Karlsruher Institut für Technologie

Module Handbook
Master's Program Mechanical Engineering (M.Sc.)

SPO SPO 2015 (issued), Study Program: Mechanical Engineering 2016

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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).

Qualification Goals
Mechanical Engineering (M.Sc.)

Graduates of the Master's degree program in mechanical engineering at KIT are able to participate independently in value-added processes in engineering and contribute through their research-oriented education to science. They are especially qualified for a responsible position in industry, science, and technical services and acquire qualifications that allow pursuing doctoral studies.

Graduates acquire broad and in-depth knowledge of engineering fundamentals. This is ensured by a compulsory area, which includes mathematical methods of engineering, modeling and simulation as well as the processes of product development. As a result, they are able to deal independently with the state of research and to further refine methods. They can develop, evaluate, and interpret comprehensive and interdisciplinary simulation studies. From their understanding of market demand and value-added processes, they are able to develop products of mechanical engineering. The methods and practices that are used can be reflected and adapted to changing conditions in order to optimize the own approach.

In the specialization area, consisting of two major fields and associated lectures, graduates acquire the essential knowledge, how to transfer the general fundamentals into concrete issues of mechanical engineering. Thus, they are qualified to play an important role in complex research and development projects as well as to participate competently in the innovation process and are professionally prepared for future leadership roles.

In other natural sciences, economics, and social sciences related lectures, students acquire further skills. Thereby they are, inter alia, in a position to make well thought out decisions, taking into account social, economic, and ethical constraints.

Graduates of the Master's program in mechanical engineering at KIT have broad and in-depth knowledge. This solid foundation enables them to analyze and synthesize complex systems. They can also develop, reflect, evaluate, and shape independently and sustainably systems and processes of mechanical engineering, taking into account technical, social, economic, and ethical constraints. They deal constructively with their own, with others' views, and present their work results in an understandable form. Graduates are able to independently identify tasks, to obtain the information necessary to their solution, to select methods, to acquire skills and thus to contribute to added value. They are in a position to choose a concrete occupational area of mechanical engineering.

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

Amtliche Bekanntmachung

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Studien- und Prüfungsordnung des Karlsruher Instituts für Technologie (KIT) für den Masterstudiengang 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 Masterstudiengang 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 Masterprüfungsordnung regelt Studienablauf, Prüfungen und den Abschluss des Studiums im Masterstudiengang Maschinenbau am KIT.

§ 2 Ziel des Studiums, Akademischer Grad

(1) Im konsekutiven Masterstudium sollen die im Bachelorstudium erworbenen wissenschaftlichen Qualifikationen weiter vertieft, verbreitert, erweitert oder ergänzt werden. Ziel des Studiums ist die Fähigkeit, die wissenschaftlichen Erkenntnisse und Methoden selbstständig anzuwenden und ihre Bedeutung und Reichweite für die Lösung komplexer wissenschaftlicher und gesellschaftlicher Problemstellungen zu bewerten.

(2) Aufgrund der bestandenen Masterprüfung wird der akademische Grad „Master of Science (M.Sc.)“ für den Masterstudiengang Maschinenbau verliehen.

§ 3 Regelstudienzeit, Studienaufbau, Leistungspunkte

(1) Die Regelstudienzeit beträgt vier Semester.

(2) 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 § 19 festgelegt. Näheres beschreibt das Modulhandbuch.

(3) 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.

(4) Der Umfang der für den erfolgreichen Abschluss des Studiums erforderlichen Studien- und Prüfungsleistungen wird in Leistungspunkten gemessen und beträgt insgesamt 120 Leistungspunkte.

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

§ 4 Modulprüfungen, Studien- und Prüfungsleistungen

(1) Die Masterprüfung 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 Masterprüfung 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 Masterarbeit 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 Masterstudiengang 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 Masterstudiengang 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 zu versagen, wenn die in Absatz 3 und 4 genannten Voraussetzungen nicht erfüllt sind. Die Zulassung kann versagt werden, wenn die betreffende Erfolgskontrolle bereits in einem grundständigen Bachelorstudiengang am KIT erbracht wurde, der Zulassungsvoraussetzung für diesen Masterstudiengang gewesen ist. Dies gilt nicht für Mastervorzugsleistungen. Zu diesen ist eine Zulassung nach Maßgabe von Satz 1 ausdrücklich zu genehmigen.

§ 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. 4 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 der 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/r 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 einer solchen 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 Betreuung zu gewährleisten, insbesondere ist die Erfolgskontrolle in Anwesenheit einer fachlich sachkundigen Person durchzuführen. 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 Masterprüfung, 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 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 Masterarbeit kann bei einer Bewertung mit „nicht ausreichend“ (5,0) einmal wiederholt werden. Eine zweite Wiederholung der Masterarbeit ist ausgeschlossen.

§ 9 Verlust des Prüfungsanspruchs

Ist eine nach dieser Studien- und Prüfungsordnung erforderliche Studien- oder Prüfungsleistung endgültig nicht bestanden oder eine Wiederholungsprüfung nach § 8 Abs. 6 nicht rechtzeitig erbracht oder die Masterprüfung bis zum Ende des Prüfungszeitraums des siebenten 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 Frist zu stellen.

§ 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 Masterarbeit 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 Masterarbeit 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 von Studierenden 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 § 19 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 Masterarbeit

(1) Voraussetzung für die Zulassung zum Modul Masterarbeit ist, dass die/der Studierende Modulprüfungen im Umfang von 74 LP erfolgreich abgelegt hat. Über Ausnahmen entscheidet der Prüfungsausschuss auf Antrag der/des Studierenden.

(1 a) Dem Modul Masterarbeit sind 30 LP zugeordnet. Es besteht aus der Masterarbeit und einer Präsentation. Die Präsentation hat spätestens sechs Wochen nach Abgabe der Masterarbeit zu erfolgen.

(2) Die Masterarbeit 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 § 17 Abs. 2 und 3 zur Vergabe des Themas berechtigen. Den Studierenden ist Gelegenheit zu geben, für das Thema Vorschläge zu machen. Soll die Masterarbeit außerhalb der KIT-Fakultät für Maschinenbau angefertigt werden, so bedarf dies der Genehmigung durch den Prüfungsausschuss. Die Masterarbeit 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 Masterarbeit erhält. Die Ausgabe des Themas erfolgt in diesem Fall über die/den Vorsitzende/n des Prüfungsausschusses.

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

(4) Die Masterarbeit 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 Masterarbeit entspricht 30 Leistungspunkten. Die maximale Bearbeitungsdauer beträgt sechs Monate. Thema und Aufgabenstellung sind an den vorgesehenen Umfang anzupassen. Der Prüfungsausschuss legt fest, in welchen Sprachen die Masterarbeit geschrieben werden kann. Auf Antrag des Studierenden kann der/die Prüfende genehmigen, dass die Masterarbeit in einer anderen Sprache als Deutsch geschrieben wird.

(5) Bei der Abgabe der Masterarbeit 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 Masterarbeit mit „nicht ausreichend“ (5,0) bewertet.

(6) Der Zeitpunkt der Ausgabe des Themas der Masterarbeit ist durch die Betreuerin/den Betreuer und die/den Studierenden festzuhalten und dies beim Prüfungsausschuss aktenkundig zu machen. Der Zeitpunkt der Abgabe der Masterarbeit 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 4 festgelegte Bearbeitungszeit auf Antrag der oder des Studierenden um höchstens drei Monate verlängern. Wird die Masterarbeit 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 Masterarbeit 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 Masterarbeit fest; er kann auch einen weiteren Gutachter bestellen. Die Bewertung hat innerhalb von sechs Wochen nach Abgabe der Masterarbeit 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 Masterzeugnis 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.

§ 16 Prüfungsausschuss

(1) Für den Masterstudiengang Maschinenbau wird ein Prüfungsausschuss gebildet. Er besteht 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 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 Prüfungsausschusses nimmt die laufenden Geschäfte wahr und wird durch das jeweilige Prüfungssekretariat unterstützt.

(3) Der 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 § 18 Absatz 1 Satz 1. Er berichtet der KIT-Fakultät regelmäßig über die Entwicklung der Prüfungs- und Studienzeiten, einschließlich der Bearbeitungszeiten für die Masterarbeiten 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.

§ 17 Prüfende und Beisitzende

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

(2) Prüfende sind Hochschullehrer/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.

§ 18 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 Masterstudiengang 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 Prüfungsausschuss. Im Rahmen der Feststellung, ob ein wesentlicher Unterschied im Sinne des Absatz 1 vorliegt, sind die zuständigen Fachvertreter/innen zu hören. Der Prüfungsausschuss entscheidet in Abhängigkeit von Art und Umfang der anzurechnenden Studien- und Prüfungsleistungen über die Einstufung in ein höheres Fachsemester.

II. Masterprüfung

§ 19 Umfang und Art der Masterprüfung

(1) Die Masterprüfung besteht aus den Modulprüfungen nach Absatz 2 und 3 sowie der Modul Masterarbeit (§ 14).

(2) Es sind Modulprüfungen im Pflichtfach „Vertiefung ingenieurwissenschaftlicher Grundlagen“ im Umfang von 50 LP abzulegen.

Die Festlegung der zur Auswahl stehenden Module wird im Modulhandbuch getroffen.

(3) Im Wahlpflichtbereich ist ein Wahlpflichtfach im Umfang von 40 LP zu absolvieren. Zur Auswahl steht mindestens das Fach „Allgemeiner Maschinenbau“. Die Festlegung der weiteren zur Auswahl stehenden Fächer und der den Fächern zugeordneten Module wird im Modulhandbuch getroffen.

§ 20 Bestehen der Masterprüfung, Bildung der Gesamtnote

(1) Die Masterprüfung ist bestanden, wenn alle in § 19 genannten Modulprüfungen mindestens mit „ausreichend“ bewertet wurden.

(2) Die Gesamtnote der Masterprüfung errechnet sich als ein mit Leistungspunkten gewichteter Notendurchschnitt der Fachnoten und dem Modul Masterarbeit.

(3) Haben Studierende die Masterarbeit mit der Note 1,0 und die Masterprüfung mit einem Durchschnitt von 1,2 oder besser abgeschlossen, so wird das Prädikat „mit Auszeichnung“ (with distinction) verliehen.

§ 21 Masterzeugnis, Masterurkunde, Diploma Supplement und Transcript of Records

(1) Über die Masterprüfung werden nach Bewertung der letzten Prüfungsleistung eine Masterurkunde und ein Zeugnis erstellt. Die Ausfertigung von Masterurkunde und Zeugnis soll nicht später als drei Monate nach Ablegen der letzten Prüfungsleistung erfolgen. Masterurkunde und Masterzeugnis werden in deutscher und englischer Sprache ausgestellt. Masterurkunde und Zeugnis tragen das Datum der erfolgreichen Erbringung der letzten Prüfungsleistung. Diese Dokumente werden den Studierenden zusammen ausgehändigt. In der Masterurkunde wird die Verleihung des akademischen Mastergrades beurkundet. Die Masterurkunde 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 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 Masterurkunde, das Masterzeugnis und das Diploma Supplement, einschließlich des Transcript of Records, werden vom Studierendenservice des KIT ausgestellt.

III. Schlussbestimmungen

§ 22 Bescheinigung von Prüfungsleistungen

Haben Studierende die Masterprüfung 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.

§ 23 Aberkennung des Mastergrades

(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 Masterprüfung für „nicht bestanden“ erklärt werden.

(2) Waren die Voraussetzungen für die Zulassung zu einer Prüfung nicht erfüllt, ohne dass die/der 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 Masterprüfung 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 Masterurkunde einzuziehen, wenn die Masterprüfung 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.

§ 24 Einsicht in die Prüfungsakten

(1) Nach Abschluss der Masterprüfung wird den Studierenden auf Antrag innerhalb eines Jahres Einsicht in das Prüfungsexemplar ihrer Masterarbeit, 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.

§ 25 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 Masterstudiengang Maschinenbau vom 28. Februar 2008 (Amtliche Bekanntmachung des KIT Nr. 79 vom 09. September 2008), zuletzt geändert durch Satzung vom 24. September 2014 (Amtliche Bekanntmachung des KIT Nr. 54 vom 01. Oktober 2014), außer Kraft.

(3) Studierende, die auf Grundlage der Studien- und Prüfungsordnung für den Masterstudiengang Maschinenbau vom 28. Februar 2008 (Amtliche Bekanntmachung des KIT Nr. 79 vom 09. September 2008), zuletzt geändert durch Satzung vom 24. September 2014 (Amtliche Bekanntmachung des KIT Nr. 54 vom 01. Oktober 2014), ihr Studium am KIT aufgenommen haben, können Prüfungen auf Grundlage dieser Studien- und Prüfungsordnung letztmalig am 30. September 2020 ablegen.

(4) Studierende, die auf Grundlage der Studien- und Prüfungsordnung für den Masterstudiengang Maschinenbau vom 28. Februar 2008 (Amtliche Bekanntmachung des KIT Nr. 79 vom 09. September 2008), zuletzt geändert durch Satzung vom 24. September 2014 (Amtliche Bekanntmachung des KIT Nr. 54 vom 01. Oktober 2014), ihr Studium am KIT aufgenommen haben, können auf Antrag ihr Studium nach der vorliegenden Studien- und Prüfungsordnung fortsetzen.

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

Karlsruhe, den 04. August 2015

Professor Dr.-Ing. Holger Hanselka
(Präsident)

Karlsruher Institut für Technologie

Die Forschungsuniversität in der Helmholtz-Gemeinschaft

Amtliche Bekanntmachung

2019 Ausgegeben Karlsruhe, den 26. Februar 2019 Nr. 04

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Satzung zur Änderung der Studien- und Prüfungsordnung des Karlsruher Instituts für Technologie (KIT) für den Masterstudiengang 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 Masterstudiengang Maschinenbau vom 04. August 2015 (Amtliche Bekanntmachung des Karlsruher Instituts für Technologie (KIT) Nr. 61 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. § 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

2. § 14 wird wie folgt geändert:

a) 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.

b) 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.

3. § 16 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.

4. § 17 Absatz 3 wird wie folgt geändert:

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

Artikel 2 – Inkrafttreten

Diese Änderungssatzung tritt zum 01. April 2019 in Kraft.

Karlsruhe, den 21. Februar 2019

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

Karlsruher Institut für Technologie

Die Forschungsuniversität in der Helmholtz-Gemeinschaft

Amtliche Bekanntmachung

2017 **Ausgegeben Karlsruhe, den 24. November 2017** **Nr. 68**

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Satzung für den Zugang zu dem Masterstudiengang Maschinenbau am Karlsruher Institut für Technologie (KIT)

vom 22. November 2017

Aufgrund von § 10 Abs. 2 Ziff. 6 und § 20 des KIT-Gesetzes (KITG), zuletzt geändert durch Artikel 4 des Gesetzes zur Änderung des Landeshochschulgebührengesetzes und anderer Gesetze vom 09. Mai 2017 (GBl. S. 245, 250), §§ 59 Abs. 1, 63 Abs. 2 des Landeshochschulgesetzes (LHG) in der Fassung vom 1. Januar 2005 (GBl. S. 1 f), zuletzt geändert durch Artikel 3 des Gesetzes zur Änderung des Landeshochschulgebührengesetzes und anderer Gesetze vom 09. Mai 2017 (GBl. S. 245, 250), hat der KIT-Senat in seiner Sitzung am 20. November 2017 die nachstehende Satzung beschlossen.

§ 1 Anwendungsbereich

Die Satzung regelt den Zugang zu dem Masterstudiengang Maschinenbau am Karlsruher Institut für Technologie (im Folgenden: KIT).

§ 2 Fristen

(1) Eine Immatrikulation erfolgt sowohl zum Winter- als auch zum Sommersemester.

(2) Der Antrag auf Immatrikulation einschließlich aller erforderlichen Unterlagen muss

- für das **Wintersemester** bis zum **30. September eines Jahres**
- für das **Sommersemester** bis zum **31. März eines Jahres**

beim KIT eingegangen sein.

§ 3 Form des Antrages

(1) Die Form des Antrags richtet sich nach den allgemeinen für das Zulassungs- und Immatrikulationsverfahren geltenden Bestimmungen in der jeweils gültigen Zulassungs- und Immatrikulationsordnung des KIT.

(2) Dem Antrag sind folgende Unterlagen beizufügen:

1. eine Kopie des Nachweises über den Bachelorabschluss oder gleichwertigen Abschluss gemäß § 5 Abs. 1 Nr. 1 samt Diploma Supplement und Transcript of Records (unter Angabe der erbrachten Leistungspunkte/ECTS),
2. Nachweise der in § 5 Abs. 1 Nr. 3 genannten Mindestkenntnisse und Mindestleistungen, aus denen die Lernziele, Studieninhalte und Leistungspunkte hervorgehen, ggfs. Nachweis einer erfolgreichen Aufnahmeprüfung gemäß § 7 Abs. 2,
3. ein Nachweis über ein mindestens 18-wöchiges Berufspraktikum, welches durch das Praktikantenamt der KIT-Fakultät für Maschinenbau anerkannt wurde (§ 6),
4. eine schriftliche Erklärung der/des Bewerber/in darüber, ob sie/er in dem Masterstudiengang Maschinenbau oder einem verwandten Studiengang mit im Wesentlichen gleichem

Inhalt gemäß § 5 Abs. 2 eine nach der Prüfungsordnung erforderliche Prüfung endgültig nicht bestanden hat oder der Prüfungsanspruch aus sonstigen Gründen nicht mehr besteht,

5. Nachweise über die in § 5 Abs. 1 Nr. 5 a) oder b) genannten Sprachkenntnisse,

6. die in der jeweils gültigen Zulassungs- und Immatrikulationsordnung genannten weiteren Unterlagen.

Das KIT kann verlangen, dass diese der Zugangsentscheidung zugrundeliegenden Dokumente bei der Einschreibung im Original vorzulegen sind.

(3) Die Immatrikulation in den Masterstudiengang Maschinenbau kann auch beantragt werden, wenn bis zum Ablauf der Bewerbungsfrist im Sinne des § 2 der Bachelorabschluss noch nicht vorliegt und aufgrund des bisherigen Studienverlaufs, insbesondere der bisherigen Studien- und Prüfungsleistungen zu erwarten ist, dass die/der Bewerber/in das Bachelorstudium rechtzeitig vor Beginn des Masterstudiengangs Maschinenbau abschließt.

In diesem Fall sind die bis zu diesem Zeitpunkt erbrachten Studien- und Prüfungsleistungen im Rahmen der Zugangsentscheidung zu berücksichtigen. Das spätere Ergebnis des Bachelorabschlusses bleibt unbeachtet. Der Bewerbung ist

a) eine Bescheinigung über die bis zum Ende der Bewerbungsfrist erbrachten Prüfungsleistungen (z.B. Notenauszug) sowie

b) eine Übersicht aller noch nicht nachgewiesenen Prüfungs- und Studienleistungen mit Angabe des Prüfungsdatums und des Nachweises der Prüfungsanmeldung beizulegen.

§ 4 Zugangskommission

(1) Zur Vorbereitung der Zugangsentscheidung setzt die KIT-Fakultät eine Zugangskommission ein, die aus mindestens zwei Personen des hauptberuflich tätigen wissenschaftlichen Personals, davon einer/einem Professor/in, besteht. Ein/e studentische/r Vertreter/in kann mit beratender Stimme an den Zugangskommissionssitzungen teilnehmen. Eines der Mitglieder der Zugangskommission führt den Vorsitz.

(2) Für den Fall, dass aufgrund hoher Bewerberzahlen mehrere Zugangskommissionen gebildet werden, findet zu Beginn des Zugangsverfahrens in einer gemeinsamen Sitzung eine Abstimmung der Bewertungsmaßstäbe unter dem Vorsitz der/des Studiendekans/Studiendekanin statt. Am Ende des Verfahrens kann eine gemeinsame Schlussbesprechung durchgeführt werden.

(3) Die Zugangskommission berichtet dem KIT-Fakultätsrat nach Abschluss des Zugangsverfahrens über die gesammelten Erfahrungen und macht Vorschläge zur Verbesserung und Weiterentwicklung des Zugangsverfahrens.

(4) Die Amtszeit der nicht studentischen Kommissionsmitglieder beträgt zwei Jahre, die des studentischen Kommissionsmitgliedes ein Jahr. Eine Wiederbestellung ist möglich.

