ott
Exams					
ST 2022	76-T-MACH-105216	Powertrain Systems Technology B: Stationary Machinery			Albers, Ott
WT 22/23	76-T-MACH-105216	Powertrain Systems Technology B: Stationary Machinery			Albers, Ott

Legend: 🖥 Online, ✣ Blended (On-Site/Online), 🗣 On-Site, ✕ Cancelled

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 22/23, 2 SWS, Language: German, Open in study portal

Lecture (V)
On-Site

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 7.175 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	Grading scale	Recurrence	Version
Completed coursework	4	pass/fail	Each summer term	1

Events					
ST 2022	2162208	Schwingungstechnisches Praktikum		Practical course /	Genda, Fidlin
Exams					
ST 2022	76-T-MACH-105373	Practical Training in Measurement of Vibrations			Fidlin

Legend: Online, Blended (On-Site/Online), On-Site, Cancelled

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 7.176 Course: Presentation [T-MACH-109189]

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

Type	Credits	Grading scale	Recurrence	Version
Completed coursework	3	pass/fail	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's Thesis must have been started.

Annotation
The workload for the presentation of the bachelor thesis is about 90 hours.

T 7.177 Course: Principles of Ceramic and Powder Metallurgy Processing [T-MACH-102111]

Responsible: Dr.-Ing. Günter Schell
Organisation: KIT Department of Mechanical Engineering

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

Type	Credits	Grading scale	Recurrence	Version
Oral examination	4	Grade to a third	Each winter term	1

Events					
WT 22/23	2193010	Basic principles of powder metallurgical and ceramic processing	2 SWS	Lecture / Blended	Schell
Exams					
ST 2022	76-T-MACH-102111	Principles of Ceramic and Powder Metallurgy Processing			Schell
WT 22/23	76-T-MACH-102111	Principles of Ceramic and Powder Metallurgy Processing			Schell

Legend: Online, Blended (On-Site/Online), On-Site, Cancelled

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
2193010, WS 22/23, 2 SWS, Language: German, Open in study portal

Lecture (V)
Blended (On-Site/Online)

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 7.178 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	Grading scale	Recurrence	Version
Oral examination	4	Grade to a third	Each winter term	1

Events					
WT 22/23	2149670	Product- and Production-Concepts for modern Automobiles	2 SWS	Lecture /	Steegmüller, Kienzle
Exams					
WT 22/23	76-T-MACH-110318	Product- and Production-Concepts for modern Automobiles			Steegmüller, Kienzle

Legend: Online, Blended (On-Site/Online), On-Site, Cancelled

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

2149670, WS 22/23, 2 SWS, Language: German, Open in study portal

Lecture (V)
Blended (On-Site/Online)

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

Organizational issues

Termine werden über Ilias bekannt gegeben.

Bei der Vorlesung handelt es sich um eine Blockveranstaltung. Eine Anmeldung über Ilias ist erforderlich.

The lecture is a block course. An application in Ilias is mandatory.

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 7.179 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	Grading scale	Recurrence	Version
Written examination	4	Grade to a third	Each winter term	2

Events					
WT 22/23	2121350	Product Lifecycle Management	2 SWS	Lecture / 🗣	Ovtcharova, Elstermann
Exams					
ST 2022	76-T-MACH-105147	Product Lifecycle Management			Ovtcharova, Elstermann
WT 22/23	76-T-MACH-105147	Product Lifecycle Management			Ovtcharova, Elstermann

Legend: 🖥 Online, ⚙ Blended (On-Site/Online), 🗣 On-Site, ✕ Cancelled

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 22/23, 2 SWS, Language: German, Open in study portal

Lecture (V)
On-Site

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 7.180 Course: Product, Process and Resource Integration in the Automotive Industry [T-MACH-102155]

Responsible: Prof. 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	Grading scale	Recurrence	Version
Oral examination	4	Grade to a third	Each summer term	2

Events					
ST 2022	2123364	Product, Process and Resource Integration in the Automotive Industry	2 SWS	Lecture / Practice (/ 🗣	Mbang
Exams					
ST 2022	76-T-MACH-102155	Product, Process and Resource Integration in the Automotive Industry			Mbang

Legend: 🖥 Online, 🔄 Blended (On-Site/Online), 🗣 On-Site, ✕ Cancelled

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 / Practice (VÜ)
On-Site
2123364, SS 2022, 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)

Organizational issues
Blockveranstaltung

Literature
Vorlesungsfolien

T 7.181 Course: Production Technology for E-Mobility [T-MACH-110984]

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

Part of: M-MACH-102812 - Major Field: Powertrain Systems
M-MACH-102815 - Major Field: Engineering Design
M-MACH-102816 - Major Field: Fundamentals of Energy Technology
M-MACH-102818 - Major Field: Vehicle Technology

Type	Credits	Grading scale	Recurrence	Version
Written examination	4	Grade to a third	Each summer term	2

Events					
ST 2022	2150605	Production Technology for E-Mobility	2 SWS	Lecture / Blended	Fleischer
Exams					
ST 2022	76-T-MACH-110984	Production Technology for E-Mobility			Fleischer
WT 22/23	76-T-MACH-110984	Production Technology for E-Mobility			Fleischer

Legend: Online, Blended (On-Site/Online), On-Site, × Cancelled

Competence Certificate
Written Exam (60 min)

Prerequisites
none

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

V Production Technology for E-Mobility
2150605, SS 2022, 2 SWS, Language: German, Open in study portal

Lecture (V)
Blended (On-Site/Online)

Content
In the lecture Production Engineering for Electromobility the students should be enabled to design, select and develop production processes for the production of the components of an electric drive train (electric motor, battery cells, fuel cells) by using research-oriented teaching.

Learning Outcomes:

The students are able to:

- describe the structure and function of a fuel cell, an electric traction drive and a batterysystem.
- reproduce the process chains for the production of the components fuel cell, battery and electric traction drive.
- apply methodical tools to solve problems along the process chain.
- derive the challenges in the production of electric drives for electric mobility.
- describe the factors influencing the individual process steps on each other using the process chain of Li-ion battery cells.
- enumerate or describe the necessary process parameters to counteract the influencing factors of the process steps in Li-ion battery cell production.
- apply methodical tools to solve problems along the process chain for the production of Li-ion battery cells.
- derive the challenge of mounting and dismounting battery modules.
- derive the challenges in the production of fuel cells for use in mobility.

Workload:

regular attendance: 42 hours
self-study: 78 hours

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

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

T 7.182 Course: Programming in CAE-Applications [T-MACH-111431]

Responsible: Prof. Dr.-Ing. Luise Kärger
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102815 - Major Field: Engineering Design

Type	Credits	Grading scale	Recurrence	Expansion	Version
Completed coursework	4	pass/fail	Each winter term	1 terms	1

Events					
WT 22/23	2113109	Programming in CAE-Applications	2 SWS	Practical course /	Kärger
Exams					
WT 22/23	76-T-MACH-111431	Programming in CAE-Applications			Kärger

Legend: Online, Blended (On-Site/Online), On-Site, Cancelled

Competence Certificate
Colloquia on exercises during the semester and presentation of a group task at the end of the semester (ungraded)

Prerequisites
The number of participating students is limited. Details for the admission process can be found in the category "Organizational issues" of the associated event.

Recommendation

- Basics of the finite element method (ideally with Abaqus)
- Basic knowledge of continuum mechanics
- Basics of programming
- Basic knowledge of fibre-reinforced polymers

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

V Programming in CAE-Applications
2113109, WS 22/23, 2 SWS, Language: German, Open in study portal

Practical course (P)
Blended (On-Site/Online)

Content

The development of components supported by numerical simulations, for example through the finite element method (FEM), has become an indispensable part of modern engineering work. They allow a virtual evaluation of different component variants and thus contribute to an efficient product development process. For the correct use of CAE methods and the generation of reliable simulation results, knowledge of the methodological background and a goal-oriented approach for the model setup and simulation evaluation is essential. Thereby, recurring problems can be solved efficiently and automatically by programming sequence and evaluation scripts. The investigation of modern material systems such as continuous fiber-reinforced plastics represents an additional challenge. For these complex materials, there is often a lack of commercially available methods, which is why the implementation of user-defined material models through suitable subroutines is increasingly necessary.

In this workshop, students learn about the everyday work of computational engineers. Step by step, the basics of the finite element method are worked out using practical examples in Abaqus, as well as typical procedures for model setup and evaluation. Building on this, basic knowledge of script programming in Python and the implementation of material models in Fortran subroutines is taught. The aim of the course is to illustrate the contents in an application-oriented manner through a combination of lectures, supervised classroom exercises and solving project tasks in small groups during the semester.

Main topics:

- Fundamentals of FE structural simulations with anisotropic materials using continuous fiber-reinforced plastics as an example (Abaqus)
- Automated model setup and evaluation with Python scripts
- Efficient evaluation of the result quality of FE-simulations
- Derivation of measures to improve structural load-bearing capacity
- User-defined material modelling (Fortran subroutines)

Learning Objectives:

Students will be able to

- understand the basics of the finite element method and use the FE software Abaqus to solve practical calculation tasks,
- automate the FE model generation as well as the result evaluation,
- evaluate the simulation results, identify errors and derive conclusions for improving the load-bearing capacity,
- understand the basics for developing material subroutines and implement them for simple examples.

Organizational issues

Die Raumbelegung und der wöchentliche Veranstaltungstermin wird zu Beginn des Wintersemesters auf der Homepage des Instituts (https://www.fast.kit.edu/lbt/1205.php) bekannt gegeben.

Aufgrund des gewünschten Betreuungsverhältnisses und der Institutsausstattung ist die maximale Anzahl der teilnehmenden Studierenden begrenzt. Die vorläufigen Anmeldung erfolgt über das zugehören Formular auf der Instituts-Homepage (https://www.fast.kit.edu/lbt/1205.php), welches Anfang September dort zusammen mit weiteren Details veröffentlicht wird. Bei zu vielen Interessenten findet eine Auswahl unter allen Interessenten statt.

The room allocation and the weekly course date will be announced at the beginning of the winter semester on the Institute's homepage (https://www.fast.kit.edu/lbt/1205.php).

Due to the desired supervision ratio and the institute's equipment, the maximum number of participating students is limited. Preliminary registration takes place via the associated form on the Institute's homepage (https://www.fast.kit.edu/lbt/1205.php), which will be published there together with further details at the beginning of September. If there are too many interested students, a selection will take place among all interested students.

T 7.183 Course: Project Internship Aditive Manufacturing: Development and Production of an Additive Component [T-MACH-110960]

Responsible: 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
M-MACH-102819 - Major Field: Materials Science and Engineering

Type	Credits	Grading scale	Recurrence	Version
Examination of another type	4	Grade to a third	Each winter term	2

Events					
WT 22/23	2149700	Project Internship Aditive Manufacturing: Development and Production of an Additive Component	2 SWS	Practical course / ⚙	Zanger, Lubkowitz
Exams					
WT 22/23	76-T-MACH-110960	Project Internship Aditive Manufacturing: Development and Production of an Additive Component			Zanger

Legend: Online, Blended (On-Site/Online), On-Site, Cancelled

Competence Certificate
Alternative test achievement (graded)

The competence certificate is a project work; alternative test achievement according to § 4 Abs. 2 No. 3 of the SPO. Here, the project work, the milestone-based presentation of the results in presentation form (10 min each) and a final oral examination (15 min) are included in the assessment.