§ 5 Zugangsvoraussetzungen

(1) Voraussetzungen für den Zugang zum Masterstudiengang Maschinenbau sind:

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1. Ein bestandener Bachelorabschluss oder mindestens gleichwertiger Abschluss in dem Studiengang Maschinenbau oder einem Studiengang mit im Wesentlichen gleichem Inhalt an einer Universität, Fachhochschule oder Berufsakademie bzw. Dualen Hochschule oder an einer ausländischen Hochschule; das Studium muss im Rahmen einer mindestens dreijährigen Regelstudienzeit und mit einer Mindestanzahl von 180 ECTS-Punkten absolviert worden sein;

2. ein mindestens 18-wöchiges Berufspraktikum, welches durch das Praktikantenamt der KIT-Fakultät für Maschinenbau anerkannt wurde (§ 6);

3. notwendige durch den Bachelorabschluss vermittelte Mindestkenntnisse und Mindestleistungen gemäß § 7;

4. dass im Masterstudiengang Maschinenbau oder einem verwandten Studiengang mit im Wesentlichen gleichem Inhalt kein endgültiges Nichtbestehen einer nach der Prüfungsordnung erforderlichen Prüfung vorliegt und der Prüfungsanspruch auch aus sonstigen Gründen noch besteht;

5. für Bewerber/innen, deren Muttersprache nicht Deutsch oder Englisch ist, der Nachweis von

   a) ausreichenden Kenntnissen der deutschen Sprache gemäß den Voraussetzungen der Zulassungs- und Immatrikulationsordnung des KIT oder

   b) ausreichenden Kenntnissen der englischen Sprache, nachgewiesen durch ein Zertifikat über das Kompetenzniveau B2 oder höher gemäß dem Gemeinsamen europäischen Referenzrahmen für Sprachen oder ein vergleichbares Zertifikat; als vergleichbar gelten ein Test of English as Foreign Language (TOEFL) mit mindestens 570 Punkten im paper-based TOEFL Test, 250 Punkten im computer-based TOEFL Test oder 88 Punkten im internet-based TOEFL Test sowie IELTS mit mindestens 6,5 Punkten. Der Nachweis englischer Sprachkenntnisse entfällt für Bewerber/innen, die ihren Bachelorabschluss in einem englischsprachigen Studiengang oder im englischsprachigen Ausland erworben haben. Die offizielle Sprache des Studienprogramms muss auf dem Abschlusszeugnis, dessen Ergänzung, im Transcript of Records oder in einer entsprechenden Bescheinigung der Hochschule vermerkt sein.

(2) Als verwandte Studiengänge gemäß Absatz 1 Nr. 4 gelten insbesondere ein Masterstudiengang Mechatronik, Mechatronik und Informationstechnik, Werkstofftechnik, Materialwissenschaft und Werkstofftechnik, Werkstoffingenieurwesen, Fahrzeugtechnik, Kraftfahrzeugtechnik, Luft- und Raumfahrttechnik, Motorentechnik, Produktionstechnik, Fertigungstechnik, Automatisierungstechnik, Entwicklung und Konstruktion, Mechanik, Mechanical Engineering, Mechatronics, Mechatronics and Information Technology, Materials Science, Automotive Engineering, Aerospace Engineering, Production Systems Engineering, Manufacturing Technology, Conception and Production in Mechanical Engineering, Computational Mechanics, Computational Mechanics of Materials and Structures, Energy Technologies, Automation. Über die Gleichwertigkeit des Bachelorabschlusses im Sinne von Absatz 1 Nr. 1 sowie die Festlegung der Studiengänge mit im Wesentlichen gleichem Inhalt im Sinne von Absatz 1 Nr. 4 über Satz 1 hinaus entscheidet die Zugangskommission des Masterstudiengangs Maschinenbau im Benehmen mit dem Prüfungsausschuss des Masterstudiengangs Maschinenbau. Bei der Anerkennung von ausländischen Abschlüssen sind die Empfehlungen der Kultusministerkonferenz sowie die Absprachen im Rahmen von Hochschulpartnerschaften zu beachten.

§ 6 Berufspraktikum

(1) Der Zugang zum Masterstudiengang Maschinenbau setzt ein mindestens 18-wöchiges Berufspraktikum voraus. Davon sind mindestens zwölf Wochen als Fachpraktikum abzuleisten. Maximal sechs Wochen können als Grundpraktikum abgeleistet werden.

(2) Die Tätigkeiten im **Grundpraktikum** können aus folgenden Gebieten gewählt werden:

1. spanende Fertigungsverfahren,
2. umformende Fertigungsverfahren,
3. urformende Fertigungsverfahren und
4. thermische Füge- und Trennverfahren.

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

(3) Die Tätigkeiten im **Fachpraktikum** müssen inhaltlich denen eines Ingenieurs entsprechen und können beispielsweise aus folgenden Gebieten gewählt werden:

1. Wärmebehandlung,
2. Werkzeug- und Vorrichtungsbau,
3. Planung von Instandhaltung, Wartung und Reparatur,
4. Planung von Messen, Prüfen und Qualitätskontrolle,
5. Oberflächentechnik,
6. Entwicklung, Konstruktion und Arbeitsvorbereitung,
7. Montage/Demontageplanung und
8. andere fachrichtungsbezogene Tätigkeiten

Näheres regelt die Praktikumsordnung für den Bachelor- und Masterstudiengang Maschinenbau der KIT-Fakultät für Maschinenbau.

(4) Über die Anerkennung des Berufspraktikums entscheidet das Praktikantenamt der KIT-Fakultät für Maschinenbau. Zur Anerkennung ist die Vorlage eines Tätigkeitsnachweises des Unternehmens (Zeugnis) im Original, das Dauer und Art der Tätigkeit während des Praktikums beschreibt, erforderlich. Tätigkeiten, die an Universitäten, gleichgestellten Hochschulen oder in vergleichbaren Forschungseinrichtungen durchgeführt wurden, werden grundsätzlich nicht als Fachpraktikum anerkannt.

(5) Liegt das Berufspraktikum bis zum Zeitpunkt der Antragsstellung noch nicht vor, kann die/der Bewerber/in im Einzelfall trotzdem unter der Auflage zugelassen werden, dass sie/er das Berufspraktikum bis zum Ende des Prüfungszeitraums des dritten Fachsemesters, spätestens aber bei der Anmeldung der Masterarbeit, nachweist. Eine etwaige Auflage wird von der Zulassungskommission festgesetzt und der/dem Bewerber/in im Rahmen der Zulassung mitgeteilt.

§ 7 Mindestkenntnisse und Mindestleistungen

(1) Die Zulassung zum Masterstudiengang Maschinenbau setzt den Nachweis voraus, dass sich der/die Bewerber/in mindestens in folgenden Fächern Fähigkeiten erworben hat, die nach Maßgabe der Lernziele, Inhalte und Leistungspunkte entsprechend des aktuellen Modulhandbuchs des Bachelorstudiengangs Maschinenbau zu denen im Bachelorstudiengang Maschinenbau am KIT gleichwertig sind:

1. Höhere Mathematik
2. Technische Thermodynamik und Wärmeübertragung
3. Technische Mechanik
4. Maschinenkonstruktionslehre
5. Werkstoffkunde
6. Strömungslehre
7. Mess- und Regelungstechnik
8. Elektrotechnik
9. Informatik.

Über die Gleichwertigkeit nach Satz 1 entscheidet die Zugangskommission des Masterstudiengangs Maschinenbau im Benehmen mit dem Prüfungsausschuss des Masterstudiengangs Maschinenbau.

(2) Sofern Bewerber die unter Absatz 1 beschriebenen Fähigkeiten nicht nachweisen können, können sie dennoch in den Studiengang immatrikuliert werden, sofern sie die für den Studiengang erforderlichen Fähigkeiten durch Bestehen einer schriftlichen Aufnahmeprüfung gemäß Anlage 1 am KIT nachweisen. Für einen erfolgreichen Nachweis darf die erfolgreiche Teilnahme an der Aufnahmeprüfung nicht länger als vier Bewerbungsverfahren zurückliegen. Ein Bewerbungsverfahren ist die auf einen bestimmten Studienbeginn bezogene Vergabe von Studienplätzen.

§ 8 Immatrikulationsentscheidung

(1) Die Entscheidung über das Erfüllen der Zugangsvoraussetzungen und die Immatrikulation trifft die/der Präsident/in auf Vorschlag der Zugangskommission.

(2) Die Immatrikulation ist zu versagen, wenn

a) die Bewerbungsunterlagen nicht fristgemäß im Sinne des § 2 oder nicht vollständig im Sinne des § 3 vorgelegt wurden,

b) die in § 5 geregelten Voraussetzungen nicht erfüllt sind,

c) im Studiengang Maschinenbau oder in einem verwandten Studiengang mit im Wesentlichen gleichem Inhalt eine nach der Prüfungsordnung erforderliche Prüfung endgültig nicht bestanden wurde oder der Prüfungsanspruch aus sonstigen Gründen nicht mehr besteht (§ 60 Abs. 2 Nr. 2 LHG, § 9 Abs. 2 HZG).

Im Fall des § 3 Abs. 3 kann die Immatrikulation unter dem Vorbehalt zugesichert werden, dass der endgültige Nachweis über den Bachelorabschluss unverzüglich, spätestens bis zwei Monate nach Beginn des Semesters, für das die Immatrikulation beantragt wurde, nachgereicht wird. Wird der Nachweis nicht fristgerecht erbracht, erlischt die Zusicherung, und eine Immatrikulation erfolgt nicht. Hat die/der Bewerber/in die Fristüberschreitung nicht zu vertreten, hat sie/er dies gegenüber der Zugangskommission zu belegen und schriftlich nachzuweisen. Die Zugangskommission kann im begründeten Einzelfall die Frist für das Nachreichen des endgültigen Zeugnisses verlängern.

(3) Erfüllt die/der Bewerber/in die Zugangsvoraussetzungen nicht und/oder kann sie/er nicht immatrikuliert werden, wird ihr/ihm das Ergebnis des Zugangsverfahrens schriftlich mitgeteilt. Der Bescheid ist zu begründen und mit einer Rechtsbehelfsbelehrung zu versehen.

(4) Über den Ablauf des Zugangsverfahrens ist eine Niederschrift anzufertigen.

(5) Im Übrigen bleiben die allgemein für das Zulassungs- und Immatrikulationsverfahren geltenden Bestimmungen in der Zulassungs- und Immatrikulationsordnung des KIT unberührt.

§ 9 Inkrafttreten

Diese Satzung tritt am Tage nach ihrer Bekanntmachung in den Amtlichen Bekanntmachungen des KIT in Kraft. Sie gilt erstmals für das Bewerbungsverfahren zum Sommersemester 2018.

Gleichzeitig tritt die Satzung für das hochschuleigene Zulassungsverfahren im Masterstudiengang Maschinenbau an der Universität Karlsruhe (TH) vom 28. Mai 2008 (Amtliche Bekanntmachungen des KIT Nr. 22 vom 28. Mai 2008), zuletzt geändert durch Satzung vom 04. August 2015 (Amtliche Bekanntmachungen des KIT Nr. 63 vom 06. August 2015) außer Kraft.

Karlsruhe, den. 22. November 2017

Prof. Dr. Holger Hanselka
(Präsident)

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Anlage 1

Aufnahmeprüfung

1. Zweck

Die Aufnahmeprüfung soll zeigen, dass die/der Bewerber/in geeignet ist, den Masterstudiengang Maschinenbau erfolgreich zu absolvieren. Die Eignungsfeststellung erfolgt nach Maßgabe des Berufsbildes des Berufes/der Berufe, die dem Abschlussziel typischerweise folgen und anhand von Qualifikationen, die denen, welche im Bachelorstudiengang Maschinenbau am KIT erworben werden können, entsprechen.

2. Anmeldung zur Prüfung

2.1 Der Antrag auf Zulassung zur Aufnahmeprüfung erfolgt schriftlich bis spätestens 14 Tage vor dem Termin der Aufnahmeprüfung bei der KIT-Fakultät für Maschinenbau.

2.2 Dem Antrag ist der Nachweis über die Bewerbung für den Masterstudiengang Maschinenbau am KIT beizufügen.

2.3 Die Entscheidung über die Zulassung zur Aufnahmeprüfung gemäß Nr. 3 trifft die Zugangskommission der KIT-Fakultät für Maschinenbau (§ 4). Zur Aufnahmeprüfung zugelassene Bewerber erhalten eine Anmeldebestätigung.

3. Zulassung zur Prüfung

3.1 An der Aufnahmeprüfung nimmt nur teil, wer

a) sich ordnungsgemäß zur Aufnahmeprüfung angemeldet hat,

b) sich gemäß § 3 form- und fristgerecht für den Masterstudiengang Maschinenbau beworben hat und

c) erklärt, dass er nicht bereits mehr als einmal an einer Aufnahmeprüfung am KIT im Masterstudiengang Maschinenbau erfolglos teilgenommen hat.

3.2 Die Teilnahme ist zu versagen, wenn die unter 3.1 genannten Voraussetzungen nicht erfüllt sind.

4. Durchführung

4.1 Die genauen Termine sowie der Ort der Aufnahmeprüfung werden spätestens sechs Wochen vor dem Prüfungstermin durch das KIT auf den Internetseiten der KIT-Fakultät für Maschinenbau bekannt gegeben.

4.2 Die Aufnahmeprüfung findet in schriftlicher Form statt und dauert 90 Minuten. Sie besteht aus vier Prüfungsteilen, die Fähigkeiten aus in § 7 Abs. 1 genannten Bereichen ermitteln und zu gleichen Teilen mit 25 Punkten bewertet werden. Die mit der Aufnahmeprüfung maximal erreichbare Punktzahl beträgt 100 Punkte. Die Aufnahmeprüfung kann zu Teilen auch im Wege des Antwort-Wahl-Verfahrens durchgeführt werden. In diesem Fall findet die Satzung zur Durchführung von Antwort-Wahl-Verfahren Anwendung.

4.3 Zur Bewertung der Aufnahmeprüfung setzt die Zugangskommission (§ 4) eine Prüfungskommission ein. Sie besteht aus mindestens zwei stimmberechtigten Mitgliedern, einem/einer Hochschullehrer/in / leitenden/leitender Wissenschaftler/in gemäß § 14 Abs. 3 Ziff. 1 KITG / Privatdozentin bzw. -dozenten, und einer akademischen Mitarbeiterin/ einem akademischen Mitarbeiter nach § 52 LHG / wissenschaftlichen Mitarbeiterin/wissenschaftlichen Mitarbeiter gemäß § 14 Abs. 3 Ziff. 2 KITG sowie einer /einem Studierenden mit beratender Stimme. Die Amtszeit der nicht studentischen Kommissionsmitglieder beträgt zwei Jahre, die des studentischen Kommissionsmitgliedes ein Jahr. Eine Wiederbestellung ist möglich.

4.4 Die Aufnahmeprüfung wird mit 0 Punkten bewertet, wenn die/der Bewerber/in zum Prüfungstermin ohne wichtigen Grund nicht erscheint. Tritt die/der Bewerber/in nach Ausgabe der Prüfungsaufgaben von der Aufnahmeprüfung zurück, wird sie/er nach dem bis zu diesem Zeitpunkt erzielten Ergebnis bewertet. Die/der Bewerber/in ist berechtigt, erneut an einer Aufnahmeprüfung teilzunehmen, wenn unverzüglich nach dem Termin der Aufnahmeprüfung dem KIT angezeigt und glaubhaft gemacht wird, dass für das Fehlen am Termin oder den Rücktritt von der Prüfung ein wichtiger Grund vorgelegen hat; bei Krankheit ist ein ärztliches Attest vorzulegen.

4.5 Versucht die/der Bewerber/in das Ergebnis der Aufnahmeprüfung durch Täuschung oder Benutzung nicht zugelassener Hilfsmittel zu beeinflussen, wird die Prüfung mit 0 Punkten bewertet. Ein/e Bewerber/in, die/der den ordnungsgemäßen Ablauf der Prüfung stört, kann von dem jeweiligen Aufsichtsführenden von der Fortsetzung der Prüfung ausgeschlossen werden; in diesem Fall wird die Prüfung mit 0 Punkten bewertet.

4.6 Das KIT übernimmt keine Kosten, die durch die Aufnahmeprüfung für die Bewerber/innen entstehen.

5. Ermittlung der Eignung und Mitteilung des Ergebnisses

5.1 Die Aufnahmeprüfung ist bestanden, wenn die/der Bewerber/in mindestens 75 Punkte, dabei mindestens 15 Punkte in jedem der vier Teilbereiche erreicht.

5.2 Die Zugangskommission (§ 4) stellt die Eignung der Bewerberin/ des Bewerbers auf Vorschlag der Prüfungskommission fest. Das Ergebnis der Aufnahmeprüfung wird den Bewerberinnen/Bewerbern schriftlich durch die KIT-Fakultät für Maschinenbau mitgeteilt. Der Bescheid ist zu begründen und mit einer Rechtsbehelfsbelehrung zu versehen.

6. Wiederholung

Bewerber/innen, die einmal erfolglos an einer Aufnahmeprüfung für den Masterstudiengang Maschinenbau am KIT teilgenommen haben, können sich frühestens im nächsten Bewerbungszeitraum einmalig erneut zur Aufnahmeprüfung für diesen Studiengang anmelden. Eine weitere Wiederholung ist nicht möglich.

Karlsruher Institut für Technologie

Die Forschungsuniversität in der Helmholtz-Gemeinschaft

Amtliche Bekanntmachung

2018 **Ausgegeben Karlsruhe, den 28. November 2018** **Nr. 63**

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Satzung zur Änderung der Satzung für den Zugang zu dem Masterstudiengang Maschinenbau am Karlsruher Institut für Technologie (KIT)

vom 28. November 2018

Aufgrund von § 10 Abs. 2 Ziff. 6 und § 20 des KIT-Gesetzes (KITG) in der Fassung vom 14. Juli 2009 (GBl. S. 317 ff), zuletzt geändert durch Artikel 2 des Gesetzes zur Weiterentwicklung des Hochschulrechts (HRWeitEG) vom 13. März 2018 (GBl S. 85, 94), §§ 59 Abs. 1, 63 Abs. 2 des Landeshochschulgesetzes (LHG) in der Fassung vom 1. Januar 2005 (GBl. S. 1 ff), zuletzt geändert durch Artikel 1 des Gesetzes zur Weiterentwicklung des Hochschulrechts (HRWeitEG) vom 13. März 2018 (GBl S. 85 ff.), hat der KIT-Senat in seiner Sitzung am 19. November 2018 die nachstehende Satzung beschlossen.

Artikel 1

1. **§ 3 Abs. 2 Ziff. 3 wird wie folgt geändert:**

   Nach dem Wort „Berufspraktikum“ werden die Worte „welches durch das Praktikantenamt der KIT-Fakultät für Maschinenbau anerkannt wurde“ gestrichen.

2. **§ 5 Abs. 1 Ziff. 3 wird wie folgt geändert:**

   Nach dem Wort „notwendige“ werden die Worte „durch den Bachelorabschluss vermittelte“ gestrichen.

3. **§ 5 Abs. 1 Ziff. 5 Buchst. b) erhält folgende Fassung:**

   „b) ausreichenden englischen Sprachkenntnisse, die mindestens dem Niveau B2 des Gemeinsamen Europäischen Referenzrahmens für Sprachen (GER) oder gleichwertig entsprechen, nachgewiesen beispielsweise durch einen der folgenden international anerkannten Tests:
   - aa) Test of English as Foreign Language (TOEFL) mit mindestens 550 Punkten im paper-based Test, oder 88 Punkten im internet-based Test oder
   - bb) IELTS mit einem Gesamtergebnis von mindestens 6.5 und keiner Section unter 5.5.

   Der Nachweis englischer Sprachkenntnisse entfällt für Bewerber/innen, die ihren Bachelorabschluss in einem englischsprachigen Studiengang oder im englischsprachigen Ausland erworben haben. Die offizielle Sprache des Studienprogramms muss auf dem Abschlusszeugnis, dessen Ergänzung, im Transcript of Records oder in einer entsprechenden Bescheinigung der Hochschule vermerkt sein.“

4. **§ 6 Abs. 5 erhält folgende Fassung:**

   „**(5)** Liegt das Berufspraktikum oder die Anerkennung des Praktikums bis zum Zeitpunkt der Antragsstellung noch nicht vor, kann die/der Bewerber/in im Einzelfall trotzdem unter der Auflage zugelassen werden, dass sie/er das Berufspraktikum bis zum Ende des Prüfungszeitraums des dritten Fachsemesters, spätestens aber bei der Anmeldung der Masterarbeit, nachweist. Eine etwaige Auflage wird von der Zulassungskommission festgesetzt und der/dem Bewerber/in im Rahmen der Zulassung mitgeteilt.“

5. **Anlage 1 Ziff. 5.1 erhält folgende Fassung:**
„5.1 Die Aufnahmeprüfung ist bestanden, wenn die/der Bewerber/in mindestens 50 Punkte, dabei mindestens 12 Punkte in jedem der vier Teilbereiche erreicht.“

Artikel 2

Diese Satzung tritt am Tage nach ihrer Bekanntmachung in den Amtlichen Bekanntmachungen des KIT in Kraft. Sie gilt erstmals für das Bewerbungsverfahren zum Sommersemester 2019.

Karlsruhe, 28. November 2018

gez. Prof. Dr. Holger Hanselka
(Präsident)

Karlsruher Institut für Technologie

Die Forschungsuniversität in der Helmholtz-Gemeinschaft

Amtliche Bekanntmachung

2019 **Ausgegeben Karlsruhe, den 29. Juli 2019** **Nr. 38**

I n h a l t **Seite**

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Zweite Satzung zur Änderung der Satzung für den Zugang zu dem Masterstudiengang Maschinenbau am Karlsruher Institut für Technologie (KIT)

vom 29. Juli 2019

Aufgrund von § 10 Abs. 2 Ziff. 6 und § 20 des KIT-Gesetzes (KITG) in der Fassung vom 14. Juli 2009 (GBl. S. 317 ff), zuletzt geändert durch Artikel 2 des Gesetzes zur Weiterentwicklung des Hochschulrechts (HRWeitEG) vom 13. März 2018 (GBl S. 85, 94), §§ 59 Abs. 1, 63 Abs. 2 des Landeshochschulgesetzes (LHG) in der Fassung vom 1. Januar 2005 (GBl. S. 1 ff), zuletzt geändert durch Artikel 1 des Gesetzes zur Weiterentwicklung des Hochschulrechts (HRWeitEG) vom 13. März 2018 (GBl S. 85 ff.), hat der KIT-Senat in seiner Sitzung am 15. Juli 2019 die nachstehende Satzung beschlossen.

Artikel 1
Anlage 1 Ziff. 5.1 der Satzung für den Zugang zu dem Masterstudiengang Maschinenbau am Karlsruher Institut für Technologie (KIT) vom 22. November 2017 (Amtliche Bekanntmachung des KIT Nr. 68 vom 24. November 2017), zuletzt geändert durch Satzung vom 28. November 2018 (Amtliche Bekanntmachung des KIT Nr. 63 vom 28. November 2018), erhält folgende Fassung:

„5.1 Die Aufnahmeprüfung ist bestanden, wenn die/der Bewerber/in mindestens 50 Punkte erreicht.“

Artikel 2
Diese Satzung tritt am Tage nach ihrer Bekanntmachung in den Amtlichen Bekanntmachungen des KIT in Kraft. Sie gilt erstmals für das Bewerbungsverfahren zum Wintersemester 2019/20.

Karlsruhe, 29. Juli 2019

gez. Prof. Dr. Holger Hanselka
(Präsident)

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

Fassung vom 08.05.2019
Letzte Änderung 23.08.2024

Inhaltsverzeichnis

0 Abkürzungsverzeichnis

Vertiefungsrichtungen:	MB	Allgemeiner Maschinenbau
	E+U	Energie- und Umwelttechnik
	FzgT	Fahrzeugtechnik
	M+M	Mechatronik und Mikrosystemtechnik
	PEK	Produktentwicklung und Konstruktion
	PT	Produktionstechnik
	ThM	Theoretischer Maschinenbau
	W+S	Werkstoffe und Strukturen für Hochleistungssysteme
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
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
	St.l.	Studienleistung, unbenotete Modulleistung
	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

Das Masterstudium kann sowohl zum Winter- als auch zum Sommersemester aufgenommen werden. Wegen der freien Wahl der Module lässt sich für das Masterstudium kein exemplarischer Studienverlauf angeben.

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 vom Prüfungsausschuss 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 6 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 absolviert wurden.

Zur Berechnung der Modul- und Fachnoten wird auf §7 der SPO verwiesen. Die Modulnote errechnet sich dabei aus einem nach den Leistungspunkten der einzelnen Teilmodule gewichteter Notendurchschnitt. Die differenzierten Noten (s. SPO § 7, Abs. 2) sind bei der Berechnung der Modulnoten als Ausgangsdaten zu verwenden.

1.2 Vertiefungsrichtungen

Es stehen folgende Vertiefungsrichtungen zur Auswahl:

Vertiefungsrichtung	Abk.	Verantwortliche/r
Allgemeiner Maschinenbau	MB	Furmans
Energie- und Umwelttechnik	E+U	Maas
Fahrzeugtechnik	FzgT	Gauterin
Mechatronik und Mikrosystemtechnik	M+M	Korvink
Produktentwicklung und Konstruktion	PEK	Albers
Produktionstechnik	PT	Schulze
Theoretischer Maschinenbau	ThM	Böhlke
Werkstoffe und Strukturen für Hochleistungssysteme	W+S	Heilmaier

Die Wahlmöglichkeiten im Wahlpflichtmodul „Grundlagen und Methoden der Vertiefungsrichtung" und in den Schwerpunkten richten sich nach der gewählten Vertiefungsrichtung. Die zur Verfügung stehenden Module der Vertiefungsrichtungen werden im Modulhandbuch aufgeführt. Schriftliche Prüfungen werden als Klausuren mit der angegebenen Prüfungsdauer in Stunden abgenommen. Prüfungsleistungen gehen mit dem angegebenen Gewicht (Gew) in die Gesamtnote ein.

Folgende Module sind im Masterstudiengang zu belegen:

Fach	Modul	LP/ Modul	Teilleistung	LP	Verant-wortliche/r	Art der Erfolgs-kontrolle	Pr (h)	Gew
Vertiefung ingenieurwissenschaftlicher Grundlagen	Produktentstehung – Bauteildimensio-nierung	7	Produktentstehung - Bauteildimensio-nierung	7	Schulze	sPr	2	7
	Produktentstehung – Entwicklungsme-thodik	6	Methoden und Pro-zesse der PGE - Produktgenerati-onsentwicklung	6	Matthiesen, Albers	sPr	2	6
	Modellbildung und Simulation	7	Modellbildung und Simulation	7	Proppe	sPr	3	7
	Mathematische Me-thoden	6	wählbare TL s. Mo-dulhandbuch	6	Heilmaier	sPr	3[1]	6
	Laborpraktikum	4	wählbare TL s. Mo-dulhandbuch	4	Stiller, Furmans	St.l.		
	Wahlpflichtmodul Maschinenbau	8	Teilleistung 1, wählbare TL s. Mo-dulhandbuch	4	Heilmaier	mPr	ca. 0,4	4
			Teilleistung 2, wählbare TL s. Mo-dulhandbuch	4	Heilmaier	mPr	ca. 0,4	4
	Wahlpflichtmodul nat/inf/etit	6	wählbare TL s. Mo-dulhandbuch	6	Maas	St.l.		
	Wahlpflichtmodul wirt/recht	4	wählbare TL s. Mo-dulhandbuch	4	Furmans	St.l.		
	Schlüsselqualifikati-onen	2	wählbare TL von HoC, FORUM (ehemals ZAK) bzw. Modulhand-buch	2	Heilmaier	St.l.		
Vertiefungsrichtung	Schwerpunkt 1	16	Kern-/Ergänzungs-bereich, wählbare TL s. Modulhand-buch	16	SP-Verant-wortliche/r	mPr	ca. 2x0,7 bzw. ca. 4x0,4	16
	Schwerpunkt 2	16	Kern-/Ergänzungs-bereich, wählbare TL s. Modulhand-buch	16	SP-Verant-wortliche/r	mPr	ca. 2x0,7 bzw. ca. 4x0,4	16
	Grundlagen und Methoden der Ver-tiefungsrichtung	8	Teilleistung 1, wählbare TL s. Mo-dulhandbuch	4	Heilmaier	mPr, sPr	ca. 0,4 bzw. 1,5 - 3	4
			Teilleistung 2, wählbare TL s. Mo-dulhandbuch	4	Heilmaier	mPr, sPr	ca. 0,4 bzw. 1,5 - 3	4
Master-arbeit	Masterarbeit	30	Masterarbeit und Präsentation	30		PraA		30

[1] Bei der Veranstaltung „WahrStudienleistunglichkeitstheorie und Statistik" beträgt die Prüfungsdauer abweichend 1,5 h.

2 Zugelassene Teilleistungen in den Wahlpflichtmodulen

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

2.1 Wahlpflichtmodul Grundlagen und Methoden der Vertiefungsrichtung

Im Masterstudiengang müssen zwei Teilleistungen mit jeweils 4 LP im Modul Grundlagen und Methoden der jeweiligen Vertiefungsrichtung erbracht werden. Wählbare Teilleistungen siehe Modulhandbuch.

2.2 Mathematische Methoden

Wählbare Teilleistungen siehe Modulhandbuch.

2.3 Wahlpflichtmodul aus dem Bereich Naturwissenschaften/Informatik/Elektrotechnik

Wählbare Teilleistungen siehe Modulhandbuch. Der Wechsel der gewählten Teilleistung ist bis zum Bestehen der Erfolgskontrolle möglich. Andere Teilleistungen, auch aus anderen Fakultäten, können mit Genehmigung des Prüfungsausschusses gewählt werden.

2.4 Wahlpflichtmodul aus dem Bereich Wirtschaft/Recht

Wählbare Teilleistungen siehe Modulhandbuch. Der Wechsel der gewählten Teilleistung ist bis zum Bestehen der Erfolgskontrolle möglich. Andere Teilleistungen, auch aus anderen Fakultäten, können mit Genehmigung des Prüfungsausschusses gewählt werden.

2.5 Wahlpflichtmodul aus dem Bereich Maschinenbau

Wählbare Teilleistungen siehe Modulhandbuch. Andere Teilleistungen, auch aus anderen Fakultäten, können mit Genehmigung des Prüfungsausschusses gewählt werden.

2.6 Laborpraktikum

Wählbare Teilleistungen siehe Modulhandbuch. Der Wechsel der gewählten Teilleistung ist bis zum Bestehen der Erfolgskontrolle möglich.

3 Schwerpunkte

Generell gilt, dass jede Teilleistung und jeder Schwerpunkt nur einmal entweder im Rahmen des Bachelorstudienganges und des konsekutiven Masterstudiengangs Maschinenbau gewählt werden kann.

3.1 Zuordnung der Schwerpunkte zu den Vertiefungsrichtungen

Folgende Schwerpunkte sind derzeit vom Fakultätsrat genehmigt. In einigen Vertiefungsrichtungen ist die Wahl des **ersten** Schwerpunkts eingeschränkt (einer der mit „p" gekennzeichneten Schwerpunkte ist zu wählen).

In einem konsekutiven Masterstudium kann der erste Masterschwerpunkt auch als w-Schwerpunkt gewählt werden, wenn ein p-Schwerpunkt dieser Vertiefungsrichtung bereits im Bachelorstudium gewählt wurde.

Schwerpunkt	SP-Verant-wortlicher	SP-Nr.	MB	E+U	FzgT	M+M	PEK	PT	ThM	W+S
Advanced Materials Modelling	Böhlke	56	w						w	w
Advanced Mechatronics	Mikut	1	w	w	w	p	w	w	w	
Angewandte Mechanik	Böhlke	30	w	w	w	w	w	w	p	w
Antriebssysteme	Albers	2	w		w		w	w		
Automatisierungstechnik	Mikut	4	w	w	w	p	w	w	w	
Bahnsystemtechnik	Gratzfeld	50	w		p	w	w			
Computational Mechanics	Proppe	6	w		w	w	w		p	
Entwicklung innovativer Geräte	Matthiesen	51	w	w	w		p	w		
Entwicklung und Konstruktion	Albers	10	w	w	w		w	w		
Fusionstechnologie	N.N.	53	w	w					w	
Gebäudeenergietechnik	H.-M. Henning	55	w	w						
Grundlagen der Energietechnik	Bauer	15	w	p	w	w	w			
Informationstechnik	Stiller	18	w	w	w	w	w	w	w	
Informationstechnik für Logistiksysteme	Furmans	19	w				w	w		
Innovation und Entrepreneurship	Class	59		w						
Integrierte Produktentwicklung	Albers	20	w	w	w		p	w		
Kerntechnik	Cheng	21	w	w					w	
Kognitive Technische Systeme	Stiller	22	w		w	w	w	w	w	
Kraftfahrzeugtechnik	Gauterin	12	w		p		w			
Kraft- und Arbeitsmaschinen	Th. Koch	24	w	w	w		w			
Kraftwerkstechnik	Bauer	23	w	w			w			
Leichtbau	F. Henning	25	w	w	w		w	w		w
Lifecycle Engineering	Ovtcharova	28	w		w	w	p	p		
Logistik und Materialflusslehre	Furmans	29	w				w	p		
Materialwissenschaft und Werkstofftechnik	Heilmaier	26	w	w	w	w	w	w	w	p
Mechatronik	Hagen-meyer	31	w	w	w	p	w	w	w	
Medizintechnik	Pylatiuk	32	w			w	w			
Mensch - Technik - Organisation	Deml	3	w	w			w	p		
Mikroaktoren und Mikrosensoren	Kohl	54	w	w	w	w	w	w		
Mikrosystemtechnik	Korvink	33	w	w	w	p	w	w		
Mobile Arbeitsmaschinen	Geimer	34	w		p	w	w	w		
Modellbildung und Simulation in der Dynamik	Fidlin	61	w	w	w	w	w	w	p	
Modellierung und Simulation in der Energie- und Strömungstechnik	Maas	27	w	w	w	w	w			
Polymerengineering	Liebig	36	w	w	w		w	w		w
Produktionstechnik	Schulze	39	w		w		w	p		
Robotik	Mikut	40	w			p	w	w	w	
Schwingungslehre	Fidlin	60	w	w	w	w	w	w	p	

Schwerpunkt	SP-Verant-wortlicher	SP-Nr.	MB	E+U	FzgT	M+M	PEK	PT	ThM	W+S
Strömungsmechanik	Frohnapfel	41	w	w	w		w		p	
Technische Keramik und Pulverwerkstoffe	Hoffmann	43	w	w	w		w			w
Technische Logistik	Furmans	44	w				w	w		
Technische Thermodynamik	Maas	45	w	w	w	w	w		w	w
Thermische Turbomaschinen	Bauer	46	w	w	w				w	w
Tribologie	Dienwiebel	47	w	w	w	w	w	w	w	w
Verbrennungsmotorische Antriebssysteme	Th. Koch	58	w	w	p	w	w			
Zuverlässigkeit im Maschinenbau	Gumbsch	49	w	w	w	w	w	w	w	p

Für jeden Schwerpunkt werden Teilleistungen im Umfang von 16 LP gewählt, davon werden mindestens 8 LP im Kernbereich (K) erworben. „KP“ bedeutet, dass die Lehrveranstaltung im Kernbereich Pflicht ist, sofern sie nicht bereits belegt wurde. Die übrigen 8 LP können aus dem Ergänzungsbereich kommen. Dabei dürfen im Rahmen von Praktika höchstens 4 LP erworben werden, die auch als Studienleistung erbracht werden können.

Die im Ergänzungsbereich (E) angegebenen Teilleistungen verstehen sich als Empfehlung, andere Teilleistungen (auch aus anderen KIT-Fakultäten) können mit Genehmigung des jeweiligen Schwerpunkt-verantwortlichen gewählt werden. Dabei ist eine Kombination mit Teilleistungen aus den Bereichen Informatik, Elektrotechnik und Mathematik in einigen Vertiefungsrichtungen besonders willkommen.

Ein Absolvieren des Schwerpunktmoduls mit mehr als 16 LP ist nur im Fall, dass die Addition innerhalb des Schwerpunktmoduls nicht auf 16 LP aufgeht, erlaubt. Nicht zulässig ist es jedoch, noch weitere Teilleistungen anzumelden, wenn bereits 16 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.

Die Bildung der Schwerpunktnote erfolgt anhand der mit einer Prüfungsleistung abgeschlossenen Teilleistungen. Dabei werden in der Regel alle Teilleistungen gemäß ihrer Leistungspunkte gewichtet. Bei der Bildung der Gesamtnote wird der Schwerpunkt mit 16 LP gewertet.

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

4 Masterarbeit

Für die Betreuung der Masterarbeit stehen je nach Vertiefungsrichtung folgende Institute (●) zur Wahl:

Institut für	Abk.	MB	E+UT	FzgT	M+M	PEK	PT	ThM	W+S
Automation und angewandte Informatik	IAI	●	●	●	●	●	●	●	●
Angewandte Werkstoffphysik	IAM-AWP	●	●	●	●	●	–	●	●
Arbeitswissenschaft und Betriebsorganisation	ifab	●	●	●	–	●	●	–	–
Fahrzeugsystemtechnik	FAST	●	●	●	●	●	–	●	●
Fördertechnik und Logistiksysteme	IFL	●	–	–	–	●	●	●	–
Informationsmanagement im Ingenieurwesen	IMI	●	–	●	●	●	●	–	–
Keramische Werkstoffe und Technologien	IAM-KWT	●	●	–	–	●	–	–	●
Angewandte Thermofluidik	IATF	●	●	–	–	–	–	–	–
Kolbenmaschinen	IFKM	●	●	●	–	●	–	–	–
Mess- und Regelungstechnik	MRT	●	●	●	●	●	–	●	–
Mikrostrukturtechnik	IMT	●	●	●	●	●	●	–	–
Produktentwicklung	IPEK	●	●	●	●	●	●	–	●
Produktionstechnik	WBK	●	–	●	●	●	●	–	●
Strömungsmechanik	ISTM	●	●	●	●	●	–	●	–
Technische Mechanik	ITM	●	●	●	●	●	●	●	●
Thermische Strömungsmaschinen	IST	●	●	●	–	●	–	●	●
Technische Thermodynamik	ITT	●	●	●	–	–	–	●	–
Werkstoff- und Biomechanik	IAM-WBM	●	●	●	●	●	●	●	●
Werkstoffkunde	IAM-WK	●	●	●	●	●	●	●	●
Computational Materials Science	IAM-CMS	●	●	●	●	●	–	●	●
Kern- und Energietechnik	IKET	●	●	–	–	–	–	–	–

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

5 Exemplarischer Studienverlaufsplan

Dieser exemplarische Studienverlaufsplan geht von einem Beginn des Studiums im Wintersemester aus. Bei Beginn im Sommersemester können sich Änderungen in der Abfolge der Module ergeben.

Lehrveranstaltungen 1. bis 4. Semester Angaben in Leistungspunkten (LP)	WS 1. Sem.	SS 2. Sem.	WS 3. Sem.	SS 4. Sem.
Produktentstehung – Bauteildimensionierung		7		
Produktentstehung – Entwicklungsmethodik		6		
Modellbildung und Simulation	7			
Mathematische Methoden			6	
Laborpraktikum	4			
Wahlpflichtmodul Maschinenbau	4		4	
Wahlpflichtmodul nat/inf/etit			6	
Wahlpflichtmodul wirt/recht			4	
Schlüsselqualifikationen			2	
Schwerpunkt I	8	8		
Schwerpunkt II		8	8	
Grundlagen und Methoden der Vertiefungsrichtung	4	4		
Masterarbeit				30

6 Änderungshistorie (ab 22.04.2015)

07.11.2016	redaktionelle Anpassung der TL-Namen in 2.1
28.06.2017	redaktionelle Anpassungen
13.07.2018	Anpassung der Schwerpunkte sowie redaktionelle Änderungen
08.05.2019	Änderung Punkt 2.1
30.08.2019	redaktionelle Änderungen, u.a. in Punkt 1.2 und 4
31.03.2020	redaktionelle Änderungen, u.a. in Punkt 1.1, 1.2 und Einfügung Punkt 5 (exemplarischer Studienablaufplan)
17.06.2024	Wegfall von Schwerpunkt Fahrdynamik, Fahrzeugkomfort und -akustik, Gauterin

9 Field of study structure

Mandatory	
Master's Thesis	30 CR
Advanced Engineering Fundamentals	50 CR
Specialization	40 CR
Voluntary	
Additional Examinations *This field will not influence the calculated grade of its parent.*	

9.1 Master's Thesis

Credits
30

Mandatory		
M-MACH-102858	Master's Thesis	30 CR

9.2 Advanced Engineering Fundamentals

Credits
50

Mandatory		
M-MACH-102593	Product Development - Dimensioning of Components	7 CR
M-MACH-102718	Product Development – Methods of Product Engineering	6 CR
M-MACH-102592	Modeling and Simulation	7 CR
M-MACH-102594	Mathematical Methods	6 CR
M-MACH-102591	Laboratory Course	4 CR
M-MACH-102597	Compulsory Elective Module Mechanical Engineering	8 CR
M-MACH-102595	Compulsory Elective Module Natural Science/Computer Science/Electrical Engineering	6 CR
M-MACH-102596	Compulsory Elective Subject Economics/Law	4 CR
M-MACH-102824	Key Competencies	2 CR

9.3 Specialization

Credits
40

Specialization (Election: 1 item)	
Specialization: General Mechanical Engineering	40 CR
Specialization: Energy- and Environment Engineering	40 CR
Specialization: Vehicle Technology	40 CR
Specialization: Mechatronics and Microsystems Technology	40 CR
Specialization: Product Development and Engineering Design	40 CR
Specialization: Production Technology	40 CR
Specialization: Theoretical Mechanical Engineering	40 CR
Specialization: Materials and Structures for High Performance Systems	40 CR