Prerequisites
none

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

V Project Internship Aditive Manufacturing: Development and Production of an Additive Component

2149700, WS 22/23, 2 SWS, Language: German, Open in study portal

Practical course (P)
Blended (On-Site/Online)

Content
The lecture "Project Internship Additive Manufacturing: Development and Production of an Additive Component" combines the basics of metallic laser powder bed fusion (LPBF) with a development project in cooperation with an industrial company.
The students learn the basics of the following topics in the project-related lecture:

- Influence of different process variables on the component quality of parts produced in the LPBF process
- Preparation and simulation of the LPBF process
- Production of additive metallic components
- Process monitoring and quality assurance in additive manufacturing
- Topology optimization
- CAM for subtractive rewor

The topics addressed in the course will be applied practically in various workshops on the individual topics and transferred to the developmental task in self-study.
Finally, the results of the elaborations are produced additively and post-processed subtractively.

Learning Outcomes:

The students …

- are able to describe the properties and applications of the additive manufacturing processes laser powder bed fusion (LPBF) and lithography assisted ceramic manufacturing (LCM).
- are able to select the appropriate manufacturing process for a technical application.
- are able to describe and implement the creation of a product along the entire additive process chain (CAD, simulation, work preparation, CAM) from the idea to the production.
- are able to discuss the development process for components that are optimized for additive manufacturing.
- are able to perform topology optimization.
- are able to simulate the additive process, compensate for process-related distortions and determine the ideal alignment on the building platform.
- are able to create necessary support structures for the additive process and to derive a building order file.
- are able to create a CAM model for the subtractive rework process of additive parts.

Workload:

regular attendance: 12 hours
self-study: 108 hours

Organizational issues
Termine werden über die Vorlesungsankündigung des wbk mitgeteilt: http://www.wbk.kit.edu/studium-und-lehre.php

Aus organisatorischen Gründen ist die Teilnehmerzahl für die Lehrveranstaltung begrenzt. Infolgedessen wird ein Auswahlprozess stattfinden. Der Link zur Bewerbung wird in der Vorlesungsankündigung über die Homepage des wbk (http://www.wbk.kit.edu/studium-und-lehre.php) zur Verfügung gestellt.

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

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

T 7.184 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	Grading scale	Recurrence	Version
Oral examination	4	Grade to a third	Each winter term	1

Competence Certificate
oral exam (20 min)

Aids: None

Prerequisites
none

T 7.185 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	Grading scale	Recurrence	Version
Oral examination	6	Grade to a third	Each term	1

Events					
ST 2022	2115817	Project Workshop: Automotive Engineering	3 SWS	Lecture / Blended	Gauterin, Gießler, Frey
WT 22/23	2115817	Project Workshop: Automotive Engineering	3 SWS	Lecture / On-Site	Gauterin, Gießler, Frey
Exams					
ST 2022	76-T-MACH-102156	Project Workshop: Automotive Engineering			Gauterin
WT 22/23	76-T-MACH-102156	Project Workshop: Automotive Engineering			Gauterin

Legend: Online, Blended (On-Site/Online), On-Site, Cancelled

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, SS 2022, 3 SWS, Language: German, Open in study portal

Lecture (V)
Blended (On-Site/Online)

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.

Organizational issues
Begrenzte Teilnehmerzahl mit Auswahlverfahren, die Bewerbungen sind am Ende des vorhergehenden Semesters einzureichen.

Raum und Termine: s. Aushang bzw. Homepage

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.

V	**Project Workshop: Automotive Engineering** 2115817, WS 22/23, 3 SWS, Language: German, Open in study portal	**Lecture (V)** **On-Site**

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.

Organizational issues
Begrenzte Teilnehmerzahl mit Auswahlverfahren, in deutscher Sprache. Bewerbungen sind am Ende des vorhergehenden Semesters einzureichen.
Termin und Raum: siehe Institutshomepage.

Limited number of participants with selection procedure, in German language. Please send the application at the end of the previous semester

Date and room: see homepage of institute.

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.

T 7.186 Course: Python Algorithm for Vehicle Technology [T-MACH-110796]

Responsible: Stephan Rhode
Organisation:
Part of: M-MACH-102818 - Major Field: Vehicle Technology

Type	Credits	Grading scale	Recurrence	Version
Written examination	4	Grade to a third	Each summer term	1

Events					
ST 2022	2114862	Python Algorithms for Automotive Engineering	2 SWS	Lecture / 🖥	Rhode
Exams					
ST 2022	76-T-MACH-110796	Python Algorithm for Vehicle Technology			Rhode
WT 22/23	76-T-Mach-110796	Python Algorithm for Vehicle Technology			Rhode

Legend: 🖥 Online, Blended (On-Site/Online), On-Site, × Cancelled

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 2022, 2 SWS, Language: German, Open in study portal

Lecture (V)
Online

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.

Organizational issues

Das Vorlesungsmaterial wird auf ILIAS bereitgestellt. Das ILIAS-Passwort erhalten Sie unter https://fast-web-01.fast.kit.edu/PasswoerterIlias/

Die Vorlesung findet digital über ILIAS statt. Die Rücksprache Termine finden in Präsenz am Campus Ost, Geb. 70.04, Raum 219 statt.

Termine hierzu werden noch bekannt gegeben.

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 7.187 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	Grading scale	Recurrence	Version
Written examination	4	Grade to a third	Each winter term	2

Events					
WT 22/23	2149667	Quality Management	2 SWS	Lecture / Blended	Lanza
Exams					
ST 2022	76-T-MACH-102107	Quality Management			Lanza
WT 22/23	76-T-MACH-102107	Quality Management			Lanza

Legend: Online, Blended (On-Site/Online), On-Site, Cancelled

Competence Certificate
Written Exam (60 min)

Prerequisites
none

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

V Quality Management — **Lecture (V)** **Blended (On-Site/Online)**
2149667, WS 22/23, 2 SWS, Language: German, Open in study portal

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

Organizational issues
Start: 24.10.2022

Vorlesungstermine montags 09:45 Uhr
Übung erfolgt während der Vorlesung

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 7.188 Course: Rail System Technology [T-MACH-106424]

Responsible: Prof. Dr.-Ing. Marcus Geimer
Prof. Dr.-Ing. Peter Gratzfeld

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102638 - Major Field: Rail System Technology

Type	Credits	Grading scale	Recurrence	Version
Oral examination	4	Grade to a third	Each term	1

Events					
ST 2022	2115919	Rail System Technology	2 SWS	Lecture / 🗣	Heckele, Gratzfeld
WT 22/23	2115919	Rail System Technology	2 SWS	Lecture / 🗣	Heckele, Gratzfeld
Exams					
ST 2022	76-T-MACH-106424	Rail System Technology			Heckele, Gratzfeld
ST 2022	76-T-MACH-106425	Rail System Technology			Heckele, Gratzfeld
WT 22/23	76-T-MACH-106424	Rail System Technology			Heckele, Reimann, Gratzfeld
WT 22/23	76-T-MACH-106425	Rail System Technology			Heckele, Reimann

Legend: 🖥 Online, ⚙ Blended (On-Site/Online), 🗣 On-Site, ✕ Cancelled

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, SS 2022, 2 SWS, Language: German, Open in study portal

Lecture (V)
On-Site

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, comparison electric traction and diesel traction, dc and ac networks, system pantograph and contact wire, filling stations

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, WS 22/23, 2 SWS, Language: German, Open in study portal

Lecture (V)
On-Site

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, comparison electric traction and diesel traction, dc and ac networks, system pantograph and contact wire, filling stations

Literature

Eine Literaturliste steht den Studierenden auf der Ilias-Plattform zum Download zur Verfügung.

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

T 7.189 Course: Rail Vehicle Technology [T-MACH-105353]

Responsible: Prof. Dr.-Ing. Marcus Geimer
Prof. Dr.-Ing. Peter Gratzfeld

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102638 - Major Field: Rail System Technology

Type	Credits	Grading scale	Recurrence	Version
Oral examination	4	Grade to a third	Each term	1

Events					
ST 2022	2115996	Rail Vehicle Technology	2 SWS	Lecture / 🗣	Reimann, Gratzfeld
WT 22/23	2115996	Rail Vehicle Technology	2 SWS	Lecture / 🗣	Reimann, Gratzfeld
Exams					
ST 2022	76-T-MACH-105353	Rail Vehicle Technology			Reimann, Gratzfeld
ST 2022	76-T-MACH-105355	Rail Vehicle Technology			Reimann, Gratzfeld
WT 22/23	76-T-MACH-105353	Rail Vehicle Technology			Reimann, Heckele, Gratzfeld
WT 22/23	76-T-MACH-105355	Rail Vehicle Technology			Reimann, Gratzfeld

Legend: 📱 Online, ⚙ Blended (On-Site/Online), 🗣 On-Site, ✕ Cancelled

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, SS 2022, 2 SWS, Language: German, Open in study portal

Lecture (V)
On-Site

Content

1. Vehicle system technology: structure and main systems of rail vehicles
2. Car body: functions, requirements, design principles, crash elements, coupling, doors and windows
3. Bogies: forces, running gears, bogies, Jakobs-bogies, active components, connection to car body, wheel arrangement
4. Drives: priciples, electric drives (main components, asynchronous traction motor, inverter, with DC supply, with AC supply, without line supply, multisystem vehicles, dual mode vehicles, hybrid vehicles), non-electric drives
5. Brakes: basics, principles (wheel brakes, rail brakes, blending), brake control (requirements and operation modes, pneumatic brake, electropneumatic brake, emergency brake, parking brake)
6. Train control management system: definition of TCMS, bus systems, components, network architectures, examples, future trends
7. Vehicle concepts: trams, metros, regional trains, intercity trains, high speed trains, double deck vehicles, 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, WS 22/23, 2 SWS, Language: German, Open in study portal

Lecture (V)
On-Site

Content

1. Vehicle system technology: structure and main systems of rail vehicles
2. Car body: functions, requirements, design principles, crash elements, coupling, doors and windows
3. Bogies: forces, running gears, bogies, Jakobs-bogies, active components, connection to car body, wheel arrangement
4. Drives: priciples, electric drives (main components, asynchronous traction motor, inverter, with DC supply, with AC supply, without line supply, multisystem vehicles, dual mode vehicles, hybrid vehicles), non-electric drives
5. Brakes: basics, principles (wheel brakes, rail brakes, blending), brake control (requirements and operation modes, pneumatic brake, electropneumatic brake, emergency brake, parking brake)
6. Train control management system: definition of TCMS, bus systems, components, network architectures, examples, future trends
7. Vehicle concepts: trams, metros, regional trains, intercity trains, high speed trains, double deck vehicles, 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).