9.3.1 Specialization: General Mechanical Engineering

Part of: Specialization

Credits
40

Mandatory		
M-MACH-102405	Fundamentals and Methods of General Mechanical Engineering	8 CR
Major Fields (Election: 2 items)		
M-MACH-105904	Major Field: Advanced Materials Modelling and Data Management *First usage possible from Apr 01, 2022.*	16 CR
M-MACH-102598	Major Field: Advanced Mechatronics	16 CR
M-MACH-102646	Major Field: Applied Mechanics	16 CR
M-MACH-102599	Major Field: Powertrain Systems	16 CR
M-MACH-102601	Major Field: Automation Technology	16 CR
M-MACH-102641	Major Field: Rail System Technology	16 CR
M-MACH-102604	Major Field: Computational Mechanics	16 CR
M-MACH-102642	Major Field: Development of Innovative Appliances and Power Tools	16 CR
M-MACH-102605	Major Field: Engineering Design	16 CR
M-MACH-102643	Major Field: Fusion Technology	16 CR
M-MACH-102648	Major Field: Energy Technology for Buildings	16 CR
M-MACH-102623	Major Field: Fundamentals of Energy Technology	16 CR
M-MACH-102624	Major Field: Information Technology	16 CR
M-MACH-102625	Major Field: Information Technology of Logistic Systems	16 CR
M-MACH-102626	Major Field: Integrated Product Development	16 CR
M-MACH-102608	Major Field: Nuclear Energy	16 CR
M-MACH-102609	Major Field: Cognitive Technical Systems	16 CR
M-MACH-102607	Major Field: Vehicle Technology	16 CR
M-MACH-102627	Major Field: Energy Converting Engines	16 CR
M-MACH-102610	Major Field: Power Plant Technology	16 CR
M-MACH-102628	Major Field: Lightweight Construction	16 CR
M-MACH-102613	Major Field: Lifecycle Engineering	16 CR
M-MACH-102629	Major Field: Logistics and Material Flow Theory	16 CR
M-MACH-102611	Major Field: Materials Science and Engineering	16 CR
M-MACH-102614	Major Field: Mechatronics	16 CR
M-MACH-102615	Major Field: Medical Technology	16 CR
M-MACH-102600	Major Field: Man - Technology - Organisation	16 CR
M-MACH-102647	Major Field: Microactuators and Microsensors	16 CR
M-MACH-102616	Major Field: Microsystem Technology	16 CR
M-MACH-102630	Major Field: Mobile Machines	16 CR
M-MACH-104434	Major Field: Modeling and Simulation in Dynamics	16 CR
M-MACH-102612	Major Field: Modeling and Simulation in Energy- and Fluid Engineering	16 CR
M-MACH-102632	Major Field: Polymer Engineering	16 CR
M-MACH-102618	Major Field: Production Technology	16 CR
M-MACH-102633	Major Field: Robotics	16 CR
M-MACH-104443	Major Field: Vibration Theory	16 CR
M-MACH-102634	Major Field: Fluid Mechanic	16 CR
M-MACH-102619	Major Field: Technical Ceramics and Powder Materials	16 CR
M-MACH-102640	Major Field: Technical Logistics	16 CR
M-MACH-102635	Major Field: Engineering Thermodynamics	16 CR
M-MACH-102636	Major Field: Thermal Turbomachines	16 CR
M-MACH-102637	Major Field: Tribology	16 CR
M-MACH-102650	Major Field: Combustion Engines Based Powertrains	16 CR
M-MACH-102602	Major Field: Reliability in Mechanical Engineering	16 CR

9.3.2 Specialization: Energy- and Environment Engineering

Part of: Specialization

Credits 40

Mandatory		
M-MACH-102575	Fundamentals and Methods of Energy and Environmental Engineering	8 CR
M-MACH-102623	Major Field: Fundamentals of Energy Technology	16 CR
Major Field (Election: 1 item)		
M-MACH-102598	Major Field: Advanced Mechatronics	16 CR
M-MACH-102646	Major Field: Applied Mechanics	16 CR
M-MACH-102601	Major Field: Automation Technology	16 CR
M-MACH-102642	Major Field: Development of Innovative Appliances and Power Tools	16 CR
M-MACH-102605	Major Field: Engineering Design	16 CR
M-MACH-102643	Major Field: Fusion Technology	16 CR
M-MACH-102648	Major Field: Energy Technology for Buildings	16 CR
M-MACH-102624	Major Field: Information Technology	16 CR
M-MACH-104323	Major Field: Innovation and Entrepreneurship	16 CR
M-MACH-102626	Major Field: Integrated Product Development	16 CR
M-MACH-102608	Major Field: Nuclear Energy	16 CR
M-MACH-102627	Major Field: Energy Converting Engines	16 CR
M-MACH-102610	Major Field: Power Plant Technology	16 CR
M-MACH-102628	Major Field: Lightweight Construction	16 CR
M-MACH-102611	Major Field: Materials Science and Engineering	16 CR
M-MACH-102614	Major Field: Mechatronics	16 CR
M-MACH-102600	Major Field: Man - Technology - Organisation	16 CR
M-MACH-102647	Major Field: Microactuators and Microsensors	16 CR
M-MACH-102616	Major Field: Microsystem Technology	16 CR
M-MACH-104434	Major Field: Modeling and Simulation in Dynamics	16 CR
M-MACH-102612	Major Field: Modeling and Simulation in Energy- and Fluid Engineering	16 CR
M-MACH-102632	Major Field: Polymer Engineering	16 CR
M-MACH-104443	Major Field: Vibration Theory	16 CR
M-MACH-102634	Major Field: Fluid Mechanic	16 CR
M-MACH-102619	Major Field: Technical Ceramics and Powder Materials	16 CR
M-MACH-102635	Major Field: Engineering Thermodynamics	16 CR
M-MACH-102636	Major Field: Thermal Turbomachines	16 CR
M-MACH-102637	Major Field: Tribology	16 CR
M-MACH-102650	Major Field: Combustion Engines Based Powertrains	16 CR
M-MACH-102602	Major Field: Reliability in Mechanical Engineering	16 CR

9.3.3 Specialization: Vehicle Technology

Part of: Specialization

Credits 40

Mandatory		
M-MACH-102739	Fundamentals and Methods of Automotive Engineering	8 CR
Major Field (p) (Election: between 1 and 2 items)		
M-MACH-102641	Major Field: Rail System Technology	16 CR
M-MACH-102607	Major Field: Vehicle Technology	16 CR
M-MACH-102630	Major Field: Mobile Machines	16 CR
M-MACH-102650	Major Field: Combustion Engines Based Powertrains	16 CR
Major Field (Election: between 0 and 1 items)		
M-MACH-102598	Major Field: Advanced Mechatronics	16 CR
M-MACH-102646	Major Field: Applied Mechanics	16 CR
M-MACH-102599	Major Field: Powertrain Systems	16 CR
M-MACH-102601	Major Field: Automation Technology	16 CR
M-MACH-102604	Major Field: Computational Mechanics	16 CR
M-MACH-102642	Major Field: Development of Innovative Appliances and Power Tools	16 CR
M-MACH-102605	Major Field: Engineering Design	16 CR
M-MACH-102623	Major Field: Fundamentals of Energy Technology	16 CR
M-MACH-102624	Major Field: Information Technology	16 CR
M-MACH-102626	Major Field: Integrated Product Development	16 CR
M-MACH-102609	Major Field: Cognitive Technical Systems	16 CR
M-MACH-102627	Major Field: Energy Converting Engines	16 CR
M-MACH-102628	Major Field: Lightweight Construction	16 CR
M-MACH-102613	Major Field: Lifecycle Engineering	16 CR
M-MACH-102611	Major Field: Materials Science and Engineering	16 CR
M-MACH-102614	Major Field: Mechatronics	16 CR
M-MACH-102647	Major Field: Microactuators and Microsensors	16 CR
M-MACH-102616	Major Field: Microsystem Technology	16 CR
M-MACH-104434	Major Field: Modeling and Simulation in Dynamics	16 CR
M-MACH-102612	Major Field: Modeling and Simulation in Energy- and Fluid Engineering	16 CR
M-MACH-102632	Major Field: Polymer Engineering	16 CR
M-MACH-102618	Major Field: Production Technology	16 CR
M-MACH-104443	Major Field: Vibration Theory	16 CR
M-MACH-102634	Major Field: Fluid Mechanic	16 CR
M-MACH-102619	Major Field: Technical Ceramics and Powder Materials	16 CR
M-MACH-102635	Major Field: Engineering Thermodynamics	16 CR
M-MACH-102636	Major Field: Thermal Turbomachines	16 CR
M-MACH-102637	Major Field: Tribology	16 CR
M-MACH-102602	Major Field: Reliability in Mechanical Engineering	16 CR

9.3.4 Specialization: Mechatronics and Microsystems Technology

Part of: Specialization

Credits 40

Mandatory		
M-MACH-102740	Fundamentals and Methods of Mechatronics and Microsystem Technology	8 CR
Major Field (p) (Election: between 1 and 2 items)		
M-MACH-102598	Major Field: Advanced Mechatronics	16 CR
M-MACH-102601	Major Field: Automation Technology	16 CR
M-MACH-102614	Major Field: Mechatronics	16 CR
M-MACH-102616	Major Field: Microsystem Technology	16 CR
M-MACH-102633	Major Field: Robotics	16 CR
Major Field (Election: between 0 and 1 items)		
M-MACH-102646	Major Field: Applied Mechanics	16 CR
M-MACH-102641	Major Field: Rail System Technology	16 CR
M-MACH-102604	Major Field: Computational Mechanics	16 CR
M-MACH-102623	Major Field: Fundamentals of Energy Technology	16 CR
M-MACH-102624	Major Field: Information Technology	16 CR
M-MACH-102609	Major Field: Cognitive Technical Systems	16 CR
M-MACH-102613	Major Field: Lifecycle Engineering	16 CR
M-MACH-102611	Major Field: Materials Science and Engineering	16 CR
M-MACH-102615	Major Field: Medical Technology	16 CR
M-MACH-102647	Major Field: Microactuators and Microsensors	16 CR
M-MACH-102630	Major Field: Mobile Machines	16 CR
M-MACH-104434	Major Field: Modeling and Simulation in Dynamics	16 CR
M-MACH-102612	Major Field: Modeling and Simulation in Energy- and Fluid Engineering	16 CR
M-MACH-104443	Major Field: Vibration Theory	16 CR
M-MACH-102635	Major Field: Engineering Thermodynamics	16 CR
M-MACH-102637	Major Field: Tribology	16 CR
M-MACH-102650	Major Field: Combustion Engines Based Powertrains	16 CR
M-MACH-102602	Major Field: Reliability in Mechanical Engineering	16 CR

9.3.5 Specialization: Product Development and Engineering Design

Part of: Specialization

Credits 40

Mandatory		
M-MACH-102741	Fundamentals and Methods of Product Development and Construction	8 CR
Major Field (p) (Election: between 1 and 2 items)		
M-MACH-102642	Major Field: Development of Innovative Appliances and Power Tools	16 CR
M-MACH-102626	Major Field: Integrated Product Development	16 CR
M-MACH-102613	Major Field: Lifecycle Engineering	16 CR
Major Field (Election: between 0 and 1 items)		
M-MACH-102598	Major Field: Advanced Mechatronics	16 CR
M-MACH-102646	Major Field: Applied Mechanics	16 CR
M-MACH-102599	Major Field: Powertrain Systems	16 CR
M-MACH-102601	Major Field: Automation Technology	16 CR
M-MACH-102641	Major Field: Rail System Technology	16 CR
M-MACH-102604	Major Field: Computational Mechanics	16 CR
M-MACH-102605	Major Field: Engineering Design	16 CR
M-MACH-102623	Major Field: Fundamentals of Energy Technology	16 CR
M-MACH-102624	Major Field: Information Technology	16 CR
M-MACH-102625	Major Field: Information Technology of Logistic Systems	16 CR
M-MACH-102609	Major Field: Cognitive Technical Systems	16 CR
M-MACH-102607	Major Field: Vehicle Technology	16 CR
M-MACH-102627	Major Field: Energy Converting Engines	16 CR
M-MACH-102610	Major Field: Power Plant Technology	16 CR
M-MACH-102628	Major Field: Lightweight Construction	16 CR
M-MACH-102629	Major Field: Logistics and Material Flow Theory	16 CR
M-MACH-102611	Major Field: Materials Science and Engineering	16 CR
M-MACH-102614	Major Field: Mechatronics	16 CR
M-MACH-102615	Major Field: Medical Technology	16 CR
M-MACH-102600	Major Field: Man - Technology - Organisation	16 CR
M-MACH-102647	Major Field: Microactuators and Microsensors	16 CR
M-MACH-102616	Major Field: Microsystem Technology	16 CR
M-MACH-102630	Major Field: Mobile Machines	16 CR
M-MACH-104434	Major Field: Modeling and Simulation in Dynamics	16 CR
M-MACH-102612	Major Field: Modeling and Simulation in Energy- and Fluid Engineering	16 CR
M-MACH-102632	Major Field: Polymer Engineering	16 CR
M-MACH-102618	Major Field: Production Technology	16 CR
M-MACH-102633	Major Field: Robotics	16 CR
M-MACH-104443	Major Field: Vibration Theory	16 CR
M-MACH-102634	Major Field: Fluid Mechanic	16 CR
M-MACH-102619	Major Field: Technical Ceramics and Powder Materials	16 CR
M-MACH-102640	Major Field: Technical Logistics	16 CR
M-MACH-102635	Major Field: Engineering Thermodynamics	16 CR
M-MACH-102637	Major Field: Tribology	16 CR
M-MACH-102650	Major Field: Combustion Engines Based Powertrains	16 CR
M-MACH-102602	Major Field: Reliability in Mechanical Engineering	16 CR

9.3.6 Specialization: Production Technology

Part of: Specialization

Credits 40

Mandatory		
M-MACH-102742	Fundamentals and Methods of Production Technology	8 CR
Major Field (p) (Election: between 1 and 2 items)		
M-MACH-102613	Major Field: Lifecycle Engineering	16 CR
M-MACH-102629	Major Field: Logistics and Material Flow Theory	16 CR
M-MACH-102600	Major Field: Man - Technology - Organisation	16 CR
M-MACH-102618	Major Field: Production Technology	16 CR
Major Field (Election: between 0 and 1 items)		
M-MACH-102598	Major Field: Advanced Mechatronics	16 CR
M-MACH-102646	Major Field: Applied Mechanics	16 CR
M-MACH-102599	Major Field: Powertrain Systems	16 CR
M-MACH-102601	Major Field: Automation Technology	16 CR
M-MACH-102642	Major Field: Development of Innovative Appliances and Power Tools	16 CR
M-MACH-102605	Major Field: Engineering Design	16 CR
M-MACH-102624	Major Field: Information Technology	16 CR
M-MACH-102625	Major Field: Information Technology of Logistic Systems	16 CR
M-MACH-102626	Major Field: Integrated Product Development	16 CR
M-MACH-102609	Major Field: Cognitive Technical Systems	16 CR
M-MACH-102628	Major Field: Lightweight Construction	16 CR
M-MACH-102611	Major Field: Materials Science and Engineering	16 CR
M-MACH-102614	Major Field: Mechatronics	16 CR
M-MACH-102647	Major Field: Microactuators and Microsensors	16 CR
M-MACH-102616	Major Field: Microsystem Technology	16 CR
M-MACH-102630	Major Field: Mobile Machines	16 CR
M-MACH-104434	Major Field: Modeling and Simulation in Dynamics	16 CR
M-MACH-102632	Major Field: Polymer Engineering	16 CR
M-MACH-102633	Major Field: Robotics	16 CR
M-MACH-104443	Major Field: Vibration Theory	16 CR
M-MACH-102640	Major Field: Technical Logistics	16 CR
M-MACH-102637	Major Field: Tribology	16 CR
M-MACH-102602	Major Field: Reliability in Mechanical Engineering	16 CR

9.3.7 Specialization: Theoretical Mechanical Engineering

Part of: Specialization

Credits 40

Mandatory		
M-MACH-102743	Fundamentals and Methods of Theoretical Foundations of Mechanical Engineering	8 CR
Major Field (p) (Election: between 1 and 2 items)		
M-MACH-102646	Major Field: Applied Mechanics	16 CR
M-MACH-102604	Major Field: Computational Mechanics	16 CR
M-MACH-104434	Major Field: Modeling and Simulation in Dynamics	16 CR
M-MACH-104443	Major Field: Vibration Theory	16 CR
M-MACH-102634	Major Field: Fluid Mechanic	16 CR
Major Field (Election: between 0 and 1 items)		
M-MACH-105904	Major Field: Advanced Materials Modelling and Data Management *First usage possible from Apr 01, 2022.*	16 CR
M-MACH-102598	Major Field: Advanced Mechatronics	16 CR
M-MACH-102601	Major Field: Automation Technology	16 CR
M-MACH-102643	Major Field: Fusion Technology	16 CR
M-MACH-102624	Major Field: Information Technology	16 CR
M-MACH-102608	Major Field: Nuclear Energy	16 CR
M-MACH-102609	Major Field: Cognitive Technical Systems	16 CR
M-MACH-102611	Major Field: Materials Science and Engineering	16 CR
M-MACH-102614	Major Field: Mechatronics	16 CR
M-MACH-102633	Major Field: Robotics	16 CR
M-MACH-102635	Major Field: Engineering Thermodynamics	16 CR
M-MACH-102636	Major Field: Thermal Turbomachines	16 CR
M-MACH-102637	Major Field: Tribology	16 CR
M-MACH-102602	Major Field: Reliability in Mechanical Engineering	16 CR

9.3.8 Specialization: Materials and Structures for High Performance Systems

Part of: Specialization

Credits 40

Mandatory		
M-MACH-102744	Fundamentals and Methods of Materials and Structures for High Performance Systems	8 CR
Major Field (p) (Election: between 1 and 2 items)		
M-MACH-102611	Major Field: Materials Science and Engineering	16 CR
M-MACH-102602	Major Field: Reliability in Mechanical Engineering	16 CR
Major Field (Election: between 0 and 1 items)		
M-MACH-105904	Major Field: Advanced Materials Modelling and Data Management *First usage possible from Apr 01, 2022.*	16 CR
M-MACH-102646	Major Field: Applied Mechanics	16 CR
M-MACH-102628	Major Field: Lightweight Construction	16 CR
M-MACH-102632	Major Field: Polymer Engineering	16 CR
M-MACH-102619	Major Field: Technical Ceramics and Powder Materials	16 CR
M-MACH-102635	Major Field: Engineering Thermodynamics	16 CR
M-MACH-102636	Major Field: Thermal Turbomachines	16 CR
M-MACH-102637	Major Field: Tribology	16 CR

9.4 Additional Examinations

Additional Examinations (Election: at most 30 credits)		
M-FORUM-106753	Supplementary Studies on Science, Technology and Society *First usage possible from Oct 01, 2024.*	16 CR

10 Modules

M 10.1 Module: Compulsory Elective Module Mechanical Engineering (MSc-Modul 04, WF) [M-MACH-102597]

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

Part of: Advanced Engineering Fundamentals

Credits	Grading scale	Recurrence	Duration	Language	Level	Version
8	Grade to a tenth	Each term	1 term	German/English	4	13

Compulsory Elective Module Mechanical Engineering (Election: 2 items)			
T-MACH-105173	Analysis of Exhaust Gas and Lubricating Oil in Combustion Engines	4 CR	Gohl
T-MACH-105437	Aerothermodynamics	4 CR	Frohnapfel, Seiler
T-MACH-105215	Applied Tribology in Industrial Product Development	4 CR	Albers, Lorentz, Matthiesen
T-MACH-105527	Applied Materials Simulation	4 CR	Gumbsch, Schneider
T-MACH-110929	Applied Materials Simulation	4 CR	Gumbsch, Schneider
T-MACH-105307	Drive Train of Mobile Machines	4 CR	Geimer
T-MACH-105649	Boosting of Combustion Engines	4 CR	Kech, Kubach
T-MACH-105518	Human Factors Engineering I	4 CR	Deml
T-MACH-105519	Human Factors Engineering II	4 CR	Deml
T-MACH-113412	Atomistic Simulations and Particle Dynamics	4 CR	Gumbsch, Schneider, Weygand
T-MACH-102141	Constitution and Properties of Wearresistant Materials	4 CR	Ulrich
T-MACH-105150	Constitution and Properties of Protective Coatings	4 CR	Ulrich
T-MACH-105381	Virtual Engineering (Specific Topics)	4 CR	Ovtcharova
T-MACH-102160	Selected Applications of Technical Logistics	4 CR	Milushev, Mittwollen
T-MACH-105428	Selected Chapters of the Combustion Fundamentals	4 CR	Maas
T-MACH-105462	Selected Problems of Applied Reactor Physics and Exercises	4 CR	Dagan
T-MACH-105310	Design of Highly Stresses Components	4 CR	Aktaa
T-MACH-105311	Design and Development of Mobile Machines	4 CR	Geimer
T-MACH-110958	Design and Optimization of Conventional and Electrified Automotive Transmissions	4 CR	Albers, Faust
T-MACH-106424	Rail System Technology	4 CR	Cichon
T-MACH-113359	Boosting the Modern Energy Landscape via Turbo Machines & Machine Learning	4 CR	Bauer
T-MACH-109933	Business Administration for Engineers and IT Professionals	4 CR	Sebregondi
T-MACH-111623	Fuels and Lubricants for Engine Powertrains	4 CR	Kehrwald, Kubach
T-MACH-105184	Fuels and Lubricants for Combustion Engines	4 CR	Kehrwald, Kubach
T-MACH-112817	Biomedical Engineering for Engineers - Fundamentals of Project Management in Medical Engineering	4 CR	Ahrens, Guber, Rajabi
T-MACH-100966	BioMEMS - Microsystems Technologies for Life-Sciences and Medicine I	4 CR	Guber
T-MACH-100967	BioMEMS - Microsystems Technologies for Life-Sciences and Medicine II	4 CR	Guber
T-MACH-100968	BioMEMS - Microsystems Technologies for Life-Sciences and Medicine III	4 CR	Guber
T-MACH-106877	BioMEMS - Microsystems Technologies for Life-Sciences and Medicine IV	4 CR	Ahrens, Guber
T-MACH-105212	CAE-Workshop	4 CR	Albers, Matthiesen
T-MACH-105407	CFD for Power Engineering	4 CR	Otic