7.190 Course: Railways in the Transportation Market [T-MACH-105540]

Responsible: Prof. Dr.-Ing. Marcus Geimer
Prof. Dr.-Ing. Peter Gratzfeld

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102638 - Major Field: Rail System Technology

Type	Credits	Grading scale	Recurrence	Version
Oral examination	4	Grade to a third	Each summer term	1

Events					
ST 2022	2114914	Railways in the Transportation Market	2 SWS	Block / 🗣	Gratzfeld
Exams					
ST 2022	76-T-MACH-105540	Railways in the Transportation Market			Gratzfeld

Legend: 📱 Online, 🧩 Blended (On-Site/Online), 🗣 On-Site, ✕ Cancelled

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 2022, 2 SWS, Language: German, Open in study portal

Block (B)
On-Site

Content
The lecture gives an overview about perspective, challenges and chances of rail systems in the national and European market. Following items will be discussed:

- Introduction and basics
- Rail reform in Germany
- Overview of Deutsche Bahn
- Regulation of railways
- Financing and development of rail infrastructure
- Group strategy “Strong Rail” and their building blocks:
  (climate, environment, digitalization, “Strong Rail” in Baden-Württemberg)
- Trends in the transportation market
- Field of actions in transport policy
- Intra- and intermodal competition
- Summary

Learning Objectives:

- To capture the entrepreneurial perspective on transport companies
- To appraise the intra- and intermodal competition
- To understand the regulative determinant
- To reflect trends in transportation market
- To comprehend strategic challenges, chances and fields of actions of transport companies
- To apply intermodal perspective
- To take important key figures of railways and transportation market
- To realize the relevance of sustainability and digitalization

Organizational issues
Die Blockvorlesung „Die Eisenbahn im Verkehrsmarkt" findet am **23.06./24.06./25.06.2022 von 9.00 bis 16.00 Uhr** am Campus Ost. Geb. 70.04, R 220 in Präsenz statt. Die Prüfung findet am 20.07.2022 in Präsenz statt.
Näheres siehe Homepage http://www.fast.kit.edu/bst/929.php

Literature
keine

T 7.191 Course: Reliability Engineering 1 [T-MACH-107447]

Responsible: Dr.-Ing. Alexei Konnov

Organisation: KIT Department of Mechanical Engineering
Institute of Thermal Turbomachinery

Part of: M-MACH-102817 - Major Field: Information Technology
M-MACH-102838 - Major Field: Energy Converting Engines

Type	Credits	Grading scale	Recurrence	Version
Written examination	3	Grade to a third	Each winter term	1

Competence Certificate
written exam

Prerequisites
none

T 7.192 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	Grading scale	Recurrence	Version
Written examination	6	Grade to a third	Each winter term	1

Events					
WT 22/23	2424152	Robotics I - Introduction to Robotics	3/1 SWS	Lecture / 🗣	Asfour
Exams					
ST 2022	7500218	Robotik I - Einführung in die Robotik			Asfour
WT 22/23	7500106	Robotics I - Introduction to Robotics			Asfour

Legend: 🖥 Online, ⚙ Blended (On-Site/Online), 🗣 On-Site, ✕ Cancelled

T 7.193 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	Grading scale	Recurrence	Version
Oral examination	4	Grade to a third	Each winter term	2

Events					
WT 22/23	2117061	Safety Engineering	2 SWS	Lecture / 🗣	Kany

Legend: 🖥 Online, ⚙ Blended (On-Site/Online), 🗣 On-Site, ✕ Cancelled

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 22/23, 2 SWS, Language: German, Open in study portal

Lecture (V)
On-Site

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

Organizational issues
Termine: siehe ILIAS.

Literature
Defren/Wickert: Sicherheit für den Maschinen- und Anlagenbau, Druckerei und
Verlag: H. von Ameln, Ratingen

T 7.194 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	Grading scale	Recurrence	Version
Written examination	4	Grade to a third	Each winter term	3

Events					
WT 22/23	2181738	Scientific computing for Engineers	2 SWS	Lecture / 🗣	Weygand, Gumbsch
WT 22/23	2181739	Exercises for Scientific Computing for Engineers	2 SWS	Practice / 🗣	Weygand
Exams					
ST 2022	76-T-MACH-100532	Scientific Computing for Engineers			Weygand, Gumbsch
WT 22/23	76-T-MACH-100532	Scientific Computing for Engineers			Weygand, Gumbsch

Legend: 🖥 Online, ⚙ Blended (On-Site/Online), 🗣 On-Site, ✕ Cancelled

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

2181738, WS 22/23, 2 SWS, Language: German, Open in study portal

Lecture (V)
On-Site

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 22/23, 2 SWS, Language: German, Open in study portal

Practice (Ü)
On-Site

Content
Exercises for the different topics of the lecture "Scientific computing for Engineers" (2181738)

regular attendance: 22,5 hours

Organizational issues
Veranstaltungsort (RZ Pool Raum) wird in Vorlesung bekannt gegeben

Literature
Skript zur Vorlesung "Wissenschaftliches Programmieren für Ingenieure" (2181738)

T 7.195 Course: Selected Problems of Applied Reactor Physics and Exercises [T-MACH-105462]

Responsible: apl. Prof. Dr. Ron Dagan
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102816 - Major Field: Fundamentals of Energy Technology

Type	Credits	Grading scale	Recurrence	Version
Oral examination	4	Grade to a third	Each summer term	1

Events					
ST 2022	2190411	Selected Problems of Applied Reactor Physics and Exercises	2 SWS	Lecture / 🗣	Dagan, Metz
Exams					
ST 2022	76-T-MACH-105462	Selected Problems of Applied Reactor Physics and Exercises			Dagan
WT 22/23	76-T-MACH-105462	Selected Problems of Applied Reactor Physics and Exercises			Dagan, Metz

Legend: 🖥 Online, 🧩 Blended (On-Site/Online), 🗣 On-Site, ✕ Cancelled

Competence Certificate
oral exam, approx. 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 2022, 2 SWS, Language: German/English, Open in study portal

Lecture (V)
On-Site

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 7.196 Course: Self-Booking-BSc-HOC-SPZ-ZAK-Graded [T-MACH-111685]

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

Part of: M-MACH-102576 - Key Competences

Type	Credits	Grading scale	Recurrence	Version
Examination of another type	2	Grade to a third	Each term	1

Competence Certificate
Completed coursework

Prerequisites
None

Self service assignment of supplementary stdues
This course can be used for self service assignment of grade aquired from the following study providers:

- House of Competence
- Sprachenzentrum
- Zentrum für Angewandte Kulturwissenschaft und Studium Generale

Annotation
Interdisciplinary qualifications (IQ) completed at the House-of-Competence (HoC), at the Zentrum für Angewandte Kulturwissenschaften (ZAK) or at the Sprachenzentrum (SpZ) can be assigned in self-service.

First, select a partial accomplishment named "self-assignment" in your study schedule and second, assign an IQ-achievement via the tab "IQ achievements".

T 7.197 Course: Self-Booking-BSc-HOC-SPZ-ZAK-Non-Graded [T-MACH-111684]

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

Part of: M-MACH-102576 - Key Competences

Type	Credits	Grading scale	Recurrence	Version
Completed coursework	2	pass/fail	Each term	1

Competence Certificate
Completed coursework

Prerequisites
None

Self service assignment of supplementary stdues
This course can be used for self service assignment of grade aquired from the following study providers:

- House of Competence
- Sprachenzentrum
- Zentrum für Angewandte Kulturwissenschaft und Studium Generale

Annotation
Interdisciplinary qualifications (IQ) completed at the House-of-Competence (HoC), at the Zentrum für Angewandte Kulturwissenschaften (ZAK) or at the Sprachenzentrum (SpZ) can be assigned in self-service.

First, select a partial accomplishment named "self-assignment" in your study schedule and second, assign an IQ-achievement via the tab "IQ achievements".

T 7.198 Course: Seminar for Rail System Technology [T-MACH-108692]

Responsible: Prof. Dr.-Ing. Marcus Geimer
Prof. Dr.-Ing. Peter Gratzfeld

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102638 - Major Field: Rail System Technology

Type	Credits	Grading scale	Recurrence	Version
Examination of another type	3	Grade to a third	Each term	2

Events					
ST 2022	2115009	Seminar for Rail System Technology	1 SWS	Seminar / 🗣	Tesar, Geimer, Gratzfeld
WT 22/23	2115009	Seminar for Rail System Technology	1 SWS	Seminar / 🗣	Gratzfeld, Tesar, Geimer
Exams					
ST 2022	76-T-MACH-2115009	Seminar for Rail System Technology			Gratzfeld, Geimer
WT 22/23	76-T-MACH-2115009	Seminar for Rail System Technology			Gratzfeld, Geimer

Legend: Online, Blended (On-Site/Online), 🗣 On-Site, × Cancelled

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, SS 2022, 1 SWS, Language: German, Open in study portal

Seminar (S) On-Site

Content

1. Railway System: railway as a 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. System structure of railway vehicles: structure and major systems of rail vehicles
4. 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
5. 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.

Learning targets:

- The students become aware of the fundamental relations and interdependencies between rail vehicles, infrastructure and operation in a rail system.
- They overview the technical components of a rail system, in particular rail vehicle technology.
- They are able to use the essential elements of scientific work and present their results in written form and verbal presentation.

Organizational issues
Teilnehmerzahl ist auf 10 begrenzt. Die Prüfung besteht aus einer schriftlichen Ausarbeitung (Seminararbeit) und einem Vortrag über die Ausarbeitung. Weitere Infos siehe Institutshomepage https://www.fast.kit.edu/bst/929_11545.php.

Max. 10 participants. Examination: Writing a Seminararbeit, final presentation. Please check the homepage for further information.

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, WS 22/23, 1 SWS, Language: German/English, Open in study portal

Seminar (S)
On-Site

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.

Organizational issues
Teilnehmerzahl ist auf 10 begrenzt. Die Prüfung besteht aus einer schriftlichen Ausarbeitung (Seminararbeit) und einem Vortrag über die Ausarbeitung. Weitere Infos siehe Institutshomepage (https://www.fast.kit.edu/bst/929_11545.php)
Max. 10 participants. Examination: Writing a Seminararbeit, final presentation. Please check the homepage for further information.

Literature
Eine Literaturliste steht den Studierenden auf der Ilias-Plattform zum Download zur Verfügung.

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

T 7.199 Course: Signals and Systems [T-ETIT-109313]

Responsible: Prof. Dr.-Ing. Michael Heizmann
Organisation: KIT Department of Electrical Engineering and Information Technology
Part of: M-MACH-102820 - Major Field: Mechatronics

Type	Credits	Grading scale	Recurrence	Expansion	Version
Written examination	6	Grade to a third	Each winter term	1 terms	1

Events					
WT 22/23	2302109	Signals and Systems	2 SWS	Lecture / Blended	Heizmann
WT 22/23	2302111	Signals and Systems (Tutorial to 2302109)	2 SWS	Practice / On-Site	Heizmann, Leven
Exams					
ST 2022	7302109	Signals and Systems			Heizmann
WT 22/23	7302109	Signals and Systems			Heizmann

Legend: Online, Blended (On-Site/Online), On-Site, × Cancelled

Prerequisites
none

T 7.200 Course: Simulation of Coupled Systems [T-MACH-105172]

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

Part of: M-MACH-104430 - Major Field: Modeling and Simulation in Dynamics

Type	Credits	Grading scale	Recurrence	Version
Oral examination	4	Grade to a third	Each summer term	2

Events					
ST 2022	2114095	Simulation of Coupled Systems	2 SWS	Lecture / 🗣	Geimer
Exams					
ST 2022	76T-MACH-105172	Simulation of Coupled Systems			Geimer
WT 22/23	76T-MACH-105172	Simulation of Coupled Systems			Geimer

Legend: 🖥 Online, ⯐ Blended (On-Site/Online), 🗣 On-Site, × Cancelled

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 2022, 2 SWS, Language: German, Open in study portal

Lecture (V)
On-Site

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 7.201 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	Grading scale	Recurrence	Version
Completed coursework	0	pass/fail	Each summer term	1

Exams			
ST 2022	76-T-MACH-108888	Simulation of Coupled Systems - Advance	Geimer
WT 22/23	76-T-MACH-108888	Simulation of Coupled Systems - Advance	Geimer

Competence Certificate
Preparation of semester report

Prerequisites
none

7.202 Course: Solar Thermal Energy Systems [T-MACH-106493]

Responsible: apl. Prof. Dr. Ron Dagan
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102816 - Major Field: Fundamentals of Energy Technology

Type	Credits	Grading scale	Recurrence	Version
Oral examination	4	Grade to a third	Each winter term	3

Events					
WT 22/23	2189400	Solar Thermal Energy Systems	2 SWS	Lecture / 🗣	Dagan
Exams					
ST 2022	76-T-MACH-106493	Solar Thermal Energy Systems			Dagan
WT 22/23	76-T-MACH-106493	Solar Thermal Energy Systems			Dagan

Legend: 🖥 Online, ❁ Blended (On-Site/Online), 🗣 On-Site, ✕ Cancelled

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
2189400, WS 22/23, 2 SWS, Language: English, Open in study portal

Lecture (V)
On-Site

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.

Organizational issues

Die Veranstaltung wird nur online gehalten, falls durch Corona Einschränkungen vorgegeben werden.

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 7.203 Course: Steering of a Global Operating Company - The Robert BOSCH GmbH as an Example [T-MACH-110961]

Responsible: Dr. Rudolf Maier
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102576 - Key Competences

Type	Credits	Grading scale	Recurrence	Version
Completed coursework	2	pass/fail	Each winter term	1

Events					
WT 22/23	2149663	Steering of a Global Operating Company - The Robert BOSCH GmbH as an Example	2 SWS	Seminar / 🗣	Grube
Exams					
WT 22/23	76-T-MACH-110961	Steering of a Global Operating Company - The Robert BOSCH GmbH as an Example			Grube

Legend: 🖥 Online, ⚙ Blended (On-Site/Online), 🗣 On-Site, ✕ Cancelled

Competence Certificate
alternative achievement (ungraded):
- attendance on at least 12 lecture units

Prerequisites
T-MACH-106375 – The Value Stream in an Industrial Company - The Value Chain at BOSCH as an Example must not have been startet.

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

V Steering of a Global Operating Company - The Robert BOSCH GmbH as an Example

Seminar (S)
On-Site

2149663, WS 22/23, 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

Organizational issues
Start: 26.10.2022

Die Anmeldung zum Seminar erfolgt über Ilias. (https://ilias.studium.kit.edu/)
Das Passwort wird im ersten Termin bekanntgegeben.

The registration for the seminar is via Ilias. (https://ilias.studium.kit.edu/)
The password will be announced in the first appointment.

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 7.204 Course: Strategic Product Development - Identification of Potentials of Innovative Products [T-MACH-105696]

Responsible: Prof. Dr.-Ing. Albert Albers
Prof. Dr.-Ing. Sven Matthiesen
Prof. 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	Grading scale	Recurrence	Version
Oral examination	3	Grade to a third	Each summer term	2

Events					
ST 2022	2146198	Strategic product development - identification of potentials of innovative products	2 SWS	Lecture /	Siebe
Exams					
ST 2022	76-T-MACH-105696	Strategic product development - identification of potentials of innovative products			Siebe, Albers

Legend: Online, Blended (On-Site/Online), On-Site, Cancelled

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): Documentation and presentation of the overall 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

2146198, SS 2022, 2 SWS, Language: German, Open in study portal

Lecture (V)
Blended (On-Site/Online)

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.

Organizational issues
Anmeldung erforderlich; Termine/ Ort und weitere Informationen siehe IPEK-Homepage

T 7.205 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
Prof. 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	Grading scale	Recurrence	Version
Examination of another type	1	Grade to a third	Each summer term	2

Events					
ST 2022	2146198	Strategic product development - identification of potentials of innovative products	2 SWS	Lecture / Blended	Siebe
Exams					
ST 2022	76-T-MACH-110396	Strategic Product Development - Identification of Potentials of Innovative Products - Case Study			Siebe

Legend: Online, Blended (On-Site/Online), On-Site, Cancelled

Competence Certificate

Successful processing of a case study(T-MACH-110396): documentation and presentation of the overall 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)
Blended (On-Site/Online)

2146198, SS 2022, 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.

Organizational issues

Anmeldung erforderlich; Termine/ Ort und weitere Informationen siehe IPEK-Homepage

T 7.206 Course: Structural Analysis of Composite Laminates [T-MACH-105970]

Responsible: Prof. 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	Grading scale	Recurrence	Version
Oral examination	4	Grade to a third	Each winter term	1

Events					
WT 22/23	2113106	Structural Analysis of Composite Laminates	2 SWS	Lecture / Practice (/ 🗣	Kärger

Legend: 🖥 Online, ⚙ Blended (On-Site/Online), 🗣 On-Site, ✕ Cancelled

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
2113106, WS 22/23, 2 SWS, Language: German, Open in study portal

Lecture / Practice (VÜ)
On-Site

Content
To reduce fuel consumption and CO_2 emissions, lightweight materials such as fiber-reinforced plasics (FRP) are increasingly being used in vehicle construction. The course is dedicated to the calculation of the material and structural behavior of FRP components with the following contents:

- Micromechanics and Homogenization of fibre-matrix-composite
- macromechanical behavior of individual layer
- Behaviour of multilayer laminate
- FE formulations
- Failure criteria
- damage analysis
- Dimensioning of FRP parts

Aim of this lecture: The students understand the mechanical correlation between fibre-matrix-configuration and macroscopic material behavior. They can formulate the stress-strain / force-strain relation of an individual layer and of a multilayer laminate by approaches of first and higher order. The students know and can interpret and apply failure criteria and approaches to model damage progression. They know simple dimension strategies to design FRP components.

Literature

H. Altenbach, J. Altenbach, W. Kissing; Mechanics of Composite Structural Elements . ISBN 978-3-642-07411-0 Springer-Verlag Berlin Heidelberg, 2004.

E. J. Barbero: Finite Element Analysis of Composite Materials. ISBN: 1-4200-5433-3 . CRC Press, Boca Raton, FL, 1. edition, 2008.

E. J. Barbero: Introduction to Composite Materials Design. CRC Press, Boca Raton, FL, 2. edition, 2011.

E. J. Barbero: Finite Element Analysis of Composite Materials Using Abaqus. ISBN: ISBN: 978-1-46-651661-8 . CRC Press, Boca Raton, FL, 2013.

Isaac M. Daniel, Ori Ishai: Engineering Mechanics of Composite Materials. Oxford Univ Press; ISBN-13: 978-0195150971 , 2. Edition, 2005.

Davila, C. G.; Camanho, P. P.; Rose, C. A.: Failure criteria for FRP laminates. Journal of Composite Materials 39: 323-345, 2005.

Hinton, M. J.; Kaddour, A. S.; Soden, P. D.: A comparison of the predictive capabilities of current failure theories for composite laminates, judged against experimental evidence. Composites Science and Technology 62: 1725-1797, 2002.

Puck, A.; Schürmann, H.: Failure analysis of FRP laminates by means of physically based phenomenological models. Composite Science and Technology 58: 1045-1067, 1998.

Reddy, J. N.: Mechanics of laminated composite plates and shells - Theory and Analysis. USA: CRC Press, Boca Raton, 2004.

Soden, P. D.; Kaddour, A. S.; Hinton, M. J.: Recommendations for designers and researchers resulting from the world-wide failure exercise. Composites Science and Technology 64: 589-604, 2004.

Stephen W. Tsai and J. Daniel D. Melo: Composite Materials Design and Testing. Composites Design Group, 978-0-9860845-1-5 Stanford University , 2015.

T 7.207 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	Grading scale	Recurrence	Version
Written examination	4	Grade to a third	Each summer term	1

Events					
ST 2022	2146192	Sustainable Product Engineering	2 SWS	Lecture / 🗣	Ziegahn
Exams					
ST 2022	76-T-MACH-105358	Sustainable Product Engineering			Ziegahn, Albers

Legend: 📱 Online, ♲ Blended (On-Site/Online), 🗣 On-Site, ✕ Cancelled

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 2022, 2 SWS, Open in study portal

Lecture (V)
On-Site

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 7.208 Course: Sustainable Production Economics [T-MACH-111859]

Responsible: Prof. Dr.-Ing. Kai Furmans
Prof. Dr.-Ing. Gisela Lanza

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-105902 - Sustainable Production Economics

Type	Credits	Grading scale	Recurrence	Expansion	Version
Written examination	5	Grade to a third	Each winter term	1 terms	1

Events					
WT 22/23	2149616	Sustainable Production Economics	4 SWS	Lecture / Practice (/	Lanza
Exams					
WT 22/23	76-T-MACH-111859	Sustainable Production Economics			Furmans, Lanza

Legend: Online, Blended (On-Site/Online), On-Site, Cancelled

Competence Certificate
written exam (duration: 90 min)

Modeled Conditions
The following conditions have to be fulfilled:

1. The course T-MACH-100304 - Production Operations Management must not have been started.
2. The course T-MACH-108734 - Production Operations Management-Project must not have been started.

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

V Sustainable Production Economics

2149616, WS 22/23, 4 SWS, Language: German, Open in study portal

Lecture / Practice (VÜ)
Blended (On-Site/Online)

Content
The lecture conveys an overall understanding of operational production management with special consideration of aspects of sustainability as well as an application-oriented understanding of the fundamental issues and methods in industrial companies. Through exercises as well as a business game synchronous to the lecture, the taught contents are deepened through application, so that the participants can apply them directly in their later professional environment.

Learning Outcomes:

After successful completion of the course, the students are able …

- to discuss, alone and in a team, the terms, contexts and models by which manufacturing companies are described;
- to discuss typical problems of manufacturing companies, especially against the background of current and future challenges of ecological, social and economic sustainability;
- to apply the most important methods for efficient and sustainable management in industrial enterprises, in particular in the sense of the circular economy, in a problem-related manner;
- to select and justify decision-making alternatives by applying the methods learned;
- to critically question the methods learned and to independently acquire methods that go beyond this.

Workload:

regular attendance: 42 hours
self-study: 108 hours

Organizational issues
Start: 24.10.2022

Vorlesungstermine montags, Übungstermine freitags.
Bekanntgabe der konkreten Übungstermine erfolgt in der ersten Vorlesung

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 7.209 Course: Sustainable Vehicle Drivetrains [T-MACH-111578]

Responsible: Prof. Dr. Thomas Koch
Dr.-Ing. Olaf Toedter

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	Grading scale	Recurrence	Version
Oral examination	4	Grade to a third	Each winter term	1

Events					
WT 22/23	2133132	Sustainable Vehicle Drivetrains	2 SWS	Lecture / 🗣	Toedter
Exams					
WT 22/23	76-T-MACH-105655	Sustainable Vehicle Drivetrains			Toedter

Legend: 🖥 Online, ⚙ Blended (On-Site/Online), 🗣 On-Site, ✕ Cancelled

Competence Certificate
oral exam (20 minutes)

Prerequisites
none

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

V Sustainable Vehicle Drivetrains

2133132, WS 22/23, 2 SWS, Open in study portal

Lecture (V)
On-Site

Content
Sustainability

Environmental balance

Legislation

Alternative fuels

BEV

Fuel cell

Hybrid drives

T 7.210 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	Grading scale	Recurrence	Version
Oral examination	4	Grade to a third	Each summer term	1

Events					
ST 2022	2106033	System Integration in Micro- and Nanotechnology I	2 SWS	Lecture / 🗣	Gengenbach
Exams					
ST 2022	76-T-MACH-105555	System Integration in Micro- and Nanotechnology			Gengenbach
WT 22/23	76-T-MACH-105555	System Integration in Micro- and Nanotechnology			Gengenbach

Legend: 🖥 Online, 🔀 Blended (On-Site/Online), 🗣 On-Site, ✕ Cancelled

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 I

2106033, SS 2022, 2 SWS, Language: German, Open in study portal

Lecture (V)
On-Site

Content
Content:

- Introduction to system integration (fundamentals)
- Brief introduction to MEMS processes
- Flexures
- Surfaces and plasma processes for surface treatment
- Adhesive bonding in engineering
- Mounting techniques in electronics
- Molded Interconnect devices (MID)
- Functional Printing
- Low temperature cofired ceramics in system integration
- 3D-Integration in semiconductor technology

Learning objectives:
The students acquire basic knowledge of challenges and system integration technologies from mechanical engineering, precision engineering and electronics.