T-MACH-105314	Computational Intelligence	4 CR	Meisenbacher, Mikut, Reischl
T-MACH-111193	Data Driven Engineering 1: Machine Learning for Dynamical Systems	4 CR	Bauer
T-MACH-105694	Data Analytics for Engineers	5 CR	Meisenbacher, Mikut, Reischl
T-MACH-113597	Decision-Making and Motion Planning for Automated Driving	6 CR	Naumann, Werling
T-MACH-108719	Designing with numerical methods in product development	4 CR	Schnack
T-MACH-105540	Railways in the Transportation Market	4 CR	Cichon
T-MACH-108721	Designing with Composites	4 CR	Schnack
T-MACH-105391	Finite Difference Methods for Numerial Solution of Thermal and Fluid Dynamical Problems	4 CR	Günther
T-MACH-113016	Digitization in the Railway System	4 CR	Cichon
T-MACH-105317	Digital Control	4 CR	Knoop
T-MACH-105226	Dynamics of the Automotive Drive Train	5 CR	Fidlin
T-MACH-111807	Introduction to Bionics	4 CR	Hölscher
T-MACH-105320	Introduction to the Finite Element Method	3 CR	Böhlke, Langhoff
T-MACH-108718	Introduction to numerical mechanics	4 CR	Schnack
T-MACH-105525	Introduction to Nuclear Energy	4 CR	Cheng
T-MACH-105321	Introduction to Theory of Materials	4 CR	Kamlah
T-MACH-100535	Introduction into Mechatronics	6 CR	Orth, Reischl
T-MACH-105209	Introduction to Multi-Body Dynamics	5 CR	Römer
T-MACH-111814	Introduction to Nanotechnology	4 CR	Hölscher
T-MACH-105439	Introduction to Nonlinear Vibrations	7 CR	Fidlin
T-MACH-102159	Elements and Systems of Technical Logistics	4 CR	Fischer, Mittwollen
T-MACH-105151	Energy Efficient Intralogistic Systems	4 CR	Kramer, Schönung
T-MACH-105952	Energy Storage and Network Integration	4 CR	Schmidt
T-MACH-105408	Energy Systems I: Renewable Energy	4 CR	Dagan
T-MACH-110817	Development of Hybrid Drivetrains	4 CR	Koch
T-MACH-105984	Fatigue of Welded Components and Structures	3 CR	Farajian
T-MACH-105228	Organ Support Systems	4 CR	Pylatiuk
T-MACH-105512	Experimental Fluid Mechanics	4 CR	Kriegseis
T-MACH-106373	Experimental techniques in thermo- and fluid-dynamics	4 CR	Cheng
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-105237	Vehicle Lightweight Design - Strategies, Concepts, Materials	4 CR	Henning
T-MACH-107667	Solid State Reactions and Kinetics of Phase	4 CR	Franke, Seifert
T-MACH-102207	Tires and Wheel Development for Passenger Cars	4 CR	Leister
T-MACH-105218	Automotive Vision	6 CR	Lauer, Stiller
T-MACH-113069	Vehicle Systems for Urban Mobility	4 CR	Cichon
T-MACH-105535	Composite Manufacturing - Polymers, Fibers, Semi-Finished Products, Manufacturing Technologies	4 CR	Henning
T-MACH-102166	Fabrication Processes in Microsystem Technology	4 CR	Bade
T-MACH-105394	Finite Volume Methods for Fluid Flow	4 CR	Günther
T-MACH-105474	Fluid-Structure-Interaction	4 CR	Frohnapfel, Mühlhausen
T-MACH-102093	Fluid Power Systems	4 CR	Geimer
T-MACH-105411	Fusion Technology A	4 CR	Perez Martin, Weiss
T-MACH-105433	Fusion Technology B	4 CR	N.N.
T-MACH-105444	Combined Cycle Power Plants	4 CR	Banuti, Schulenberg
T-MACH-105467	Microstructure Characteristics Relationships	6 CR	Gruber, Kraft
T-MACH-105157	Foundry Technology	4 CR	Günther, Klan
T-MACH-111003	Global Logistics	4 CR	Furmans
T-MACH-110991	Global Production	4 CR	Lanza

T-MACH-110816	Large Diesel and Gas Engines for Ship Propulsions	4 CR	Kubach
T-MACH-102117	Automotive Engineering II	4 CR	Gauterin, Gießler
T-MACH-102111	Principles of Ceramic and Powder Metallurgy Processing	4 CR	Schell
T-MACH-105044	Fundamentals of Catalytic Exhaust Gas Aftertreatment	4 CR	Deutschmann, Grunwaldt, Kubach, Lox
T-MACH-105235	Principles of Medicine for Engineers	4 CR	Pylatiuk
T-MACH-105182	Introduction to Microsystem Technology I	4 CR	Badilita, Jouda, Korvink
T-MACH-105183	Introduction to Microsystem Technology II	4 CR	Jouda, Korvink
T-MACH-105324	Foundations of Nonlinear Continuum Mechanics	4 CR	Kamlah
T-MACH-109919	Basics of Technical Logistics I	4 CR	Mittwollen, Oellerich
T-MACH-109920	Basics of Technical Logistics II	6 CR	Furmans
T-MACH-105213	Fundamentals of Combustion I	4 CR	Maas
T-MACH-105325	Fundamentals of Combustion II	4 CR	Bykov, Maas
T-MACH-105424	Optical Flow Measurement: Fundamentals and Applications	4 CR	Frohnapfel, Seiler
T-MACH-106746	Hands-on BioMEMS	4 CR	Guber
T-MACH-105398	High Performance Computing	5 CR	Nestler, Selzer
T-MACH-105459	High Temperature Materials	4 CR	Heilmaier
T-MACH-106374	Human-oriented Productivity Management: Personnel Management	4 CR	Stock
T-MACH-105425	Hydrodynamic Stability: From Order to Chaos	4 CR	Class
T-MACH-105375	Industrial Aerodynamics	4 CR	Frohnapfel, Kröber
T-MACH-105388	Introduction to Industrial Production Economics	4 CR	Dürrschnabel
T-MACH-112882	Innovation2Business – Innovation Strategy in the Industrial Corporate Practice	4 CR	Albers
T-MACH-113068	Innovation and Project Management in Rail Vehicle Engineering	4 CR	Cichon
T-MACH-105404	Innovative Nuclear Systems	4 CR	Cheng
T-MACH-110334	International Production Engineering A	4 CR	Fleischer
T-MACH-110335	International Production Engineering B	4 CR	Fleischer
T-MACH-105466	Introduction to Neutron Cross Section Theory and Nuclear Data Generation	4 CR	Dagan
T-MACH-100287	Introduction to Ceramics	6 CR	Schell
T-MACH-102182	Ceramic Processing Technology	4 CR	Binder
T-MACH-105402	Nuclear Power Plant Technology	4 CR	Badea, Cheng
T-MACH-105410	Coal Fired Power Plants	4 CR	Schulenberg
T-MACH-105330	Design with Plastics	4 CR	Liedel
T-MACH-100293	Structural Materials	6 CR	Guth
T-MACH-105221	Lightweight Engineering Design	4 CR	Düser, Ott
T-MACH-110377	Continuum Mechanics of Solids and Fluids	3 CR	Böhlke, Frohnapfel
T-MACH-105786	Contact Mechanics	4 CR	Greiner
T-MACH-112115	Artificial Intelligence in Production	4 CR	Fleischer
T-MACH-105164	Laser in Automotive Engineering	4 CR	Schneider
T-MACH-112763	Laser Material Processing	4 CR	Schneider
T-MACH-105231	Leadership and Management Development	4 CR	Albers, Matthiesen, Ploch
T-MACH-110954	Lightweight Constructions with Fiber-Reinforced-Polymers – Theory and Practice	4 CR	Kärger, Liebig
T-MACH-105426	Magnetohydrodynamics	4 CR	Bühler
T-MACH-105434	Magnet Technology of Fusion Reactors	4 CR	Weiss, Wolf
T-MACH-105440	Leadership and Conflict Management	4 CR	Hatzl
T-MACH-105224	Machine Dynamics II	4 CR	Proppe
T-MACH-108957	Mathematical Fundamentals of Numerical Mechanics	4 CR	Schnack
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	Fidlin, Höllig, Römer
T-MACH-105295	Mathematical Methods in Fluid Mechanics	6 CR	Frohnapfel
T-MACH-105419	Mathematical Models and Methods in Combustion Theory	4 CR	Bykov
T-MACH-105189	Mathematical Models and Methods for Production Systems	6 CR	Baumann, Furmans
T-MACH-108717	Mechanics of Laminated Composites	4 CR	Schnack
T-MACH-105333	Mechanics and Strength of Polymers	4 CR	von Bernstorff
T-MACH-105334	Mechanics in Microtechnology	4 CR	Greiner, Gruber
T-MACH-105335	Measurement II	4 CR	Stiller
T-MACH-105468	Metals	6 CR	Heilmaier, Pundt
T-MACH-105167	Analysis Tools for Combustion Diagnostics	4 CR	Pfeil
T-MACH-105557	Microenergy Technologies	4 CR	Kohl
T-MACH-101910	Microactuators	4 CR	Kohl
T-MACH-105303	Modelling of Microstructures	5 CR	August, Nestler
T-MACH-111030	Micro- and nanotechnology in implant technology	4 CR	Ahrens, Doll
T-MACH-102199	Model Based Application Methods	4 CR	Kirschbaum
T-MACH-105396	Modeling of Thermodynamical Processes	6 CR	Maas, Schießl
T-MACH-100300	Modelling and Simulation	5 CR	Gumbsch, Nestler
T-MACH-113367	Modeling of polymer and suspension flows for industrial manufacturing processes	4 CR	Kärger, Wittemann
T-MACH-105169	Engine Measurement Techniques	4 CR	Bernhardt
T-MACH-111578	Sustainable Vehicle Drivetrains	4 CR	Koch, Toedter
T-MACH-102167	Nanotribology and -Mechanics	4 CR	Dienwiebel, Hölscher
T-MACH-111026	Nonlinear Continuum Mechanics	3 CR	Böhlke
T-MACH-108720	Numerical Mechanics for Industrial Applications	4 CR	Schnack
T-MACH-105420	Numerical Simulation of Multi-Phase Flows	4 CR	Wörner
T-MACH-102200	Polymers in MEMS C: Biopolymers and Bioplastics	4 CR	Rapp, Worgull
T-MACH-105339	Numerical Simulation of Reacting Two Phase Flows	4 CR	Koch
T-MACH-105397	Numerical Simulation of Turbulent Flows	4 CR	Grötzbach
T-MACH-105338	Numerical Fluid Mechanics	4 CR	Gatti, Magagnato
T-MACH-105442	Intellectual Property Rights and Strategies in Industrial Companies	4 CR	Düser, Zacharias
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-105516	Multi-Scale Plasticity	4 CR	Greiner, Schulz
T-MACH-102181	PLM for Product Development in Mechatronics	4 CR	Eigner
T-MACH-102137	Polymer Engineering I	4 CR	Liebig
T-MACH-102138	Polymer Engineering II	4 CR	Liebig
T-MACH-102192	Polymers in MEMS A: Chemistry, Synthesis and Applications	4 CR	Rapp
T-MACH-102191	Polymers in MEMS B: Physics, Microstructuring and Applications	4 CR	Worgull
T-MACH-113713	Practical Course: Autonomous Driving	6 CR	Frey, Gießler
T-MACH-105147	Product Lifecycle Management	4 CR	Ovtcharova
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-110984	Production Technology for E-Mobility	4 CR	Fleischer
T-MACH-105523	Productivity Management in Production Systems	4 CR	Stowasser
T-MACH-102156	Project Workshop: Automotive Engineering	6 CR	Frey, Gauterin, Gießler
T-MACH-105441	Development of Oil-Hydraulic Powertrain Systems	4 CR	Geerling
T-MACH-105348	Process Simulation in Forming Operations	4 CR	Helm
T-MACH-102157	High Performance Powder Metallurgy Materials	4 CR	Schell
T-MACH-102107	Quality Management	4 CR	Lanza
T-MACH-105405	Reactor Safety I: Fundamentals	4 CR	Sanchez-Espinoza

T-MACH-105350	Computational Vehicle Dynamics	4 CR	Proppe
T-MACH-105351	Computational Mechanics I	6 CR	Böhlke, Langhoff
T-MACH-105352	Computational Mechanics II	6 CR	Böhlke, Langhoff
T-MACH-105421	Reduction Methods for the Modeling and the Simulation of Combustion Processes	4 CR	Bykov
T-MACH-111888	Re:Invent - Revolutionary Business Models as the Basis for Product Innovations	4 CR	Schneider
T-MACH-109122	X-ray Optics	4 CR	Last
T-MACH-105724	Failure Analysis	4 CR	Greiner, Schneider
T-MACH-105353	Rail Vehicle Technology	4 CR	Cichon
T-MACH-112106	Fatigue of Materials	4 CR	Guth
T-MACH-112121	Seminar Application of Artificial Intelligence in Production	4 CR	Fleischer
T-INFO-109911	Safe Human-Robot-Collaboration	3 CR	Kurth
T-MACH-105171	Safety Engineering	4 CR	Kany
T-MACH-105971	Simulation of the Process Chain of Continuously Fiber Reinforced Composite Structure	4 CR	Kärger
T-MACH-105172	Simulation of Coupled Systems	4 CR	Geimer
T-MACH-105400	Scaling in Fluid Dynamics	4 CR	Bühler
T-MACH-106493	Solar Thermal Energy Systems	4 CR	Dagan
T-MACH-105372	Theory of Stability	6 CR	Fidlin
T-MACH-111821	Control of Mobile Machines	4 CR	Becker, Geimer
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-105422	Flows with Chemical Reactions	4 CR	Class
T-MACH-105403	Flows and Heat Transfer in Energy Technology	4 CR	Cheng
T-MACH-102170	Structural and Phase Analysis	4 CR	Wagner
T-MACH-105970	Structural Analysis of Composite Laminates	4 CR	Kärger
T-MACH-102103	Superhard Thin Film Materials	4 CR	Ulrich
T-MACH-105358	Sustainable Product Engineering	4 CR	Albers, Matthiesen, Ziegahn
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-111382	Technical Acoustics	4 CR	Pantle, Walter
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-105361	Technical Design in Product Development	4 CR	Albers, Matthiesen, Schmid
T-MACH-105362	Technology of Steel Components	4 CR	Schulze
T-MACH-105456	Ten Lectures on Turbulence	4 CR	Otic
T-MACH-105363	Thermal Turbomachines I	6 CR	Bauer
T-MACH-105364	Thermal Turbomachines II	6 CR	Bauer
T-MACH-107670	Fundamentals in Materials Thermodynamics and Heterogeneous Equilibria	4 CR	Franke, Seifert
T-MACH-106372	Thermal-Fluid-Dynamics	4 CR	Ruck
T-MACH-105423	Tractors	4 CR	Geimer, Kremmer
T-MACH-105366	Turbo Jet Engines	4 CR	Bauer
T-MACH-111591	Turbo Charging of Internal Combustion Engines	4 CR	Kech, Kubach
T-MACH-105177	Metal Forming	4 CR	Herlan
T-MACH-105429	Combustion Diagnositics	4 CR	Maas, Schießl
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-102148	Gear Cutting Technology	4 CR	Klaiber

T-MACH-102123	Virtual Engineering I	4 CR	Ovtcharova
T-MACH-102124	Virtual Engineering II	4 CR	Ovtcharova
T-MACH-105430	Heatpumps	4 CR	Maas, Wirbser
T-MACH-105529	Heat Transfer in Nuclear Reactors	4 CR	Cheng
T-MACH-113362	Heat Transfer and Cooling at Thermally Highly Loaded Components	4 CR	Bauer, Schulz
T-MACH-105416	Hydrogen Technologies	4 CR	Jedicke, Jordan
T-MACH-105211	Materials of Lightweight Construction	4 CR	Liebig
T-MACH-105369	Materials Modelling: Dislocation Based Plasticity	4 CR	Weygand
T-MACH-100532	Scientific Computing for Engineers	4 CR	Gumbsch, Weygand
T-MACH-105985	Ignition Systems	4 CR	Toedter
T-MACH-111840	Reliability and Test Engineering	5 CR	Gwosch
T-MACH-105406	Two-Phase Flow and Heat Transfer	4 CR	Schulenberg, Wörner
Compulsory Elective Module Mechanical Engineering (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
T-MACH-108889	BUS-Controls - Advance *This item will not influence the grade calculation of this parent.*	0 CR	Geimer
T-MACH-110928	Exercises for Applied Materials Simulation	2 CR	Gumbsch, Schneider
T-MACH-108888	Simulation of Coupled Systems - Advance *This item will not influence the grade calculation of this parent.*	0 CR	Geimer
T-MACH-110396	Strategic Product Development - Identification of Potentials of Innovative Products - Case Study *This item will not influence the grade calculation of this parent.*	1 CR	Albers, Matthiesen, Siebe
T-MACH-111820	Control of Mobile Machines – Prerequisites	0 CR	Becker, Geimer
T-MACH-111027	Tutorial Nonlinear Continuum Mechanics	1 CR	Böhlke
T-MACH-109304	Excercises - Fatigue of Welded Components and Structures *This item will not influence the grade calculation of this parent.*	1 CR	Farajian
T-MACH-107671	Exercises for Applied Materials Simulation *This item will not influence the grade calculation of this parent.*	2 CR	Gumbsch, Schneider
T-MACH-110330	Tutorial Introduction to the Finite Element Method	1 CR	Böhlke, Langhoff
T-MACH-107632	Exercises for Solid State Reactions and Kinetics of Phase Transformations *This item will not influence the grade calculation of this parent.*	2 CR	Franke, Seifert
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
T-MACH-107669	Exercises for Fundamentals in Materials Thermodynamics and Heterogeneous Equilibria *This item will not influence the grade calculation of this parent.*	2 CR	Seifert

Competence Certificate
written or oral 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 chosen brick courses.

Module grade calculation
Average of exams (with equal weight).

Workload
The work load is about 240 hours, corresponding to 8 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
Lecture, Tutorial, Lab Course

M 10.2 Module: Compulsory Elective Module Natural Science/Computer Science/ Electrical Engineering (MSc-Modul WPF-Modul NIE) [M-MACH-102595]

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

Part of: Advanced Engineering Fundamentals

Credits	Grading scale	Recurrence	Duration	Language	Level	Version
6	pass/fail	Each term	1 term	German/English	4	10

Election notes
One or more brick courses, with a total of at least 6 CP, must be successfully completed.

Compulsory Elective Module Natural Science/Computer Science/Electrical Engineering (Election:)			
T-CHEMBIO-100302	Applied Chemistry *This item will not influence the grade calculation of this parent.*	4 CR	
T-MACH-108847	Applied Mathematics in Natural Science: Flows with chemical reactions *This item will not influence the grade calculation of this parent.*	6 CR	Class
T-INFO-101363	Automated Visual Inspection and Image Processing *This item will not influence the grade calculation of this parent.*	6 CR	Beyerer
T-ETIT-101956	Bioelectric Signals *This item will not influence the grade calculation of this parent.*	3 CR	Loewe
T-ETIT-101938	Communication Systems and Protocols *This item will not influence the grade calculation of this parent.*	5 CR	Becker, Becker
T-CHEMBIO-100303	Introduction to Rheology *This item will not influence the grade calculation of this parent.*	6 CR	
T-ETIT-112895	Electric Drives, Power Electronics and Electrical Grids	6 CR	Hiller
T-INFO-101262	Human Brain and Central Nervous System: Anatomy, Information Transfer, Signal Processing, Neurophysiology and Therapy *This item will not influence the grade calculation of this parent.*	3 CR	Asfour, Spetzger
T-CIWVT-111063	Genetics *This item will not influence the grade calculation of this parent.*	2 CR	Neumann
T-ETIT-112851	Fundamentals of Data Transmission	6 CR	Schmalen, Zwick
T-INFO-101377	Localization of Mobile Agents *This item will not influence the grade calculation of this parent.*	6 CR	Hanebeck
T-MACH-108845	Magnetohydrodynamics *This item will not influence the grade calculation of this parent.*	6 CR	Bühler
T-ETIT-113625	Medical Imaging Technology *This item will not influence the grade calculation of this parent.*	6 CR	Spadea
T-ETIT-113607	Medical Measurement Technology *This item will not influence the grade calculation of this parent.*	6 CR	Nahm
T-INFO-102061	Mobile Computing and Internet of Things *This item will not influence the grade calculation of this parent.*	3 CR	Beigl
T-INFO-113119	Mobile Computing and Internet of Things - Exercise *This item will not influence the grade calculation of this parent.*	2 CR	Beigl
T-ETIT-101939	Photovoltaics *This item will not influence the grade calculation of this parent.*	6 CR	Powalla
T-MACH-109084	Physical Basics of Laser Technology *This item will not influence the grade calculation of this parent.*	6 CR	Schneider
T-ETIT-111815	Physiology and Anatomy for Biomedical Engineering *This item will not influence the grade calculation of this parent.*	6 CR	Nahm
T-ETIT-100711	Practical Aspects of Electrical Drives *This item will not influence the grade calculation of this parent.*	4 CR	Doppelbauer
T-ETIT-101911	Sensors *This item will not influence the grade calculation of this parent.*	3 CR	Menesklou
T-ETIT-112860	Signals and Systems	7 CR	Kluwe, Wahls
T-ETIT-113837	Signal Processing Methods	6 CR	Wahls
T-MACH-108846	Stability: from Order to Chaos *This item will not influence the grade calculation of this parent.*	6 CR	Class

T-ETIT-110788	Superconductors for Energy Applications *This item will not influence the grade calculation of this parent.*	5 CR	Grilli
T-CIWVT-111062	Cell Biology *This item will not influence the grade calculation of this parent.*	3 CR	Gottwald

Competence Certificate
The success is monitored within the framework of academic achievements, it can vary according to the individually choice. The module is not graded, and remains not graded even after the choice of one or several graded brick courses.