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 7.211 Course: System Integration in Micro- and Nanotechnology 2 [T-MACH-110272]

Responsible: Dr. Ulrich Gengenbach
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102820 - Major Field: Mechatronics

Type	Credits	Grading scale	Recurrence	Version
Oral examination	4	Grade to a third	Each winter term	1

Events					
WT 22/23	2105040	System Integration in Micro- and Nanotechnology 2	2 SWS	Lecture / 🗣	Gengenbach
Exams					
ST 2022	76-T-MACH-110272	System Integration in Micro- and Nanotechnology 2			Gengenbach
WT 22/23	76-T-MACH-110272	System Integration in Micro- and Nanotechnology 2			Gengenbach

Legend: 🖥 Online, ❋ Blended (On-Site/Online), 🗣 On-Site, ✕ Cancelled

Competence Certificate
Oral exam, approx. 15 min.

Prerequisites
None

Annotation
Attention: The lecture and exam will be offered for the first time in WS20/21!

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

V System Integration in Micro- and Nanotechnology 2

2105040, WS 22/23, 2 SWS, Language: German, Open in study portal

Lecture (V)
On-Site

Content
Introduction to system integration (novel processes and applications)

Assembly of hybrid microsystems

Packaging processes

Applications:

- Micro process engineering
- Lab-on-chip systems
- Microoptical systems
- Silicon Photonics

Novel integration processes:

- Direct Laser Writing
- Self Assembly

Learning objectives
The students acquire knowledge of novel system integration technologies and their application in microoptic and microfluidic systems.

Literature
N.-T. Nguyen, Fundamentals and Applications of Microfluidics, Artech House

G. T. Reed, Silicon Photonics: An Introduction, Wiley

T 7.212 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	Grading scale	Recurrence	Version
Written examination	4	Grade to a third	Each summer term	4

Events					
ST 2022	2174576	Systematic Materials Selection	3 SWS	Lecture / 🧩	Dietrich
ST 2022	2174577	Excercises in Systematic Materials Selection	1 SWS	Practice / 🧩	Dietrich, Mitarbeiter
Exams					
ST 2022	76-T-MACH-100531	Systematic Materials Selection			Dietrich
WT 22/23	76-T-MACH-100531	Systematic Materials Selection			Dietrich

Legend: 🖥 Online, 🧩 Blended (On-Site/Online), 🗣 On-Site, ✕ Cancelled

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 2022, 3 SWS, Language: German, Open in study portal

Lecture (V)
Blended (On-Site/Online)

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 7.213 Course: Technical Acoustics [T-MACH-111382]

Responsible: Dr. Iris Pantle
Johannes Walter

Organisation: KIT Department of Mechanical Engineering
Institute of Thermal Turbomachinery

Part of: M-MACH-102815 - Major Field: Engineering Design
M-MACH-102816 - Major Field: Fundamentals of Energy Technology

Type	Credits	Grading scale	Recurrence	Version
Oral examination	4	Grade to a third	Each term	1

Events					
ST 2022	2158107	Technical Acoustics	2 SWS	Lecture / 🗣	Walter, Pantle
Exams					
ST 2022	76-T-MACH-111382	Technical Acoustics			Pantle, Walter
WT 22/23	76-T-MACH-111382	Technical Acoustics			Pantle, Walter

Legend: 🖥 Online, ⚙ Blended (On-Site/Online), 🗣 On-Site, ✕ Cancelled

Competence Certificate
oral exam, 30 min.

Prerequisites
None

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

V Technical Acoustics
2158107, SS 2022, 2 SWS, Language: German, Open in study portal

Lecture (V)
On-Site

Content
Basics of acoustics

Perception and weighting of noise (human hearing)

Description of acoustic parameters, level notation

Noise propagation

Acoustical measurement techniques

regular attendance: 28 hours
self-study: 60 hours

preparation for exam: 30 hours

Oral examination
Duration: 30 minutes
No tools or reference materials may be used during the exam.

WARNING for ETIT students: the recognition is not possible because the Faculty of Electrical Engineering and Information Technology also offers a "Technical Acoustics" course.

Students get to know the basics of technical acoustics in general. Application of the knowledge in different fields of engineering.

Students learn physical basics of acoustics and human perception. Physical-empirical laws for determination of sound and noise levels of various emission and immission situations will be worked out or derived. Furtheron general sound measurement methods of machinery will be taught.

Students are able to understand mechanisms of sound origin, propagation and reduction, as well as measuring technics

Organizational issues
Lehrveranstaltung findet in 14tägigem Rhythmus statt. 1. Termin in 1. Vorlesungswoche.

Literature

1. Vorlesungsskript (von Homepage des Instituts herunterladbar).
2. Heckl, M.; Müller, H. A.: Taschenbuch der Technischen Akustik, Springer-Verlag.
3. Veit, Ivar: Technische Akustik. Vogel-Verlag (Kamprath-Reihe), Würzburg.
4. Henn, H. et al.: Ingenieurakustik. Vieweg-Verlag.

T 7.214 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	Grading scale	Recurrence	Version
Written examination	4	Grade to a third	Each summer term	1

Events					
ST 2022	2146179	Technical Design in Product Development	2 SWS	Lecture / ✕	Schmid

Legend: Online, Blended (On-Site/Online), On-Site, ✕ Cancelled

Competence Certificate
Written exam (60 min)

Only dictionnary is allowed

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

V Technical Design in Product Development

2146179, SS 2022, 2 SWS, Language: German, Open in study portal

Lecture (V)
Cancelled

Content
Introduction
Relevant parameters on product value in Technical Design
Design in Methodical Development and Engineering and for a differentiated validation of products
Design in the concept stage of Product Development
Design in the draft and elaboration stage of Product Development

Best Practice

After listening the module "technical design" the students should have knowledge about the basics of technical oriented design as an integral part of the methodical product development

The students have knowledge about ...

- the interface between engineer and designer.
- all relevant human-product requirements as f. exp. demographic/ geographic and psychographic features, relevant perceptions, typical content recognition as well as ergonomic bases.
- the approaches concerning the design of a product, product program or product system with focus on structure, form-, color- and graphic design within the phases of the design process.
- the design of functions and supporting structures as well as the important interface between human and machine.
- relevant parameters of a good corporate design.

Organizational issues
Die Veranstaltung **findet** 2022 **nicht statt**.

Literature

Markus Schmid, Thomas Maier
Technisches Interface Design
Anforderungen, Bewertung, Gestaltung.
Springer Vieweg Verlag (http://www.springer.com/de/book/9783662549476)
Hardcover ISBN: 978-3-662-54947-6 / eBook ISBN: 978-3-662-54948-3
2017

Hartmut Seeger
Design technischer Produkte, Produktprogramme und -systeme
Industrial Design Engineering.
2. , bearb. und erweiterte Auflage.
Springer-Verlag GmbH (http://www.springer.com/de/book/9783540236535)
ISBN: 3540236538
September 2005 - gebunden - 396 Seiten

T 7.215 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	Grading scale	Recurrence	Version
Written examination	8	Grade to a third	Each winter term	2

Events					
WT 22/23	2165501	Technical Thermodynamics and Heat Transfer I	4 SWS	Lecture / 🗣	Maas
WT 22/23	3165014	Technical Thermodynamics and Heat Transfer I	4 SWS	Lecture / 🗣	Schießl, Maas
Exams					
ST 2022	76-T-MACH-104747	Technical Thermodynamics and Heat Transfer I			Maas, Schießl
ST 2022	76-T-MACH-104747-englisch	Technical Thermodynamics and Heat Transfer I			Maas, Schießl
WT 22/23	76-T-MACH-104747	Technical Thermodynamics and Heat Transfer I			Maas, Schießl
WT 22/23	76-T-MACH-104747-english	Technical Thermodynamics and Heat Transfer I			Maas, Schießl

Legend: 🖥 Online, ❖ Blended (On-Site/Online), 🗣 On-Site, ✕ Cancelled

Competence Certificate
Prerequisite: attestation each semester by homework assignments

Written exam, approx. 3 hours

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
2165501, WS 22/23, 4 SWS, Language: German, Open in study portal

Lecture (V)
On-Site

Content

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

Organizational issues
Die Vorlesung findet bis Ende November online statt.

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.

V

Technical Thermodynamics and Heat Transfer I

3165014, WS 22/23, 4 SWS, Language: English, Open in study portal

Lecture (V)
On-Site

Content

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

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 7.216 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	Grading scale	Recurrence	Version
Written examination	7	Grade to a third	Each summer term	1

Events					
ST 2022	2166526	Technical Thermodynamics and Heat Transfer II	3 SWS	Lecture /	Maas
ST 2022	3166526	Technical Thermodynamics and Heat Transfer II	3 SWS	Lecture /	Schießl
Exams					
ST 2022	76-T-MACH-105287-englisch	Technical Thermodynamics and Heat Transfer II			Maas, Schießl
WT 22/23	76-T-MACH-105287	Technical Thermodynamics and Heat Transfer II			Maas, Schießl
WT 22/23	76-T-MACH-105287-english	Technical Thermodynamics and Heat Transfer II			Maas, Schießl

Legend: Online, Blended (On-Site/Online), On-Site, Cancelled

Competence Certificate
Prerequisite: attestation each semester by homework assignments

Written exam, approx. 3 hours

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 2022, 3 SWS, Language: German, Open in study portal

Lecture (V)
Blended (On-Site/Online)

Content

- Repetition of the topics of "Thermodynamics and Heat Transfer I"
- Behavior of mixtures
- Moist air
- Kinetic theory of gases
- Behavior of real substances described by equations of state
- Chemical reactions and applications of the laws of thermodynamics to chemical reactions
- Reaction kinetics
- Heat Transfer

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.

V

Technical Thermodynamics and Heat Transfer II

3166526, SS 2022, 3 SWS, Language: English, Open in study portal

Lecture (V)
Blended (On-Site/Online)

Content

- Repetition of the topics of "Thermodynamics and Heat Transfer I"
- Behavior of mixtures
- Moist air
- Kinetic theory of gases
- Behavior of real substances described by equations of state
- Chemical reactions and applications of the laws of thermodynamics to chemical reactions
- Reaction kinetics
- Heat Transfer

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 7.217 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	Grading scale	Recurrence	Version
Oral examination	4	Grade to a third	Each summer term	2

Events					
ST 2022	2174579	Technology of steel components	2 SWS	Lecture /	Schulze
Exams					
ST 2022	76-T-MACH-105362	Technology of Steel Components			Schulze
WT 22/23	76-T-MACH-105362	Technology of Steel Components			Schulze

Legend: Online, Blended (On-Site/Online), On-Site, × Cancelled

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 2022, 2 SWS, Language: German, Open in study portal

Lecture (V)
Blended (On-Site/Online)

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 7.218 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	Grading scale	Recurrence	Version
Oral examination	4	Grade to a third	Each winter term	1

Competence Certificate
oral exam, approx. 30 min..

Prerequisites
none

T 7.219 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	Grading scale	Recurrence	Version
Oral examination	6	Grade to a third	Each summer term	1

Events					
ST 2022	2163113	Theory of Stability	2 SWS	Lecture / Blended	Fidlin
ST 2022	2163114	Übungen zu Stabilitätstheorie	2 SWS	Practice / Blended	Fidlin, Yüzbasioglu
Exams					
ST 2022	76-T-MACH-105372	Theory of Stability			Fidlin

Legend: Online, Blended (On-Site/Online), On-Site, × Cancelled

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
2163113, SS 2022, 2 SWS, Language: German, Open in study portal

Lecture (V)
Blended (On-Site/Online)

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 7.220 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	Grading scale	Recurrence	Version
Oral examination	4	Grade to a third	Each winter term	1

Events					
WT 22/23	2169472	Thermal Solar Energy	2 SWS	Lecture / 🗣	Stieglitz
Exams					
ST 2022	76-T-MACH-105225	Thermal Solar Energy			Stieglitz
WT 22/23	76-T-MACH-105225	Thermal Solar Energy			Stieglitz

Legend: 🖥 Online, ♲ Blended (On-Site/Online), 🗣 On-Site, × Cancelled

Competence Certificate
Oral examination of about 30 minutes

Prerequisites
none

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

V Thermal Solar Energy

2169472, WS 22/23, 2 SWS, Language: German, Open in study portal

Lecture (V)
On-Site

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

Organizational issues
Die Veranstaltung wird nur online gehalten, falls durch Corona Einschränkungen vorgegeben werden.

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 7.221 Course: Thermal Turbomachines I [T-MACH-105363]

Responsible: Prof. Dr.-Ing. Hans-Jörg Bauer
Organisation: KIT Department of Mechanical Engineering
Institute of Thermal Turbomachinery
Part of: M-MACH-102838 - Major Field: Energy Converting Engines

Type	Credits	Grading scale	Recurrence	Version
Oral examination	6	Grade to a third	Each winter term	1

Events					
WT 22/23	2169453	Thermal Turbomachines I	3 SWS	Lecture / 🗣	Bauer
WT 22/23	2169454	Tutorial - Thermal Turbo Machines I	2 SWS	Practice / 🗣	Bauer
WT 22/23	2169553	Thermal Turbomachines I (in English)	3 SWS	Lecture / 🗣	Bauer
Exams					
ST 2022	76-T-MACH-105363	Thermal Turbomachines I			Bauer
ST 2022	76T-Mach-105363-Wdh	Thermal Turbomachines I (for repeater)			Bauer
WT 22/23	76-T-MACH-105363	Thermal Turbomachines I			Bauer
WT 22/23	76-T-MACH-105363-Wdh	Thermal Turbomachines I (for repeaters)			Bauer

Legend: 🖥 Online, ⚙ Blended (On-Site/Online), 🗣 On-Site, ✕ Cancelled

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 22/23, 3 SWS, Language: German, Open in study portal

Lecture (V)
On-Site

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)**
2169553, WS 22/23, 3 SWS, Language: English, Open in study portal

Lecture (V)
On-Site

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 7.222 Course: Thermal Turbomachines II [T-MACH-105364]

Responsible: Prof. Dr.-Ing. Hans-Jörg Bauer
Organisation: KIT Department of Mechanical Engineering
Institute of Thermal Turbomachinery
Part of: M-MACH-102838 - Major Field: Energy Converting Engines

Type	Credits	Grading scale	Recurrence	Version
Oral examination	6	Grade to a third	Each summer term	2

Events					
ST 2022	2170476	Thermal Turbomachines II	3 SWS	Lecture / 🗣	Bauer
ST 2022	2170477	Tutorial - Thermal Turbomachines II (Übung - Thermische Turbomaschinen II)	2 SWS	Practice / 🗣	Bauer, Mitarbeiter
ST 2022	2170553	Thermal Turbomachines II (in English)	3 SWS	Lecture / Practice (/ 🗣	Bauer
Exams					
ST 2022	76-T-MACH-105364	Thermal Turbomachines II			Bauer
WT 22/23	76-T-MACH-105364	Thermal Turbomachines II			Bauer
WT 22/23	76-T-MACH-105364-Wdh	Thermal Turbomachines II (for repeaters)			Bauer

Legend: 🖥 Online, ⚙ Blended (On-Site/Online), 🗣 On-Site, ✕ Cancelled

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) On-Site**
2170476, SS 2022, 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)**
2170553, SS 2022, 3 SWS, Language: English, Open in study portal

Lecture / Practice (VÜ)
On-Site

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 7.223 Course: Tires and Wheel Development for Passenger Cars [T-MACH-102207]

Responsible: Hon.-Prof. Dr. Günter Leister
Organisation: KIT Department of Mechanical Engineering

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

Type	Credits	Grading scale	Recurrence	Version
Oral examination	4	Grade to a third	Each summer term	1

Events					
ST 2022	2114845	Tires and Wheel Development for Passenger Cars	2 SWS	Lecture / 🗣	Leister
Exams					
ST 2022	76-T-MACH-102207	Tires and Wheel Development for Passenger Cars			Leister
WT 22/23	76-T-MACH-102207	Tires and Wheel Development for Passenger Cars			Leister

Legend: 🖥 Online, ⚙ Blended (On-Site/Online), 🗣 On-Site, ✕ Cancelled

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 2022, 2 SWS, Language: German, Open in study portal

Lecture (V)
On-Site

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.

Organizational issues
Voraussichtliche Termine, nähere Informationen und eventuelle Terminänderungen:

siehe Institutshomepage.

Literature
Manuskript zur Vorlesung

Manuscript to the lecture

T 7.224 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	Grading scale	Recurrence	Version
Oral examination	8	Grade to a third	Each winter term	2

Events					
WT 22/23	2181114	Tribology	5 SWS	Lecture / Practice (/ 🗣	Dienwiebel, Scherge

Legend: 🖥 Online, ⚙ Blended (On-Site/Online), 🗣 On-Site, ✕ Cancelled

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** — **Lecture / Practice (VÜ) On-Site**

2181114, WS 22/23, 5 SWS, Language: German, Open in study portal

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 7.225 Course: Turbo Charging of Internal Combustion Engines [T-MACH-111591]

Responsible: Dr.-Ing. Johannes Kech
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	Grading scale	Recurrence	Version
Oral examination	4	Grade to a third	Each summer term	1

Events					
WT 22/23	2134153	Boosting of Combustion Engines	2 SWS	/	Kech

Legend: Online, Blended (On-Site/Online), On-Site, Cancelled

Competence Certificate
oral exam, appr. 20 min

Prerequisites
none

T 7.226 Course: Turbo Jet Engines [T-MACH-105366]

Responsible: Prof. Dr.-Ing. Hans-Jörg Bauer
Organisation: KIT Department of Mechanical Engineering
Institute of Thermal Turbomachinery
Part of: M-MACH-102838 - Major Field: Energy Converting Engines

Type	Credits	Grading scale	Recurrence	Version
Oral examination	4	Grade to a third	Each summer term	1

Events					
ST 2022	2170478	Turbo Jet Engines	2 SWS	Lecture / 🗣	Bauer
Exams					
ST 2022	76-T-MACH-105366	Turbo Jet Engines			Bauer
WT 22/23	76-T-MACH-105366	Turbo Jet Engines			Bauer

Legend: 🖥 Online, ❂ Blended (On-Site/Online), 🗣 On-Site, ✕ Cancelled

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 2022, 2 SWS, Language: German, Open in study portal

Lecture (V)
On-Site

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 7.227 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	Grading scale	Recurrence	Version
Completed coursework (written)	0	pass/fail	Each winter term	2

Events					
WT 22/23	0131100	Übungen zu 0131000	2 SWS	Practice	Arens
WT 22/23	0131300	Übungen zu 0131200	2 SWS	Practice	Arens

Competence Certificate
Learning assessment is carried out by written assigments (pre-requesite). Exact requirements will be communicated in the lectures.

Prerequisites
None.

T 7.228 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	Grading scale	Recurrence	Version
Completed coursework (written)	0	pass/fail	Each summer term	2

Events					
ST 2022	0180900	Übungen zu 0180800	2 SWS	Practice	Arens
ST 2022	0181100	Übungen zu 0181000	2 SWS	Practice	Arens
Exams					
ST 2022	7700024	Problem Class for Advanced Mathematics II			Hettlich, Arens, Griesmaier

Competence Certificate
Learning assessment is carried out by written assigments (pre-requesite). Exact requirements will be communicated in the lectures.

Prerequisites
None.

T 7.229 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	Grading scale	Recurrence	Version
Completed coursework (written)	0	pass/fail	Each winter term	2

Events					
WT 22/23	0131500	Übungen zu 0131400	2 SWS	Practice	Hettlich

Competence Certificate
Learning assessment is carried out by written assigments (pre-requesite). Exact requirements will be communicated in the lectures.

Prerequisites
None.

T 7.230 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-102582 - Major Field: Continuum Mechanics
M-MACH-102746 - Compulsory Elective Module

Type	Credits	Grading scale	Recurrence	Version
Completed coursework	1	pass/fail	Each winter term	1

Events					
WT 22/23	2161253	Tutorial Continuum mechanics of solids and fluids	1 SWS	Practice / 🧩	Dyck, Karl, Böhlke

Legend: 🖥 Online, 🧩 Blended (On-Site/Online), 🗣 On-Site, x Cancelled

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 (BSc) that have chosen the Major Field "Continuum Mechanics" and for students of Material Science and Material Technology (BSc) the prerequisites consist of successfully solving the written homework sheets as well as the computational homework sheets during the associated computer tutorials.

For students of Mechanical Engineering 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.

Prerequisites
None

Annotation
Due to capacity reasons it is possible that not all students of this course can be admitted to the computer tutorials. Students of the bachelor's degree program in mechanical engineering who have chosen the Major Field Continuum Mechanics (SP-Nr 13) and students of the bachelor's degree program in material science and material technology will be admitted to the computer tutorials in any case.
If additional places are available in the computer tutorials for this course, these will be allocated according to the BSc average grade.

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

V Tutorial Continuum mechanics of solids and fluids

2161253, WS 22/23, 1 SWS, Language: German, Open in study portal

Practice (Ü)
Blended (On-Site/Online)

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 7.231 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	Grading scale	Recurrence	Version
Completed coursework	0	pass/fail	Each winter term	2

Events					
WT 22/23	2161246	Tutorial Engineering Mechanics I	2 SWS	Practice /	Dyck, Sterr, Böhlke
WT 22/23	3161011	Engineering Mechanics I (Tutorial)	2 SWS	Practice /	Kehrer, Görthofer, Langhoff

Legend: Online, Blended (On-Site/Online), On-Site, Cancelled

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

2161246, WS 22/23, 2 SWS, Language: German, Open in study portal

Practice (Ü)
Blended (On-Site/Online)

Content
Please refer to the lecture Engineering Mechanics I.