Prerequisites
none

Competence Goal
After completing the elective module "Wahlpflichtmodul" the attendants are able to extend their knowledge in the field of mechanical engineering in the disciplines natural sciences, electrical engineering or the informatics. The attendants are aware of typical approaches in fields, that differ sufficiently from mechanical engineering and know specific methods and fundamentals of these fields. Thus, the attendants are able to solve interdisciplinary problems by applying this knowledge and to adopt specialist skills by themselves later.

Content
Please refer to the description of the listed brick courses.

Workload
The work load is about 180 hours, corresponding to 6 credit points.

Learning type
Lecture
Exercise course (depending on the course)

M 10.3 Module: Compulsory Elective Subject Economics/Law (MSc-Modul WPF-Modul WR) [M-MACH-102596]

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

Part of: Advanced Engineering Fundamentals

Credits	Grading scale	Recurrence	Duration	Language	Level	Version
4	pass/fail	Each term	1 term	German	4	5

Compulsory Elective Module Economics/Law (Election: 1 item)			
T-MACH-110652	Human Factors Engineering II	4 CR	Deml
T-MACH-112585	Leadership and Management Development	4 CR	Albers, Matthiesen, Ploch
T-MACH-111070	Leadership and Conflict Management	4 CR	Hatzl
T-INFO-112672	Public Law I & II	6 CR	N.N.
T-MACH-112586	Quality Management	4 CR	Lanza
T-GEISTSOZ-110845	Technical and Environmental Historical Perspectives on Current Innovation Processes	4 CR	Popplow

Competence Certificate
The success is monitored within the framework of academic achievements, it can vary according to the individually choice.

Prerequisites
none

Competence Goal
Students can enlarge their knowledge about law and economics which affect mechanical engineering self-determined. They are able to describe circumstances of the case considering law or economics and apply it to simple cases. Later on in work life, they are able to evaluate, if and which subject specific support is necessary.

Content
see chosen brick course

Module grade calculation
The module is not graded, and remains not graded even after the choice of one or several graded brick courses.

Workload
The work load is about 120 hours, corresponding to 4 credit points.

Learning type
Lectures and practices; self-study

M 10.4 Module: Fundamentals and Methods of Automotive Engineering (MSc-WPfM-GuM-FzgT) [M-MACH-102739]

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

Part of: Specialization / Specialization: Vehicle Technology (mandatory)

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

Fundamentals and Methods of Automotive Engineering (Election: 2 items)			
T-MACH-105518	Human Factors Engineering I	4 CR	Deml
T-MACH-105212	CAE-Workshop	4 CR	Albers, Matthiesen
T-MACH-111193	Data Driven Engineering 1: Machine Learning for Dynamical Systems	4 CR	Bauer
T-MACH-100535	Introduction into Mechatronics	6 CR	Orth, Reischl
T-MACH-105209	Introduction to Multi-Body Dynamics	5 CR	Römer
T-ETIT-100534	Electrical Engineering for Business Engineers, Part II	5 CR	Menesklou
T-MACH-102093	Fluid Power Systems	4 CR	Geimer
T-MACH-109919	Basics of Technical Logistics I	4 CR	Mittwollen, Oellerich
T-MACH-109920	Basics of Technical Logistics II	6 CR	Furmans
T-MACH-105213	Fundamentals of Combustion I	4 CR	Maas
T-MACH-105210	Machine Dynamics	5 CR	Proppe
T-MACH-105293	Mathematical Methods in Dynamics	6 CR	Proppe
T-MACH-105294	Mathematical Methods of Vibration Theory	6 CR	Fidlin, Höllig, Römer
T-MACH-105295	Mathematical Methods in Fluid Mechanics	6 CR	Frohnapfel
T-MACH-100300	Modelling and Simulation	5 CR	Gumbsch, Nestler
T-MACH-102152	Novel Actuators and Sensors	4 CR	Kohl, Sommer
T-MATH-102242	Numerical Mathematics for Students of Computer Science	6 CR	Rieder, Weiß, Wieners
T-MACH-102102	Physical Basics of Laser Technology	5 CR	Schneider
T-MACH-100530	Physics for Engineers	5 CR	Dienwiebel, Gumbsch, Nesterov-Müller, Weygand
T-MACH-105147	Product Lifecycle Management	4 CR	Ovtcharova
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
T-MATH-109620	Probability Theory and Statistics	6 CR	Bäuerle, Ebner, Fasen-Hartmann, Hug, Klar, Last, Trabs, Winter
T-MACH-105292	Heat and Mass Transfer	4 CR	Maas, Yu
T-MACH-100532	Scientific Computing for Engineers	4 CR	Gumbsch, Weygand

Competence Certificate
2 individual exams: written or oral, graded

Prerequisites
None

Competence Goal
"Fundamentals and Methods of Automotive Engineering" serves as a comprehensive, in-depth analysis of fundamentals in selected areas of mechanical engineering.

Content
see chosen brick course

Workload
The work load is about 240 hours, corresponding to 8 credit points.

Learning type
Lecture, exercise.

10.5 Module: Fundamentals and Methods of Energy and Environmental Engineering (MSc-WPfM-GuM-E+U) [M-MACH-102575]

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

Part of: Specialization / Specialization: Energy- and Environment Engineering (mandatory)

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

Mandatory			
T-MACH-105292	Heat and Mass Transfer	4 CR	Maas, Yu
Fundamentals and Methods of Energy and Environmental Engineering (Election: 1 item)			
T-MACH-105212	CAE-Workshop	4 CR	Albers, Matthiesen
T-MACH-100535	Introduction into Mechatronics	6 CR	Orth, Reischl
T-MACH-105209	Introduction to Multi-Body Dynamics	5 CR	Römer
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-105210	Machine Dynamics	5 CR	Proppe
T-MACH-105295	Mathematical Methods in Fluid Mechanics	6 CR	Frohnapfel
T-MACH-102152	Novel Actuators and Sensors	4 CR	Kohl, Sommer
T-MATH-102242	Numerical Mathematics for Students of Computer Science	6 CR	Rieder, Weiß, Wieners
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-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-105290	Vibration Theory	5 CR	Fidlin

Competence Certificate
2 individual exams: written or oral, graded

Prerequisites
none

Competence Goal
"Fundamentals and Methods of Energy and Environmental Engineering" serves as a comprehensive, in-depth analysis of fundamentals in selected areas of mechanical engineering.

Content
see chosen brick course

Workload
The work load is about 240 hours, corresponding to 8 credit points.

Learning type
Lecture, exercise

M 10.6 Module: Fundamentals and Methods of General Mechanical Engineering (MSc-WPfM-GuM-MB) [M-MACH-102405]

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

Part of: Specialization / Specialization: General Mechanical Engineering (mandatory)

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

Fundamentals and Methods of General Mechanical Engineering (Election: 2 items)			
T-MACH-105518	Human Factors Engineering I	4 CR	Deml
T-MACH-105212	CAE-Workshop	4 CR	Albers, Matthiesen
T-MACH-100535	Introduction into Mechatronics	6 CR	Orth, Reischl
T-MACH-105209	Introduction to Multi-Body Dynamics	5 CR	Römer
T-MACH-102093	Fluid Power Systems	4 CR	Geimer
T-MACH-105182	Introduction to Microsystem Technology I	4 CR	Badilita, Jouda, Korvink
T-MACH-105183	Introduction to Microsystem Technology II	4 CR	Jouda, Korvink
T-MACH-105213	Fundamentals of Combustion I	4 CR	Maas
T-MACH-109919	Basics of Technical Logistics I	4 CR	Mittwollen, Oellerich
T-MACH-109920	Basics of Technical Logistics II	6 CR	Furmans
T-MACH-105210	Machine Dynamics	5 CR	Proppe
T-MACH-105293	Mathematical Methods in Dynamics	6 CR	Proppe
T-MACH-105294	Mathematical Methods of Vibration Theory	6 CR	Fidlin, Höllig, Römer
T-MACH-110375	Mathematical Methods in Continuum Mechanics	4 CR	Böhlke
T-MACH-105295	Mathematical Methods in Fluid Mechanics	6 CR	Frohnapfel
T-MACH-105298	Mathematical Methods in Structural Mechanics	5 CR	Böhlke
T-MACH-105189	Mathematical Models and Methods for Production Systems	6 CR	Baumann, Furmans
T-MACH-105303	Modelling of Microstructures	5 CR	August, Nestler
T-MACH-100300	Modelling and Simulation	5 CR	Gumbsch, Nestler
T-MACH-102152	Novel Actuators and Sensors	4 CR	Kohl, Sommer
T-MACH-102102	Physical Basics of Laser Technology	5 CR	Schneider
T-MACH-100530	Physics for Engineers	5 CR	Dienwiebel, Gumbsch, Nesterov-Müller, Weygand
T-MACH-105147	Product Lifecycle Management	4 CR	Ovtcharova
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
T-MACH-105292	Heat and Mass Transfer	4 CR	Maas, Yu
T-MACH-100532	Scientific Computing for Engineers	4 CR	Gumbsch, Weygand
Fundamentals and Methods of General Mechanical Engineering (Ü) (Election:)			
T-MACH-106831	Tutorial Mathematical Methods in Structural Mechanics *This item will not influence the grade calculation of this parent.*	1 CR	Böhlke
T-MACH-110376	Tutorial Mathematical Methods in Continuum Mechanics	2 CR	Böhlke

Competence Certificate
2 individual exams: written or oral, graded

Prerequisites
None.

Competence Goal
"Fundamentals and Methods of General Mechanical Engineering" serves as a comprehensive, in-depth analysis of fundamentals in selected areas of mechanical engineering.

Content
see chosen brick course

Workload
The work load is about 240 hours, corresponding to 8 credit points.

Learning type
Lecture, exercise

M 10.7 Module: Fundamentals and Methods of Materials and Structures for High Performance Systems (MSc-WPfPM-W+S) [M-MACH-102744]

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

Part of: Specialization / Specialization: Materials and Structures for High Performance Systems (mandatory)

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

Mandatory			
T-MACH-100531	Systematic Materials Selection	4 CR	Dietrich, Schulze
Fundamentals and Methods of Materials and Structures for High Performance Systems (Election: 1 item)			
T-MACH-105212	CAE-Workshop	4 CR	Albers, Matthiesen
T-MACH-105209	Introduction to Multi-Body Dynamics	5 CR	Römer
T-MACH-109919	Basics of Technical Logistics I	4 CR	Mittwollen, Oellerich
T-MACH-105210	Machine Dynamics	5 CR	Proppe
T-MACH-110375	Mathematical Methods in Continuum Mechanics	4 CR	Böhlke
T-MACH-110378	Mathematical Methods in Micromechanics	5 CR	Böhlke
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-105290	Vibration Theory	5 CR	Fidlin
T-MACH-100532	Scientific Computing for Engineers	4 CR	Gumbsch, Weygand
Fundamentals and Methods of Materials and Structures for High Performance Systems (Ü) (Election:)			
T-MACH-110379	Tutorial Mathematical Methods in Micromechanics	1 CR	Böhlke
T-MACH-110376	Tutorial Mathematical Methods in Continuum Mechanics	2 CR	Böhlke

Competence Certificate
2 individual exams: written or oral, graded

Prerequisites
none

Competence Goal
"Fundamentals and Methods of Materials and Structures for High Performance Systems" serves as a comprehensive, in-depth analysis of fundamentals in selected areas of mechanical engineering.

Content
see chosen brick course

Workload
The work load is about 240 hours, corresponding to 8 credit points.

Learning type
Lecture, exercise.

M 10.8 Module: Fundamentals and Methods of Mechatronics and Microsystem Technology (MSc-WPfM-M+M) [M-MACH-102740]

Responsible: Prof. Dr. Jan Gerrit Korvink
Organisation: KIT Department of Mechanical Engineering

Part of: Specialization / Specialization: Mechatronics and Microsystems Technology (mandatory)

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

Fundamentals and Methods of Mechatronics and Microsystem Technology (Election: 1 item)			
T-MACH-100535	Introduction into Mechatronics	6 CR	Orth, Reischl
T-MACH-105182	Introduction to Microsystem Technology I	4 CR	Badilita, Jouda, Korvink
Fundamentals and Methods of Mechatronics and Microsystem Technology (Election: 1 item)			
T-MACH-105212	CAE-Workshop	4 CR	Albers, Matthiesen
T-MACH-105209	Introduction to Multi-Body Dynamics	5 CR	Römer
T-MACH-105182	Introduction to Microsystem Technology I	4 CR	Badilita, Jouda, Korvink
T-MACH-105183	Introduction to Microsystem Technology II	4 CR	Jouda, Korvink
T-MACH-109919	Basics of Technical Logistics I	4 CR	Mittwollen, Oellerich
T-MACH-105213	Fundamentals of Combustion I	4 CR	Maas
T-MACH-105210	Machine Dynamics	5 CR	Proppe
T-MACH-105293	Mathematical Methods in Dynamics	6 CR	Proppe
T-MACH-105294	Mathematical Methods of Vibration Theory	6 CR	Fidlin, Höllig, Römer
T-MACH-102152	Novel Actuators and Sensors	4 CR	Kohl, Sommer
T-MATH-102242	Numerical Mathematics for Students of Computer Science	6 CR	Rieder, Weiß, Wieners
T-MACH-102102	Physical Basics of Laser Technology	5 CR	Schneider
T-MACH-100530	Physics for Engineers	5 CR	Dienwiebel, Gumbsch, Nesterov-Müller, Weygand
T-MACH-105147	Product Lifecycle Management	4 CR	Ovtcharova
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
T-MATH-109620	Probability Theory and Statistics	6 CR	Bäuerle, Ebner, Fasen-Hartmann, Hug, Klar, Last, Trabs, Winter
T-MACH-105292	Heat and Mass Transfer	4 CR	Maas, Yu

Competence Certificate
2 individual exams: written or oral, graded

Prerequisites
None

Competence Goal
"Fundamentals and Methods of Mechatronics and Microsystem Technology" serves as a comprehensive, in-depth analysis of fundamentals in selected areas of mechanical engineering.

Content
see chosen brick course

Workload
The work load is about 240 hours, corresponding to 8 credit points.

Learning type
Lecture, exercise

10.9 Module: Fundamentals and Methods of Product Development and Construction (MSc-WPfM-GuM-PEK) [M-MACH-102741]

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

Organisation: KIT Department of Mechanical Engineering

Part of: Specialization / Specialization: Product Development and Engineering Design (mandatory)

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

Fundamentals and Methods of Product Development and Construction (Election: 2 items)			
T-MACH-105518	Human Factors Engineering I	4 CR	Deml
T-MACH-105212	CAE-Workshop	4 CR	Albers, Matthiesen
T-MACH-100535	Introduction into Mechatronics	6 CR	Orth, Reischl
T-MACH-105209	Introduction to Multi-Body Dynamics	5 CR	Römer
T-MACH-102093	Fluid Power Systems	4 CR	Geimer
T-MACH-105182	Introduction to Microsystem Technology I	4 CR	Badilita, Jouda, Korvink
T-MACH-105183	Introduction to Microsystem Technology II	4 CR	Jouda, Korvink
T-MACH-109919	Basics of Technical Logistics I	4 CR	Mittwollen, Oellerich
T-MACH-109920	Basics of Technical Logistics II	6 CR	Furmans
T-MACH-105210	Machine Dynamics	5 CR	Proppe
T-MACH-105293	Mathematical Methods in Dynamics	6 CR	Proppe
T-MACH-105294	Mathematical Methods of Vibration Theory	6 CR	Fidlin, Höllig, Römer
T-MACH-105295	Mathematical Methods in Fluid Mechanics	6 CR	Frohnapfel
T-MACH-105298	Mathematical Methods in Structural Mechanics	5 CR	Böhlke
T-MACH-102152	Novel Actuators and Sensors	4 CR	Kohl, Sommer
T-MACH-102102	Physical Basics of Laser Technology	5 CR	Schneider
T-MACH-105147	Product Lifecycle Management	4 CR	Ovtcharova
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
T-MACH-105292	Heat and Mass Transfer	4 CR	Maas, Yu
Fundamentals and Methods of Product Development and Construction (Ü) (Election:)			
T-MACH-106831	Tutorial Mathematical Methods in Structural Mechanics *This item will not influence the grade calculation of this parent.*	1 CR	Böhlke

Competence Certificate
2 individual exams: written or oral, graded

Prerequisites
None

Competence Goal
"Fundamentals and Methods of Product Development and Construction" serves as a comprehensive, in-depth analysis of fundamentals in selected areas of mechanical Engineering.

Content
See brick courses.

Workload
The work load is about 240 hours, corresponding to 8 credit points.

Learning type
Lecture, exercise.

M 10.10 Module: Fundamentals and Methods of Production Technology (MSc-WPf-GuM-PT) [M-MACH-102742]

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

Part of: Specialization / Specialization: Production Technology (mandatory)

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

Fundamentals and Methods of Production Technology (Election: 2 items)			
T-MACH-105518	Human Factors Engineering I	4 CR	Deml
T-MACH-105212	CAE-Workshop	4 CR	Albers, Matthiesen
T-MACH-100535	Introduction into Mechatronics	6 CR	Orth, Reischl
T-MACH-105209	Introduction to Multi-Body Dynamics	5 CR	Römer
T-MACH-102093	Fluid Power Systems	4 CR	Geimer
T-MACH-105182	Introduction to Microsystem Technology I	4 CR	Badilita, Jouda, Korvink
T-MACH-105183	Introduction to Microsystem Technology II	4 CR	Jouda, Korvink
T-MACH-109919	Basics of Technical Logistics I	4 CR	Mittwollen, Oellerich
T-MACH-109920	Basics of Technical Logistics II	6 CR	Furmans
T-MACH-105210	Machine Dynamics	5 CR	Proppe
T-MACH-110375	Mathematical Methods in Continuum Mechanics	4 CR	Böhlke
T-MACH-105189	Mathematical Models and Methods for Production Systems	6 CR	Baumann, Furmans
T-MACH-100300	Modelling and Simulation	5 CR	Gumbsch, Nestler
T-MACH-102152	Novel Actuators and Sensors	4 CR	Kohl, Sommer
T-MATH-102242	Numerical Mathematics for Students of Computer Science	6 CR	Rieder, Weiß, Wieners
T-MACH-102102	Physical Basics of Laser Technology	5 CR	Schneider
T-MACH-105147	Product Lifecycle Management	4 CR	Ovtcharova
T-MACH-100531	Systematic Materials Selection	4 CR	Dietrich, Schulze
T-MACH-102083	Integrated Information Systems for Engineers	4 CR	Ovtcharova
T-MACH-105290	Vibration Theory	5 CR	Fidlin
Fundamentals and Methods of Production Technology (Ü) (Election:)			
T-MACH-110376	Tutorial Mathematical Methods in Continuum Mechanics *This item will not influence the grade calculation of this parent.*	2 CR	Böhlke

Competence Certificate
2 exams:

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
"Fundamentals and Methods of Production Technology" serves as a comprehensive, in-depth analysis of fundamentals in selected areas of mechanical engineering

Content
Fundamentals and Methods of Production Technology

Workload
The work load is about 240 hours, corresponding to 8 credit points.

Learning type
Lectures, seminars, workshops, excursions

M 10.11 Module: Fundamentals and Methods of Theoretical Foundations of Mechanical Engineering (MSc-WPfM-GuM-ThM) [M-MACH-102743]

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

Part of: Specialization / Specialization: Theoretical Mechanical Engineering (mandatory)

Credits	Grading scale	Recurrence	Duration	Language	Level	Version
8	Grade to a tenth	Each term	2 terms	German/English	4	7

Fundamentals and Methods of Theoretical Foundations of Mechanical Engineering (Election: 2 items)			
T-MACH-105209	Introduction to Multi-Body Dynamics	5 CR	Römer
T-MACH-112758	experimental Characterisation of thermo-visco-elastic materials	4 CR	Böhlke, Kehrer
T-MACH-102093	Fluid Power Systems	4 CR	Geimer
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-110378	Mathematical Methods in Micromechanics	5 CR	Böhlke
T-MACH-105294	Mathematical Methods of Vibration Theory	6 CR	Fidlin, Höllig, Römer
T-MACH-105295	Mathematical Methods in Fluid Mechanics	6 CR	Frohnapfel
T-MACH-105189	Mathematical Models and Methods for Production Systems	6 CR	Baumann, Furmans
T-MACH-105396	Modeling of Thermodynamical Processes	6 CR	Maas, Schießl
T-MACH-105303	Modelling of Microstructures	5 CR	August, Nestler
T-MACH-100300	Modelling and Simulation	5 CR	Gumbsch, Nestler
T-MACH-111026	Nonlinear Continuum Mechanics	3 CR	Böhlke
T-MATH-102242	Numerical Mathematics for Students of Computer Science	6 CR	Rieder, Weiß, Wieners
T-MACH-100530	Physics for Engineers	5 CR	Dienwiebel, Gumbsch, Nesterov-Müller, Weygand
T-MACH-100531	Systematic Materials Selection	4 CR	Dietrich, Schulze
T-MACH-105290	Vibration Theory	5 CR	Fidlin
T-MATH-109620	Probability Theory and Statistics	6 CR	Bäuerle, Ebner, Fasen-Hartmann, Hug, Klar, Last, Trabs, Winter
T-MACH-105292	Heat and Mass Transfer	4 CR	Maas, Yu
T-MACH-100532	Scientific Computing for Engineers	4 CR	Gumbsch, Weygand
T-MACH-113694	Phase-Field Method in Thermomechanics	4 CR	Prahs
Fundamentals and Methods of Theoretical Foundations of Mechanical Engineering (Ü) (Election:)			
T-MACH-111027	Tutorial Nonlinear Continuum Mechanics	1 CR	Böhlke
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
T-MACH-110379	Tutorial Mathematical Methods in Micromechanics	1 CR	Böhlke

Competence Certificate
2 individual exams: written or oral, graded

Prerequisites
None

Competence Goal
"Fundamentals and Methods of Theoretical Foundations of Mechanical Engineering" serves as a comprehensive, in-depth analysis of fundamentals in selected areas of mechanical engineering.

Content
see chosen course

Workload
The work load is about 240 hours, corresponding to 8 credit points.

Learning type
Lecture, tutorial

M 10.12 Module: Key Competencies [M-MACH-102824]

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

Part of: Advanced Engineering Fundamentals

Credits	Grading scale	Recurrence	Duration	Language	Level	Version
2	pass/fail	Each term	1 term	German/English	4	5

Election notes
Interdisciplinary qualifications (IQ) completed at the House of Competence (HoC), at the Zentrum für Angewandte Kulturwissenschaft und Studium Generale at the Forum for Science and Society (FORUM, formerly 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".

Key Competencies (Election: 1 item)			
T-MACH-105721	Engineer's Field of Work	2 CR	Doppelbauer, Geimer
T-MACH-110961	Steering of a Global Operating Company - The Robert BOSCH GmbH as an Example	2 CR	Grube
T-MACH-111686	Self-Booking-MSc-HOC-SPZ-ZAK-Non-Graded	2 CR	Heilmaier
T-MACH-111687	Self-Booking-MSc-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 of safeguarding 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 of freely selectable courses offered by the KIT-House of Competence (HoC), the Sprachenzentrums (SpZ), the Studium Generale at the Forum for Science and Society (FORUM, formerly ZAK), and the brick courses contained in the elective block of key qualifications with a work load corresponding to a total of at least 2 ECTS. Upon request, the examination board may approve further courses as freely selectable subjects in the module "Key Competences".

Module grade calculation
Certification without grade

Annotation
Only HoC/SPZ/FORUM courses and courses from the "Compulsory-elective block Key Competences" can be chosen.

Workload
The work load is about 60 hours (thereof an attendance time of about 28 hours), corresponding to 2 credit points in the Master of Science program.

Learning type
lectures, seminars, tutorials, lab courses.

10.13 Module: Laboratory Course (MSc-Modul 07, FP) [M-MACH-102591]

Responsible: Prof. Dr.-Ing. Kai Furmans
Prof. Dr.-Ing. Christoph Stiller

Organisation: KIT Department of Mechanical Engineering

Part of: Advanced Engineering Fundamentals

Credits	Grading scale	Recurrence	Duration	Language	Level	Version
4	pass/fail	Each term	1 term	German/English	4	5

Specialized Practical Training (Election: 1 item)			
T-MACH-105447	Metallographic Lab Class *This item will not influence the grade calculation of this parent.*	4 CR	Heilmaier, Kauffmann
T-MACH-113701	Industrial Mobile Robotics Lab	4 CR	Furmans
T-MACH-105222	Motor Vehicle Labor	4 CR	Frey
T-MACH-108312	Introduction to Microsystem Technology - Practical Course *This item will not influence the grade calculation of this parent.*	4 CR	Last
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-105370	Laboratory Mechatronics *This item will not influence the grade calculation of this parent.*	4 CR	Hagenmeyer, Stiller
T-MACH-105300	Measurement Instrumentation Lab *This item will not influence the grade calculation of this parent.*	4 CR	Klemp, Stiller
T-MACH-105337	Engine Laboratory *This item will not influence the grade calculation of this parent.*	4 CR	Wagner
T-MACH-113488	Lab Course Microcontrollers for Highly Automated Rail Vehicles	4 CR	Cichon
T-MACH-106707	Workshop on Computer-based Flow Measurement Techniques *This item will not influence the grade calculation of this parent.*	4 CR	Bauer
T-MACH-102154	Laboratory Laser Materials Processing *This item will not influence the grade calculation of this parent.*	4 CR	Schneider
T-MACH-105343	Lab Course Experimental Solid Mechanics *This item will not influence the grade calculation of this parent.*	4 CR	Böhlke
T-MACH-108878	Laboratory Production Metrology	4 CR	Lanza, Stamer
T-MACH-105813	Practical Course “Tribology”	4 CR	Dienwiebel, Schneider
T-MACH-105346	Production Techniques Laboratory *This item will not influence the grade calculation of this parent.*	4 CR	Deml, Fleischer, Furmans, Ovtcharova
T-MACH-110983	Project Internship Aditive Manufacturing: Development and Production of an Additive Component	4 CR	Zanger
T-MACH-106738	ProVIL - Product Development in a Virtual Idea Laboratory *This item will not influence the grade calculation of this parent.*	4 CR	Albers
T-MACH-105373	Practical Training in Measurement of Vibrations *This item will not influence the grade calculation of this parent.*	4 CR	Fidlin
T-MACH-108796	Flow Measurement Techniques *This item will not influence the grade calculation of this parent.*	4 CR	Kriegseis

Competence Certificate
The success is monitored within the framework of academic achievements, it can vary according to the individually choice. The module is not graded, and remains not graded even after the choice of one or several graded brick courses.

Prerequisites
none

Competence Goal
Students are able to:

- Model typical problems in the laboratory and use typical methods of mecanical science to inquire,
- Built experiment designs, while choosing appropriate system components and models,
- Accomplish experiments goal-oriented,
- Analyse and evaluate results of experiments.

Content
see chosen practical training

Workload
The work load is about 120 hours, corresponding to 4 credit points.

Learning type
practical training, self-study

10.14 Module: Major Field: Advanced Materials Modelling and Data Management (SP 56) [M-MACH-105904]

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

Part of: Specialization / Specialization: General Mechanical Engineering (Major Fields) (Usage from 4/1/2022)
Specialization / Specialization: Theoretical Mechanical Engineering (Major Field) (Usage from 4/1/2022)
Specialization / Specialization: Materials and Structures for High Performance Systems (Major Field) (Usage from 4/1/2022)

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

Mandatory			
T-MACH-111537	Mathematical Methods in Micro Mechanics	4 CR	Böhlke
T-MACH-111588	Data Science and Scientific Workflows	3 CR	Gumbsch, Weygand
T-MACH-111603	Data Science and Scientific Workflows (Project)	1 CR	Gumbsch, Weygand
Advanced Materials Modelling and Data Management (E) (Election:)			
T-MACH-105459	High Temperature Materials	4 CR	Heilmaier
T-MACH-105554	Thin Film and Small-scale Mechanical Behavior	4 CR	Gruber, Kirchlechner, Weygand
T-MACH-110957	Hydrogen in Materials: from Energy Storage to Hydrogen Embrittlement	4 CR	Pundt
T-MACH-113412	Atomistic Simulations and Particle Dynamics	4 CR	Gumbsch, Schneider, Weygand

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
After having finished this major field the students can

- list important concepts and models for describing material behaviour
- map different material models or concepts to different length scales
- understand concepts of data management, digital workflows and digital infrastructure

Content
The comprehensive topic of the major field is the knowledge of basic scientific methods and concepts for describing the material behaviour of applied materials considering their microstructure.Hereby, methods of data management and digital workflows are combined with concepts of material modelling and microstructure description within a unified approach. Together with standardization processes synergies and increase of efficiency for cooperation of scientists can be realized.

The precise topics refer to the fields of mechanics, computational material science and material science.

Annotation
none

Workload
The work load is about 480 hours in the Master of Science program, whereof the presence time is 100 h

Learning type
Lectures, Tutorials, consultation hours

M 10.15 Module: Major Field: Advanced Mechatronics (SP 01) [M-MACH-102598]

Responsible: apl. Prof. Dr. Markus Reischl
Organisation: KIT Department of Mechanical Engineering

Part of: Specialization / Specialization: General Mechanical Engineering (Major Fields)
Specialization / Specialization: Energy- and Environment Engineering (Major Field)
Specialization / Specialization: Vehicle Technology (Major Field)
Specialization / Specialization: Mechatronics and Microsystems Technology (Major Field (p))
Specialization / Specialization: Product Development and Engineering Design (Major Field)
Specialization / Specialization: Production Technology (Major Field)
Specialization / Specialization: Theoretical Mechanical Engineering (Major Field)

Credits	Grading scale	Recurrence	Duration	Language	Level	Version
16	Grade to a tenth	Each term	2 terms	German/English	4	13

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

Advanced Mechatronics (K) (Election: at least 8 credits)			
T-MACH-105694	Data Analytics for Engineers	5 CR	Meisenbacher, Mikut, Reischl
T-MACH-100535	Introduction into Mechatronics	6 CR	Orth, Reischl
T-MACH-105335	Measurement II	4 CR	Stiller
Advanced Mechatronics (E) (Election: at most 9 credits)			
T-MACH-108844	Automated Manufacturing Systems	8 CR	Fleischer
T-MACH-100966	BioMEMS - Microsystems Technologies for Life-Sciences and Medicine I	4 CR	Guber
T-MACH-100967	BioMEMS - Microsystems Technologies for Life-Sciences and Medicine II	4 CR	Guber
T-MACH-100968	BioMEMS - Microsystems Technologies for Life-Sciences and Medicine III	4 CR	Guber
T-MACH-105212	CAE-Workshop	4 CR	Albers, Matthiesen
T-MACH-105314	Computational Intelligence	4 CR	Meisenbacher, Mikut, Reischl
T-MACH-111193	Data Driven Engineering 1: Machine Learning for Dynamical Systems	4 CR	Bauer
T-MACH-111373	Data Driven Engineering 2: Advanced Topics	4 CR	Bauer
T-MACH-113597	Decision-Making and Motion Planning for Automated Driving	6 CR	Naumann, Werling
T-MACH-105317	Digital Control	4 CR	Knoop
T-MACH-111260	Dynamics of Electro-Mechanical Systems	5 CR	Altoé, Fidlin
T-MACH-105209	Introduction to Multi-Body Dynamics	5 CR	Römer
T-MACH-105514	Experimental Dynamics	5 CR	Fidlin
T-MACH-105218	Automotive Vision	6 CR	Lauer, Stiller
T-MACH-105187	IT-Fundamentals of Logistics	4 CR	Thomas
T-MACH-105378	Cognitive Automobiles - Laboratory	6 CR	Kitt, Lauer, Stiller
T-MACH-105221	Lightweight Engineering Design	4 CR	Düser, Ott
T-MACH-105223	Machine Vision	8 CR	Lauer, Stiller
T-MACH-105293	Mathematical Methods in Dynamics	6 CR	Proppe
T-MACH-105294	Mathematical Methods of Vibration Theory	6 CR	Fidlin, Höllig, Römer
T-MACH-105334	Mechanics in Microtechnology	4 CR	Greiner, Gruber
T-INFO-101266	Human-Machine-Interaction	6 CR	Beigl
T-MACH-105557	Microenergy Technologies	4 CR	Kohl
T-MACH-101910	Microactuators	4 CR	Kohl
T-MACH-105539	Modern Control Concepts I	4 CR	Groell, Matthes

T-MACH-106691	Modern Control Concepts II	4 CR	Groell
T-MACH-106692	Modern Control Concepts III	4 CR	Groell
T-MACH-102152	Novel Actuators and Sensors	4 CR	Kohl, Sommer
T-MACH-111249	Optical Measuring Systems	4 CR	Sieber
T-MACH-105442	Intellectual Property Rights and Strategies in Industrial Companies	4 CR	Düser, Zacharias
T-MACH-108878	Laboratory Production Metrology	4 CR	Lanza, Stamer
T-INFO-108014	Robotics I - Introduction to Robotics	6 CR	Asfour
T-ETIT-112860	Signals and Systems	7 CR	Kluwe, Wahls
T-MACH-105990	Simulation of Optical Systems	4 CR	Sieber
T-MACH-105372	Theory of Stability	6 CR	Fidlin
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
T-MACH-105985	Ignition Systems	4 CR	Toedter
Advanced Mechatronics (I) (Election: at most 6 credits)			
T-MACH-105341	Lab Computer-Aided Methods for Measurement and Control	4 CR	Klemp, Stiller
T-INFO-112030	Practical Course: Smart Energy System Lab	6 CR	Waczowicz
Advanced Mechatronics (Ü) (Election:)			
T-INFO-106257	Human-Machine-Interaction Pass *This item will not influence the grade calculation of this parent.*	0 CR	Beigl

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 of the major Advanced Mechatronics know the future-oriented procedures. They are able to creatively solve complex interdisciplinary questions, in particular by applying the latest computer-assisted mathematical methods.

Content
The Advanced Mechatronics offers a broad, multidisciplinary body of knowledge. It qualifies graduates to solve essential mechatronic questions. In particular the following disciplines are covered by the major Advanced Mechatronics:

- Control theory
- measurement technology and signal processing,
- modelling and
- mathematical methods.

Workload
The work load is about 480 hours, corresponding to 16 credit points.

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

M 10.16 Module: Major Field: Applied Mechanics (SP 30) [M-MACH-102646]

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

Part of: Specialization / Specialization: General Mechanical Engineering (Major Fields)
Specialization / Specialization: Energy- and Environment Engineering (Major Field)
Specialization / Specialization: Vehicle Technology (Major Field)
Specialization / Specialization: Mechatronics and Microsystems Technology (Major Field)
Specialization / Specialization: Product Development and Engineering Design (Major Field)
Specialization / Specialization: Production Technology (Major Field)
Specialization / Specialization: Theoretical Mechanical Engineering (Major Field (p))
Specialization / Specialization: Materials and Structures for High Performance Systems (Major Field)

Credits	Grading scale	Recurrence	Duration	Language	Level	Version
16	Grade to a tenth	Each term	2 terms	German/English	4	7

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

Applied Mechanics (K) (Election: at least 8 credits)			
T-MACH-105351	Computational Mechanics I	6 CR	Böhlke, Langhoff
T-MACH-105352	Computational Mechanics II	6 CR	Böhlke, Langhoff
Applied Mechanics (E) (Election: at most 1 item)			
T-MACH-105321	Introduction to Theory of Materials	4 CR	Kamlah
T-MACH-105439	Introduction to Nonlinear Vibrations	7 CR	Fidlin
T-MACH-112758	experimental Characterisation of thermo-visco-elastic materials	4 CR	Böhlke, Kehrer
T-MACH-105324	Foundations of Nonlinear Continuum Mechanics	4 CR	Kamlah
T-MACH-110378	Mathematical Methods in Micromechanics	5 CR	Böhlke
T-MACH-105303	Modelling of Microstructures	5 CR	August, Nestler
T-MACH-111026	Nonlinear Continuum Mechanics	3 CR	Böhlke
T-MATH-102242	Numerical Mathematics for Students of Computer Science	6 CR	Rieder, Weiß, Wieners
T-MACH-105348	Process Simulation in Forming Operations	4 CR	Helm
T-MACH-105349	Computational Dynamics	4 CR	Proppe
T-MACH-105350	Computational Vehicle Dynamics	4 CR	Proppe
T-MACH-105971	Simulation of the Process Chain of Continuously Fiber Reinforced Composite Structure	4 CR	Kärger
T-MACH-105372	Theory of Stability	6 CR	Fidlin
T-MACH-105970	Structural Analysis of Composite Laminates	4 CR	Kärger
T-MACH-105290	Vibration Theory	5 CR	Fidlin
T-MACH-105369	Materials Modelling: Dislocation Based Plasticity	4 CR	Weygand
T-MACH-100532	Scientific Computing for Engineers	4 CR	Gumbsch, Weygand
Applied Mechanics (Ü) (Election:)			
T-MACH-111027	Tutorial Nonlinear Continuum Mechanics	1 CR	Böhlke
T-MACH-110379	Tutorial Mathematical Methods in Micromechanics	1 CR	Böhlke

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
After having finished this major field the students can

- list important mathematical concepts that are applied in mechanics
- analyze, evaluate and assess models of mechanics according to their mathematical structure
- apply mathematical algorithms for solving special problems in mechanics
- select a mathematical description of a given problem in mechanics

Content
See brick courses.

Workload
The work load is about 480 hours, corresponding to 16 credit points.

Learning type
Lectures, Tutorials, consultation hours

M 10.17 Module: Major Field: Automation Technology (SP 04) [M-MACH-102601]

Responsible: apl. Prof. Dr. Ralf Mikut
Organisation: KIT Department of Mechanical Engineering

Part of:
Specialization / Specialization: General Mechanical Engineering (Major Fields)
Specialization / Specialization: Energy- and Environment Engineering (Major Field)
Specialization / Specialization: Vehicle Technology (Major Field)
Specialization / Specialization: Mechatronics and Microsystems Technology (Major Field (p))
Specialization / Specialization: Product Development and Engineering Design (Major Field)
Specialization / Specialization: Production Technology (Major Field)
Specialization / Specialization: Theoretical Mechanical Engineering (Major Field)

Credits	Grading scale	Recurrence	Duration	Language	Level	Version
16	Grade to a tenth	Each term	2 terms	German/English	4	10

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

Automation Technology (K) (Election: at least 8 credits)			
T-MACH-105314	Computational Intelligence	4 CR	Meisenbacher, Mikut, Reischl
T-MACH-105694	Data Analytics for Engineers	5 CR	Meisenbacher, Mikut, Reischl
T-MACH-105317	Digital Control	4 CR	Knoop
T-MACH-100535	Introduction into Mechatronics	6 CR	Orth, Reischl
T-MACH-105539	Modern Control Concepts I	4 CR	Groell, Matthes
Automation Technology (E) (Election: at most 8 credits)			
T-MACH-108844	Automated Manufacturing Systems	8 CR	Fleischer
T-MACH-105212	CAE-Workshop	4 CR	Albers, Matthiesen
T-MACH-113597	Decision-Making and Motion Planning for Automated Driving	6 CR	Naumann, Werling
T-MACH-112115	Artificial Intelligence in Production	4 CR	Fleischer
T-MACH-105223	Machine Vision	8 CR	Lauer, Stiller
T-MACH-105335	Measurement II	4 CR	Stiller
T-MACH-106691	Modern Control Concepts II	4 CR	Groell
T-MACH-106692	Modern Control Concepts III	4 CR	Groell
T-MACH-111249	Optical Measuring Systems	4 CR	Sieber
T-MACH-105442	Intellectual Property Rights and Strategies in Industrial Companies	4 CR	Düser, Zacharias
T-MACH-113031	Rapid Industrialization of Immature Products using the Example of Electric Mobility	4 CR	Bauer
T-MACH-112121	Seminar Application of Artificial Intelligence in Production	4 CR	Fleischer
T-MACH-105990	Simulation of Optical Systems	4 CR	Sieber
T-MACH-105185	Control Technology	4 CR	Gönnheimer
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-110962	Machine Tools and High-Precision Manufacturing Systems	8 CR	Fleischer
T-MACH-102149	Virtual Reality Practical Course	4 CR	Ovtcharova
T-INFO-106270	Seminar: Energy Informatics	4 CR	Hagenmeyer
Automation Technology (P) (Election: at most 6 credits)			
T-MACH-105370	Laboratory Mechatronics	4 CR	Hagenmeyer, Stiller
T-MACH-108878	Laboratory Production Metrology	4 CR	Lanza, Stamer
T-MACH-105341	Lab Computer-Aided Methods for Measurement and Control	4 CR	Klemp, Stiller
T-INFO-112030	Practical Course: Smart Energy System Lab	6 CR	Waczowicz

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
The Automation Engineering offers both theoretical foundations and practical knowledge in the field of automation. Students can select, apply and enhance existing methods. The main focus of the major is on

- Applied control engineering
- Automation
- Examples of field applications

Students of Automation Engineering are qualified to master complex challenges of the future. They are able to apply their profound knowledge and the future-oriented methods independent of a particular application field.