Literature
Siehe Vorlesung Technische Mechanik I

T 7.232 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	Grading scale	Recurrence	Version
Completed coursework (written)	0	pass/fail	Each summer term	2

Events					
ST 2022	2162251	Tutorial Engineering Mechanics II	2 SWS	Practice / Blended	Dyck, Sterr, Böhlke
ST 2022	3162011	Engineering Mechanics II (Tutorial)	2 SWS	Practice / Blended	Kehrer, Görthofer, Langhoff
Exams					
ST 2022	76-T-MACH-100284	Tutorial Engineering Mechanics II			Böhlke, Langhoff
ST 2022	76-T-MACH-100284-englisch	Tutorial Engineering Mechanics II			Böhlke, Langhoff

Legend: Online, Blended (On-Site/Online), On-Site, Cancelled

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

2162251, SS 2022, 2 SWS, Language: German, Open in study portal

Practice (Ü)
Blended (On-Site/Online)

Content
see lecture Engineering Mechanics II

Literature
Siehe Vorlesung Technische Mechanik II

V Engineering Mechanics II (Tutorial)

3162011, SS 2022, 2 SWS, Language: English, Open in study portal

Practice (Ü)
Blended (On-Site/Online)

Content
see lecture "Engineering Mechanics II"

Literature
see lecture "Engineering Mechanics II"

T 7.233 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	Grading scale	Recurrence	Version
Completed coursework (written)	0	pass/fail	Each winter term	2

Events					
WT 22/23	2161204	Engineering Mechanics III (Tutorial)	2 SWS	Practice / 🗣	Fidlin, Altoé
WT 22/23	3161013	Engineering Mechanics III (Tutorial)	2 SWS	Practice / 🗣	Römer, Altoé
Exams					
WT 22/23	76-T-MACH-105202	Tutorial Engineering Mechanics III			Seemann

Legend: 🖥 Online, ⚙ Blended (On-Site/Online), 🗣 On-Site, ✕ Cancelled

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)

2161204, WS 22/23, 2 SWS, Language: German, Open in study portal

Practice (Ü)
On-Site

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)

3161013, WS 22/23, 2 SWS, Language: English, Open in study portal

Practice (Ü)
On-Site

Content
Exercises related to the lecture

T 7.234 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	Grading scale	Recurrence	Version
Completed coursework (written)	0	pass/fail	Each summer term	1

Events					
ST 2022	2162232	Engineering Mechanics IV (Tutorial)	2 SWS	Practice /	Proppe, Keller
ST 2022	3162013	Engineering Mechanics 4 (Tutorial)	2 SWS	Practice /	Proppe, Keller
Exams					
ST 2022	76-T-MACH-105203	Tutorial Engineering Mechanics IV			Seemann

Legend: Online, Blended (On-Site/Online), On-Site, Cancelled

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 2022, 2 SWS, Language: German, Open in study portal

Practice (Ü)
Blended (On-Site/Online)

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 7.235 Course: Tutorial Introduction to Computational Fluid Dynamics [T-MACH-111033]

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
M-MACH-102746 - Compulsory Elective Module

Type	Credits	Grading scale	Recurrence	Expansion	Version
Completed coursework	1	pass/fail	Each summer term	1 terms	1

Events					
ST 2022	2154534	Tutorial Introduction to Computational Fluid Dynamics	2 SWS	Practice / Blended (On-Site/Online)	Stroh, Frohnapfel
Exams					
ST 2022	76-T-MACH-111033	Tutorial Introduction to Computational Fluid Dynamics			Stroh

Legend: Online, Blended (On-Site/Online), On-Site, Cancelled

Competence Certificate
The competence certificate consists of successfully solving the computational homework tasks.

Prerequisites
none

Annotation
Successful participation in this course allows for registration to the Exam: "Introduction to Computational Fluid Dynamics" (see T-MACH-110362).

Knowledge of the contents of the courses "Continuum Mechanics of Solids and Fluids" and "Mathematical Methods of Continuum Mechanics" as well as the corresponding tutorials is expected.

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

V Tutorial Introduction to Computational Fluid Dynamics

2154534, SS 2022, 2 SWS, Language: German, Open in study portal

Practice (Ü)
Blended (On-Site/Online)

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 7.236 Course: Tutorial Introduction to the Finite Element Method [T-MACH-110330]

Responsible: Prof. Dr.-Ing. Thomas Böhlke
Dr.-Ing. Tom-Alexander Langhoff

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102582 - Major Field: Continuum Mechanics
M-MACH-102746 - Compulsory Elective Module

Type	Credits	Grading scale	Recurrence	Version
Completed coursework	1	pass/fail	Each summer term	1

Events					
ST 2022	2162257	Tutorial Introduction to the Finite Element Method	1 SWS	Practice /	Dyck, Lauff, Langhoff, Böhlke
Exams					
ST 2022	76-T-MACH-110330	Tutorial Introduction to the Finite Element Method			Böhlke, Langhoff

Legend: Online, Blended (On-Site/Online), On-Site, Cancelled

Competence Certificate

Successful participation in this course allows for registration to the Exam "Introduction to the Finite Element Method" (see 76-T-MACH-105320)

For students of Mechanical Engineering (BSc) 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 during the associated computer tutorials.

For students of Mechanical Engineering that have chosen a different Major Field and for students from different fields of study the prerequisites consist of successfully solving only the written homework sheets.

Annotation

Knowledge of the contents of the courses "Continuum Mechanics of Solids and Fluids" and "Mathematical Methods of Continuum Mechanics" as well as the corresponding tutorials are expected.

Due to capacity reasons it is possible that not all students of this course can be admitted to the computer tutorials. Students of the bachelor's degree program in mechanical engineering who have chosen the Major Field Continuum Mechanics (SP-Nr 13) will be admitted to the computer tutorials in any case.
If additional places are available in the computer tutorials for this course, these will be allocated according to the BSc average grade.

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

V Tutorial Introduction to the Finite Element Method

2162257, SS 2022, 1 SWS, Language: German, Open in study portal

Practice (Ü)
Blended (On-Site/Online)

Content

See lecture "Introduction to the Finite Element Method"

Literature

siehe Vorlesung "Einführung in die Finite-Elemente-Methode"

T 7.237 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	Grading scale	Recurrence	Expansion	Version
Completed coursework	2	pass/fail	Each winter term	1 terms	2

Events					
WT 22/23	2161255	Tutorial Mathematical Methods in Confinuum Mechanics	2 SWS	Practice /	Gajek, Lauff, Böhlke

Legend: Online, Blended (On-Site/Online), On-Site, Cancelled

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

2161255, WS 22/23, 2 SWS, Language: German, Open in study portal

Practice (Ü)
Blended (On-Site/Online)

Content
See "Mathematical Methods in Continuum Mechanics"

Literature
Siehe "Mathematische Methoden der Kontinuumsmechanik"

T 7.238 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	Grading scale	Recurrence	Version
Oral examination	4	Grade to a third	Each winter term	1

Events					
ST 2022	2114856	Vehicle Ride Comfort & Acoustics I	2 SWS	Lecture /	Gauterin
WT 22/23	2113806	Vehicle Comfort and Acoustics I	2 SWS	Lecture /	Gauterin
Exams					
ST 2022	76-T-MACH-105154	Vehicle Comfort and Acoustics I			Gauterin
ST 2022	76T-MACH-105154_Wiederholer_2	Vehicle Comfort and Acoustics I			Gauterin
ST 2022	76T-MACH-105154_Wiederholung	Vehicle Comfort and Acoustics I			Gauterin
WT 22/23	76-T-MACH-105154	Vehicle Comfort and Acoustics I			Gauterin

Legend: Online, Blended (On-Site/Online), On-Site, × Cancelled

Competence Certificate
Oral Examination

Duration: approx. 30 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 Ride Comfort & Acoustics I

2114856, SS 2022, 2 SWS, Language: English, Open in study portal

Lecture (V)
Blended (On-Site/Online)

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.

Organizational issues

You will find the lecture material on ILIAS. Please refer to https://fast-web-01.fast.kit.edu/PasswoerterIlias/ to get the ILIAS password

Kann nicht mit der Veranstaltung [2113806] kombiniert werden.

Can not be combined with lecture [2113806]

Genaue Termine entnehmen Sie bitte der Institushomepage.

Scheduled dates:

see homepage of the institute.

Classroom attendence depends on the development of the pandemic situation.

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 Comfort and Acoustics I**

2113806, WS 22/23, 2 SWS, Language: German, Open in study portal

Lecture (V)
On-Site

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.

Organizational issues

Das Vorlesungsmaterial wird auf ILIAS bereitgestellt. Das ILIAS-Passwort erhalten Sie unter https://fast-web-01.fast.kit.edu/PasswoerterIlias/

Kann nicht mit der Veranstaltung [2114856] kombiniert werden.

Can not be combined with lecture [2114856]

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 7.239 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	Grading scale	Recurrence	Version
Oral examination	4	Grade to a third	Each summer term	1

Events					
ST 2022	2114825	Vehicle Comfort and Acoustics II	2 SWS	Lecture / Blended	Gauterin
ST 2022	2114857	Vehicle Ride Comfort & Acoustics II	2 SWS	Lecture / Blended	Gauterin
Exams					
ST 2022	76-T-MACH-105155	Vehicle Comfort and Acoustics II			Gauterin
ST 2022	76-T-MACH-105155_Wiederholung	Vehicle Comfort and Acoustics II			Gauterin
WT 22/23	76-T-MACH-105155	Vehicle Comfort and Acoustics II			Gauterin

Legend: Online, Blended (On-Site/Online), On-Site, Cancelled

Competence Certificate
Oral Examination

Duration: approx. 30 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 2022, 2 SWS, Language: German, Open in study portal

Lecture (V)
Blended (On-Site/Online)

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.

Organizational issues
Das Vorlesungsmaterial wird auf ILIAS bereitgestellt. Das ILIAS-Passwort erhalten Sie unter https://fast-web-01.fast.kit.edu/PasswoerterIlias/

Kann nicht mit der Veranstaltung [2114857] kombiniert werden.

Can not be combined with lecture [2114857]

Je nach Pandemie Lage wird evtl. kurzfristig auf "Online Veranstaltung" geändert.

Literature
Das Skript wird zu jeder Vorlesung zur Verfügung gestellt.

V

Vehicle Ride Comfort & Acoustics II

2114857, SS 2022, 2 SWS, Language: English, Open in study portal

Lecture (V)
Blended (On-Site/Online)

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.

Organizational issues
You will find the lecture material on ILIAS. Please refer to https://fast-web-01.fast.kit.edu/PasswoerterIlias/ to get the ILIAS password

Genaue Termine entnehmen Sie bitte der Institushomepage.

Kann nicht mit der Veranstaltung [2114825] kombiniert werden.

Scheduled dates:

see homepage of the institute.

Can not be combined with lecture [2114825].

Classroom attendence depends on the development of the pandemic situation

Literature
Das Skript wird zu jeder Vorlesung zur Verfügung gestellt.

The script will be supplied in the lectures.

T 7.240 Course: Vehicle Ergonomics [T-MACH-108374]

Responsible: Prof. Dr.-Ing. Barbara Deml
Organisation: KIT Department of Mechanical Engineering

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

Type	Credits	Grading scale	Recurrence	Version
Written examination	4	Grade to a third	Each summer term	1

Events					
ST 2022	2110050	Vehicle Ergonomics	2 SWS	Lecture / 🗣	Deml
Exams					
ST 2022	76-T-MACH-108374	Vehicle Ergonomics			Deml

Legend: 🖥 Online, ⚙ Blended (On-Site/Online), 🗣 On-Site, × Cancelled

Competence Certificate
written exam, 60 minutes

Prerequisites
none

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

V Vehicle Ergonomics
2110050, SS 2022, 2 SWS, Language: German, Open in study portal

Lecture (V)
On-Site

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.

Organizational issues
Die Vorlesung hat einen Arbeitsaufwand von 120 h (= 4 LP).

Schriftliche Klausur findet am 27.07.2022.

Literature
Die Literaturliste wird in der Vorlesung ausgegeben. Die Folien zur Vorlesung stehen auf ILIAS zum Download zur Verfügung.

T 7.241 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	Grading scale	Recurrence	Version
Written examination	4	Grade to a third	Each winter term	1

Events					
WT 22/23	2113102	Vehicle Lightweight design – Strategies, Concepts, Materials	2 SWS	Lecture /	Henning
Exams					
ST 2022	76-T-MACH-105237	Vehicle Lightweight Design - Strategies, Concepts, Materials			Henning
WT 22/23	76-T-MACH-105237	Vehicle Lightweight Design - Strategies, Concepts, Materials			Henning

Legend: Online, Blended (On-Site/Online), On-Site, Cancelled

Competence Certificate
Written exam; Duration approx. 90 min

Prerequisites
none

Recommendation
none

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

V Vehicle Lightweight design – Strategies, Concepts, Materials
2113102, WS 22/23, 2 SWS, Language: German, Open in study portal

Lecture (V)
Blended (On-Site/Online)

Content
Strategies in lightweight design
Shape optimization, light weight materials, multi-materials and concepts for lightweight design

Construction methods
Differential, integral, sandwich, modular, bionic

Body construction
Shell, space frame, monocoque

Metalic materials
Steel, aluminium, magnesium, titan

Aim of this lecture:

Students learn that lightweight design is a process of realizing a demanded function by using the smallest possible mass. They understand lightweight construction as a complex optimization problem with multiple boundary conditions, involving competences from methods, materials and production.

Students learn the established lightweight strategies and ways of construction. They know the metallic materials used in lightweight construction and understand the relation between material and vehicle body.

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 7.242 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	Grading scale	Recurrence	Version
Written examination	5	Grade to a third	Each winter term	2

Events					
WT 22/23	2161212	Vibration Theory	2 SWS	Lecture	Römer
WT 22/23	2161213	Übungen zu Technische Schwingungslehre	2 SWS	Practice	Römer, Keller
Exams					
ST 2022	76-T-MACH-105290	Vibration Theory			Fidlin
WT 22/23	76-T-MACH-105290	Vibration Theory			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 22/23, 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 22/23, 2 SWS, Language: German, Open in study portal

Practice (Ü)

Content
Exercises related to the lecture

T 7.243 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	Grading scale	Recurrence	Version
Oral examination	4	Grade to a third	Each summer term	1

Events					
ST 2022	3122031	Virtual Engineering (Specific Topics)	2 SWS	Lecture / 🖥	Ovtcharova, Maier
Exams					
ST 2022	76-T-MACH-105381	Virtual Engineering (Specific Topics)			Ovtcharova
WT 22/23	76-T-MACH-105381	Virtual Engineering (Specific Topics)			Ovtcharova

Legend: 🖥 Online, Blended (On-Site/Online), On-Site, × Cancelled

Competence Certificate
oral exam, approx. 20 min.

Prerequisites
none

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

V Virtual Engineering (Specific Topics)
3122031, SS 2022, 2 SWS, Language: English, Open in study portal

Lecture (V)
Online

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

Organizational issues
Vorlesungszeiten siehe ILIAS / Lecture times see ILIAS

Literature
Lecture slides / Vorlesungsfolien

T 7.244 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	Grading scale	Recurrence	Version
Examination of another type	4	Grade to a third	Each term	2

Events					
WT 22/23	2123375	Virtual Reality Practical Course	3 SWS	Project (P / 🗣	Ovtcharova, Häfner
Exams					
ST 2022	76-T-MACH-102149	Virtual Reality Practical Course			Ovtcharova, Häfner

Legend: 🖥 Online, ❖ Blended (On-Site/Online), 🗣 On-Site, ✕ Cancelled

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 22/23, 3 SWS, Language: German/English, Open in study portal

Project (PRO)
On-Site

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

Organizational issues
Siehe Homepage zur Lehrveranstaltung

Literature
Keine / None

T 7.245 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	Grading scale	Recurrence	Version
Written examination	3	Grade to a third	Each summer term	2

Events					
ST 2022	2118097	Warehousing and distribution systems	2 SWS	Lecture / 🗣	Furmans
Exams					
ST 2022	76-T-MACH-105174	Warehousing and Distribution Systems			Furmans

Legend: 🖥 Online, ⚙ Blended (On-Site/Online), 🗣 On-Site, ✕ Cancelled

Competence Certificate
The success control takes place in form of a written examination (60 min) during the semester break (according to §4(2), 1 SPO). If the number of participants is low, an oral examination (according to §4 (2), 2 SPO) may also be offered.

Prerequisites
none

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

V Warehousing and distribution systems

2118097, SS 2022, 2 SWS, Language: German, Open in study portal

Lecture (V)
On-Site

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 7.246 Course: Wave and Quantum Physics [T-PHYS-108322]

Responsible: apl. Prof. Dr. Gernot Goll
apl. Prof. Dr. Bernd Pilawa
Organisation: KIT Department of Physics
Part of: M-PHYS-104030 - Physics

Type	Credits	Grading scale	Recurrence	Version
Written examination	5	Grade to a third	Each summer term	1

Events					
ST 2022	4040411	Wellen und Quantenphysik	2 SWS	Lecture / 🗣	Pilawa
ST 2022	4040412	Übungen zu Wellen und Quantenphysik	1 SWS	Practice / 🗣	Pilawa, Bieling
ST 2022	4040431	Wave and Quantum Physics	2 SWS	Lecture / 🗣	Goll
ST 2022	4040432	Exercises to Wave and Quantum Physics	1 SWS	Practice / 🗣	Goll, Palkhivala
Exams					
ST 2022	7800123	Wellen und Quantenphysik (Exam in German)			Pilawa
ST 2022	7800124	Wave and Quantum Physics (Exam in English)			Goll

Legend: 🖥 Online, 🧩 Blended (On-Site/Online), 🗣 On-Site, ✕ Cancelled

Competence Certificate
Written exam (usually about 180 min)

Prerequisites
none

T 7.247 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	Grading scale	Recurrence	Version
Oral examination	4	Grade to a third	Each winter term	2

Exams			
ST 2022	76-T-MACH-105443	Wave Propagation	Seemann

Competence Certificate
oral exam, 30 min.

T 7.248 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	Grading scale	Recurrence	Version
Oral examination	4	Grade to a third	Each winter term	1

Events					
WT 22/23	2173571	Welding Technology	2 SWS	Block / 🗣	Farajian
Exams					
ST 2022	76-T-MACH-105170	Welding Technology			Farajian

Legend: 🖥 Online, ❖ Blended (On-Site/Online), 🗣 On-Site, ✕ Cancelled

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 22/23, 2 SWS, Language: German, Open in study portal

Block (B)
On-Site

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

Organizational issues
Blockveranstaltung im Januar und Februar. Zur Teilnahme an der Vorlesung ist eine Anmeldung beim Dozenten per E-Mail an Farajian@slv-duisburg.de erforderlich. Vorlesungstermine und Hörsaal werden den angemeldeten Teilnehmern Anfang des Jahres mitgeteilt.

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 7.249 Course: Windpower [T-MACH-105234]

Responsible: Norbert Lewald

Organisation: KIT Department of Mechanical Engineering
Institute of Thermal Turbomachinery

Part of: M-MACH-102816 - Major Field: Fundamentals of Energy Technology
M-MACH-102838 - Major Field: Energy Converting Engines

Type	Credits	Grading scale	Recurrence	Version
Written examination	4	Grade to a third	Each winter term	2

Events					
WT 22/23	2157381	Windpower	2 SWS	/	Lewald, Pritz
Exams					
ST 2022	76-T-MACH-105234	Windpower			Lewald
WT 22/23	76-T-MACH-105234	Windpower			Lewald

Legend: Online, Blended (On-Site/Online), On-Site, Cancelled

Competence Certificate
written exam, 120 minutes

Prerequisites
none

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

V Windpower
2157381, WS 22/23, 2 SWS, Language: German, Open in study portal

On-Site

7.250 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	Grading scale	Recurrence	Version
Completed coursework	4	pass/fail	Each summer term	1

Events					
ST 2022	2110969	Working Methods in Mechanical Engineering	1 SWS	Course (/	Deml
ST 2022	2142975	Workshop 'Working Methods in Mechanical Engineering' (IMT)	1 SWS	Others (sons /	Worgull
ST 2022	2174970	Working Methods in Mechanical Engineering	1 SWS	Course (/	Deml
Exams					
ST 2022	76-T-MACH-105296	Working Techniques for Mechanical Engineering			Deml
ST 2022	76-T-MACH-105296-englisch	Working Methods in Mechanical Engineering			Deml

Legend: Online, Blended (On-Site/Online), On-Site, Cancelled

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
2110969, SS 2022, 1 SWS, Language: English, Open in study portal

Course (Ku)
Blended (On-Site/Online)

Organizational issues
The course addresses students in the Bachelor program Mechanical Engineering in the **fourth** semester. Students in the Bachelor program Mechanical Engineering in the second semester, as well as students in the Master program Mechanical Engineering or other programs, may participate in case of vacancies. The lecture consists of an e-learning course, combined with an online exam and accompanying self-study over the entire lecture period.

V Workshop 'Working Methods in Mechanical Engineering' (IMT)
2142975, SS 2022, 1 SWS, Language: German, Open in study portal

Others (sonst.)
Blended (On-Site/Online)

Content
Within the frame of a scientific conference the contents from the corresponding lesson will be implemented in a practical way.

The students have to organise a scientific conference by themself. The contributions have to prepared by the students and will be presented within the frame of abstracts, conference articles, posters, and presentations.

1. part of the workshop - Organisation of a conference

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

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

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

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

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

4. part of the workshop - Moderation and presentation

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

Organizational issues
Ort/Termin s. Institutshomepage

Für Studierende des Bachelorstudiengangs Maschinenbau. Informationen und zentrale Anmeldung unter www.mach.kit.edu/atm. Anmeldeschluss: siehe ATM-Vorlesung (2174970)

Literature
Übungsskript - Wichtige Punkte über wissenschaftliches Schreiben, Zitieren, Postergestaltung, Moderation und Präsentation werden zusammengefasst und bilden einen kleinen Leitfaden für den Workshop

T 7.251 Course: Workshop on Computer-based Flow Measurement Techniques [T-MACH-106707]

Responsible: Prof. Dr.-Ing. Hans-Jörg Bauer
Organisation: KIT Department of Mechanical Engineering
Institute of Thermal Turbomachinery
Part of: M-MACH-102816 - Major Field: Fundamentals of Energy Technology

Type	Credits	Grading scale	Recurrence	Version
Completed coursework	4	pass/fail	Each term	1

Events					
ST 2022	2171488	Workshop on computer-based flow measurement techniques	3 SWS	Practical course / 🗣	Bauer, Mitarbeiter
WT 22/23	2171488	Workshop on computer-based flow measurement techniques	3 SWS	Practical course / ✕	Bauer, Mitarbeiter
Exams					
ST 2022	76-T-MACH-106707	Workshop on computer-based flow measurement techniques			Bauer

Legend: 🖥 Online, 🧩 Blended (On-Site/Online), 🗣 On-Site, ✕ Cancelled

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 — **Practical course (P) On-Site**
2171488, SS 2022, 3 SWS, Language: German, Open in study portal

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

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

Organizational issues
Der aktuelle Status wird auf der ITS-homepage bekannt gegeben.

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)** **Cancelled**
2171488, WS 22/23, 3 SWS, Language: German, Open in study portal

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

Organizational issues
Das Praktikum findet im WS 2022/23 nicht statt.

Literature
Germer, H.; Wefers, N.: Meßelektronik, Bd. 1, 1985

LabView User Manual

Hoffmann, Jörg: Taschenbuch der Messtechnik, 6., aktualisierte. Aufl. , 2011