Content
See brick courses.

Workload
The work load is about 480 hours, corresponding to 16 credit points.

Learning type
Lectures, Tutorials

M 10.18 Module: Major Field: Cognitive Technical Systems (SP 22) [M-MACH-102609]

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

Part of: Specialization / Specialization: General Mechanical Engineering (Major Fields)
Specialization / Specialization: Vehicle Technology (Major Field)
Specialization / Specialization: Mechatronics and Microsystems Technology (Major Field)
Specialization / Specialization: Product Development and Engineering Design (Major Field)
Specialization / Specialization: Production Technology (Major Field)
Specialization / Specialization: Theoretical Mechanical Engineering (Major Field)

Credits	Grading scale	Recurrence	Duration	Language	Level	Version
16	Grade to a tenth	Each term	2 terms	German/English	4	5

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

Cognitive Technical Systems (K) (Election: at least 8 credits)			
T-MACH-105694	Data Analytics for Engineers	5 CR	Meisenbacher, Mikut, Reischl
T-MACH-113597	Decision-Making and Motion Planning for Automated Driving	6 CR	Naumann, Werling
T-MACH-105218	Automotive Vision	6 CR	Lauer, Stiller
Cognitive Technical Systems (E) (Election: at most 8 credits)			
T-MACH-105314	Computational Intelligence	4 CR	Meisenbacher, Mikut, Reischl
T-MACH-111193	Data Driven Engineering 1: Machine Learning for Dynamical Systems	4 CR	Bauer
T-MACH-111373	Data Driven Engineering 2: Advanced Topics	4 CR	Bauer
T-MACH-105317	Digital Control	4 CR	Knoop
T-MACH-108374	Vehicle Ergonomics	4 CR	Ehrhardt
T-INFO-112194	Introduction to Artificial Intelligence	5 CR	Friederich, Neumann
T-MACH-102128	Information Systems and Supply Chain Management	3 CR	Kilger
T-MACH-105378	Cognitive Automobiles - Laboratory	6 CR	Kitt, Lauer, Stiller
T-INFO-101377	Localization of Mobile Agents	6 CR	Hanebeck
T-MACH-105223	Machine Vision	8 CR	Lauer, Stiller
T-MACH-105335	Measurement II	4 CR	Stiller
T-MACH-105350	Computational Vehicle Dynamics	4 CR	Proppe
T-INFO-108014	Robotics I - Introduction to Robotics	6 CR	Asfour
T-INFO-101352	Robotics III - Sensors in Robotics	3 CR	Asfour
T-MACH-112115	Artificial Intelligence in Production	4 CR	Fleischer
T-MACH-112121	Seminar Application of Artificial Intelligence in Production	4 CR	Fleischer
Cognitive Technical Systems (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, Stiller
T-MACH-105341	Lab Computer-Aided Methods for Measurement and Control *This item will not influence the grade calculation of this parent.*	4 CR	Klemp, 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 fundamental components and processing steps of cognitive technical systems
- explain the interplay of individual components and the flow of information between them
- outline the major properties of cognitive functions at examples in emerging applications like vehicular technology or robotics
- determine the level of system function and safety for cognitive technical systems

Content
See brick courses.

Workload
The work load is about 480 hours, corresponding to 16 credit points.

Learning type
Lectures, Tutorials

10.19 Module: Major Field: Combustion Engines Based Powertrains (SP 58) [M-MACH-102650]

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

Part of:
Specialization / Specialization: General Mechanical Engineering (Major Fields)
Specialization / Specialization: Energy- and Environment Engineering (Major Field)
Specialization / Specialization: Vehicle Technology (Major Field (p))
Specialization / Specialization: Mechatronics and Microsystems Technology (Major Field)
Specialization / Specialization: Product Development and Engineering Design (Major Field)

Credits	Grading scale	Recurrence	Duration	Language	Level	Version
16	Grade to a tenth	Each term	2 terms	German/English	4	9

Mandatory			
T-MACH-111550	CO2-Neutral Combustion Engines and their Fuels I	4 CR	Koch
T-MACH-111585	Hydrogen and reFuels - Energy Conversion in Combustion Engines	4 CR	Kubach
Combustion engines based powertrains (E1) (Election:)			
T-MACH-105044	Fundamentals of Catalytic Exhaust Gas Aftertreatment	4 CR	Deutschmann, Grunwaldt, Kubach, Lox
T-MACH-105167	Analysis Tools for Combustion Diagnostics	4 CR	Pfeil
T-MACH-105169	Engine Measurement Techniques	4 CR	Bernhardt
T-MACH-104609	Combustion Engines II	5 CR	Koch, Kubach
T-MACH-113265	Tools for HPC and AI in Engineering	4 CR	Braun
Combustion engines based powertrains (E2) (Election:)			
T-MACH-105173	Analysis of Exhaust Gas and Lubricating Oil in Combustion Engines	4 CR	Gohl
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-110817	Development of Hybrid Drivetrains	4 CR	Koch
T-MACH-110816	Large Diesel and Gas Engines for Ship Propulsions	4 CR	Kubach
T-MACH-105985	Ignition Systems	4 CR	Toedter
T-MACH-105310	Design of Highly Stresses Components	4 CR	Aktaa
T-MACH-108844	Automated Manufacturing Systems	8 CR	Fleischer
T-MACH-100092	Automotive Engineering I	8 CR	Gauterin, Gießler
T-MACH-102117	Automotive Engineering II	4 CR	Gauterin, Gießler
T-MACH-105325	Fundamentals of Combustion II	4 CR	Bykov, Maas
T-MACH-112882	Innovation2Business – Innovation Strategy in the Industrial Corporate Practice	4 CR	Albers
T-MACH-105210	Machine Dynamics	5 CR	Proppe
T-MACH-105224	Machine Dynamics II	4 CR	Proppe
T-MACH-105167	Analysis Tools for Combustion Diagnostics	4 CR	Pfeil
T-MACH-105337	Engine Laboratory	4 CR	Wagner
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	Düser, Zacharias
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-105531	Tribology	8 CR	Dienwiebel, Scherge
T-MACH-111591	Turbo Charging of Internal Combustion Engines	4 CR	Kech, Kubach
T-MACH-102148	Gear Cutting Technology	4 CR	Klaiber

Combustion engines based powertrains (P) (Election: at most 4 credits)			
T-MACH-105337	Engine Laboratory *This item will not influence the grade calculation of this parent.*	4 CR	Wagner
Combustion engines based powertrains (Ü) (Election:)			
T-MACH-109303	Exercices - Tribology *This item will not influence the grade calculation of this parent.*	0 CR	Dienwiebel

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
After completion of SP 58 students are able to:

- transfer fundamentals of thermodynamics and technical combustion to applications of combustion engines
- name and describe applications
- describe and explain the working principle of combustion engine and its application in vehicles
- analyze and evaluate propulsion systems

Content
Energy converting machines are a key issue of technical engineering. Design and working principle are subject of the core area of SP 58. Fundamentals of thermodynamics are transferred to the application of internal combustion engines. In the supplementary area Measurement techniques to analyze and develop combustion engines as well as Fuels, Lubes and special engine concepts are addressed. The application of engines in drivetrains and production processes are continuative topics.

Workload
The work load is about 480 hours, corresponding to 16 credit points.

Learning type
Lecture, tutorial.

10.20 Module: Major Field: Computational Mechanics (SP 06) [M-MACH-102604]

Responsible: Prof. Dr.-Ing. Carsten Proppe
Organisation: KIT Department of Mechanical Engineering

Part of:
Specialization / Specialization: General Mechanical Engineering (Major Fields)
Specialization / Specialization: Vehicle Technology (Major Field)
Specialization / Specialization: Mechatronics and Microsystems Technology (Major Field)
Specialization / Specialization: Product Development and Engineering Design (Major Field)
Specialization / Specialization: Theoretical Mechanical Engineering (Major Field (p))

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

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

Computational Mechanics (K) (Election: at least 8 credits)			
T-MACH-105338	Numerical Fluid Mechanics	4 CR	Gatti, Magagnato
T-MACH-105349	Computational Dynamics	4 CR	Proppe
T-MACH-105351	Computational Mechanics I	6 CR	Böhlke, Langhoff
Computational Mechanics (E) (Election: at most 8 credits)			
T-MACH-105390	Application of Advanced Programming Languages in Mechanical Engineering	4 CR	Weygand
T-MACH-105391	Finite Difference Methods for Numerial Solution of Thermal and Fluid Dynamical Problems	4 CR	Günther
T-MACH-105394	Finite Volume Methods for Fluid Flow	4 CR	Günther
T-MACH-105396	Modeling of Thermodynamical Processes	6 CR	Maas, Schießl
T-MACH-105420	Numerical Simulation of Multi-Phase Flows	4 CR	Wörner
T-MACH-105339	Numerical Simulation of Reacting Two Phase Flows	4 CR	Koch
T-MACH-105397	Numerical Simulation of Turbulent Flows	4 CR	Grötzbach
T-MACH-105350	Computational Vehicle Dynamics	4 CR	Proppe
T-MACH-105352	Computational Mechanics II	6 CR	Böhlke, Langhoff
T-MACH-113412	Atomistic Simulations and Particle Dynamics	4 CR	Gumbsch, Schneider, Weygand
Computational Mechanics (P) (Election: at most 4 credits)			
T-MACH-105392	FEM Workshop - Constitutive Laws *This item will not influence the grade calculation of this parent.*	4 CR	Schulz, Weygand

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
The module offers a wide interdisciplinary education of the students in the areas which are summarized internationally under the concept 'Computational Mechanics':

* Continuum modelling (in structural mechanics, material theory, dynamics, fluid mechanics and thermodynamics)
* Numerical mathematics
* Informatics

Students know the procedures oriented to the future of modern engineering. They have the ability for individual, creative solutions of complicated problems with numerical means and take into account the interaction with neighboring fields.

Content
See brick courses.

Workload
The work load is about 480 hours, corresponding to 16 credit points.

Learning type
Lectures, Tutorials

10.21 Module: Major Field: Development of Innovative Appliances and Power Tools (SP 51) [M-MACH-102642]

Responsible: Prof. Dr.-Ing. Sven Matthiesen

Organisation: KIT Department of Mechanical Engineering

Part of: Specialization / Specialization: General Mechanical Engineering (Major Fields)
Specialization / Specialization: Energy- and Environment Engineering (Major Field)
Specialization / Specialization: Vehicle Technology (Major Field)
Specialization / Specialization: Product Development and Engineering Design (Major Field (p))
Specialization / Specialization: Production Technology (Major Field)

Credits	Grading scale	Recurrence	Duration	Language	Level	Version
16	Grade to a tenth	Each term	2 terms	German/English	4	10

Election regulations
Elections in this module must be complete and require confirmation. Election is only possible until the lower bounds are reached.

Mandatory			
T-MACH-105229	Appliance and Power Tool Design	2 CR	Matthiesen
T-MACH-110767	Appliance and Power Tool Design Project Work *This item will not influence the grade calculation of this parent.*	6 CR	Matthiesen
Development of innovative appliances and power tools (E) (Election:)			
T-MACH-105518	Human Factors Engineering I	4 CR	Deml
T-MACH-105212	CAE-Workshop	4 CR	Albers, Matthiesen
T-INFO-110819	Edge-AI in Software and Sensor Applications	4 CR	Pankratius
T-MACH-100535	Introduction into Mechatronics	6 CR	Orth, Reischl
T-MACH-105235	Principles of Medicine for Engineers	4 CR	Pylatiuk
T-MACH-112882	Innovation2Business – Innovation Strategy in the Industrial Corporate Practice	4 CR	Albers
T-MACH-105330	Design with Plastics	4 CR	Liedel
T-MACH-105221	Lightweight Engineering Design	4 CR	Düser, Ott
T-MACH-105231	Leadership and Management Development	4 CR	Albers, Matthiesen, Ploch
T-MACH-101910	Microactuators	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	Düser, Zacharias
T-MACH-105441	Development of Oil-Hydraulic Powertrain Systems	4 CR	Geerling
T-MACH-102107	Quality Management	4 CR	Lanza
T-MACH-111888	Re:Invent - Revolutionary Business Models as the Basis for Product Innovations	4 CR	Schneider
T-MACH-113031	Rapid Industrialization of Immature Products using the Example of Electric Mobility	4 CR	Bauer
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-111382	Technical Acoustics	4 CR	Pantle, Walter
T-MACH-111840	Reliability and Test Engineering	5 CR	Gwosch
Development of innovative appliances and power tools (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, Stiller

Competence Certificate
Performance review see individual partial performance.

Prerequisites
Due to organizational reasons, the number of participants is limited. At the beginning of august, a registration form will be available at the IPEK website. In the case of too many applicants, a selection process will be taking place. An early application is advantageous.

Competence Goal
Graduates are able to analyze and to synthesize complex technical products under consideration of customer, business and market demands. Specifically, they can address specific boundary conditions of devices and power tool manufacturers in power-tool development They and are able to take into account the resulting effects of complex product development projects: e.g. the production in large quantities, complexity of mechatronic solutions or workflow management of interdisciplinary and distributed development teams. The graduates are able to assess and optimize their work results in terms of quality, costs and user benefits. They have a holistic insight into the processes that are necessary for creating products in this specific context and thus are prepared for the technical and non-technical requirements of responsible positions in the team-oriented product development of devices and power tools.

Content
See brick courses.

Module grade calculation
When calculating the module grade, the partial performance T-MACH-105229 is weighted with 8 ECTS. All other partial achievements are weighted with the specified ECTS.

Workload
The work load is about 480 hours, corresponding to 16 credit points.

Learning type
Lecture, exercise.

10.22 Module: Major Field: Energy Converting Engines (SP 24) [M-MACH-102627]

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

Part of: Specialization / Specialization: General Mechanical Engineering (Major Fields)
Specialization / Specialization: Energy- and Environment Engineering (Major Field)
Specialization / Specialization: Vehicle Technology (Major Field)
Specialization / Specialization: Product Development and Engineering Design (Major Field)

Credits	Grading scale	Recurrence	Duration	Language	Level	Version
16	Grade to a tenth	Each term	2 terms	German/English	4	7

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

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 9 credits)			
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-CIWVT-110571	Design of a Jet Engine Combustion Chamber	6 CR	Harth
T-MACH-105515	Introduction to Numerical Fluid Dynamics	4 CR	Pritz
T-MACH-110817	Development of Hybrid Drivetrains	4 CR	Koch
T-MACH-105512	Experimental Fluid Mechanics	4 CR	Kriegseis
T-MACH-102093	Fluid Power Systems	4 CR	Geimer
T-MACH-110816	Large Diesel and Gas Engines for Ship Propulsions	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-105338	Numerical Fluid Mechanics	4 CR	Gatti, Magagnato
T-MACH-105337	Engine Laboratory	4 CR	Wagner
T-MACH-111578	Sustainable Vehicle Drivetrains	4 CR	Koch, Toedter
T-MACH-111022	Physical Measurement Technology	4 CR	Buchenau
T-MACH-105441	Development of Oil-Hydraulic Powertrain Systems	4 CR	Geerling
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-105365	Turbine and Compressor Design	4 CR	Bauer
T-MACH-105366	Turbo Jet Engines	4 CR	Bauer
T-MACH-111591	Turbo Charging of Internal Combustion Engines	4 CR	Kech, Kubach
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-105234	Windpower	4 CR	Lewald
T-MACH-105784	Vortex Dynamics	4 CR	Kriegseis, Leister
T-MACH-105985	Ignition Systems	4 CR	Toedter

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
Die Studierenden erwerben in den grundlagenorientierten Kernfächern des Schwerpunktes breite und fundierte Kenntnisse der wissenschaftlichen Theorien, Prinzipien und Methoden der Kraft- und Arbeitsmaschinen, um diese entwerfen, einsetzen und bewerten zu können.

Darauf aufbauend vertiefen die Studierenden in den Ergänzungsfächern ausgewählte Anwendungsfelder, sodass sie im Anschluss in der Lage sind, Probleme aus diesem Anwendungsfeld selbstständig zu analysieren, zu bewerten und hierauf aufbauend Lösungsansätze zu entwickeln.

Die Studierenden können nach Abschluss des Schwerpunkts insbesondere

- Funktion und Einsatz von Kraft- und Arbeitsmaschinen benennen,
- den Stand der Technik und daraus resultierende Anwendungsfelder der Kraft- und Arbeitsmaschinen beschreiben und am Beispiel anzuwenden,
- grundlegende Theorien, Methoden und Eigenschaften für die verschiedenen Anwendungsfelder der Kraft- und Arbeitsmaschinen benennen und diese einsetzen und bewerten.

Content
See brick courses.

Workload
The work load is about 480 hours, corresponding to 16 credit points.

Learning type
Lecture, tutorial.

M 10.23 Module: Major Field: Energy Technology for Buildings (SP 55) [M-MACH-102648]

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

Part of: Specialization / Specialization: General Mechanical Engineering (Major Fields)
Specialization / Specialization: Energy- and Environment Engineering (Major Field)

Credits	Grading scale	Recurrence	Duration	Language	Level	Version
16	Grade to a tenth	Each term	2 terms	German/English	4	5

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

Mandatory			
T-MACH-105559	Technical Energy Systems for Buildings 1: Processes & Components	4 CR	Schmidt
Energy Technology for Buildings (K) (Election: at least 4 credits)			
T-MACH-105560	Technical Energy Systems for Buildings 2: System Concept	4 CR	Schmidt
Energy Technology for Buildings (E) (Election: at most 8 credits)			
T-ARCH-107406	Energy and Indoor Climate Concepts	4 CR	Wagner
T-MACH-105408	Energy Systems I: Renewable Energy	4 CR	Dagan
T-ETIT-100724	Photovoltaic System Design	3 CR	Grab
T-MACH-106372	Thermal-Fluid-Dynamics	4 CR	Ruck
T-MACH-105430	Heatpumps	4 CR	Maas, Wirbser
T-MACH-105234	Windpower	4 CR	Lewald
T-MACH-106493	Solar Thermal Energy Systems	4 CR	Dagan
Energy Technology for Buildings (P) (Election: at most 6 credits)			
T-INFO-112030	Practical Course: Smart Energy System Lab	6 CR	Waczowicz

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
After completing the courses in SP 55 „Energy technology for buildings“ the students have achieved a comprehensive overview on the energy demand for air-conditioning of buildings (heating, cooling, humidification, dehumidification, ventilation) and the techniques for energy supply of buildings (heat, cold, locally generated electricity). They know the methods for evaluation of technologies regarding ecologic, criteria, primary energy and economic viability and they have the ability to apply these methods to concrete cases. They also have gained knowledge on all renewable energy technologies that are relevant for application in buildings, in particular solar thermal collectors and systems and photovoltaic systems as well as energy storage technologies that are applied in buildings (heat storage, batteries).

Content
See brick courses.

Workload
The work load is about 480 hours, corresponding to 16 credit points.

Learning type
Lecture, exercise.

M 10.24 Module: Major Field: Engineering Design (SP 10) [M-MACH-102605]

Responsible: Prof. Dr.-Ing. Tobias Düser
Organisation: KIT Department of Mechanical Engineering

Part of: Specialization / Specialization: General Mechanical Engineering (Major Fields)
Specialization / Specialization: Energy- and Environment Engineering (Major Field)
Specialization / Specialization: Vehicle Technology (Major Field)
Specialization / Specialization: Product Development and Engineering Design (Major Field)
Specialization / Specialization: Production Technology (Major Field)

Credits	Grading scale	Recurrence	Duration	Language	Level	Version
16	Grade to a tenth	Each term	2 terms	German/English	4	8

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

Engineering Design (K) (Election: at least 8 credits)			
T-MACH-105216	Powertrain Systems Technology B: Stationary Machinery	4 CR	Düser, Ott
T-MACH-113405	Drive System Engineering A: Automotive Systems	4 CR	Düser, Ott
T-MACH-105221	Lightweight Engineering Design	4 CR	Düser, Ott
Engineering Design (E) (Election: at most 8 credits)			
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
T-MACH-111398	Design of Fuel Cell Systems	4 CR	Haußmann
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	Ehrhardt
T-MACH-102105	Manufacturing Technology	8 CR	Schulze
T-MACH-100092	Automotive Engineering I	8 CR	Gauterin, Gießler
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	Harrer
T-MACH-105163	Fundamentals of Automobile Development II	2 CR	Harrer
T-MACH-112882	Innovation2Business – Innovation Strategy in the Industrial Corporate Practice	4 CR	Albers
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	Geerling
T-MACH-102107	Quality Management	4 CR	Lanza
T-MACH-111888	Re:Invent - Revolutionary Business Models as the Basis for Product Innovations	4 CR	Schneider
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, Stiller
T-MACH-111431	Programming in CAE-Applications	4 CR	Kärger
T-MACH-110960	Project Internship Additive 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

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

Content
See brick courses.

Workload
The work load is about 480 hours, corresponding to 16 credit points.

Learning type
Lectures, Tutorials

10.25 Module: Major Field: Engineering Thermodynamics (SP 45) [M-MACH-102635]

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

Part of: Specialization / Specialization: General Mechanical Engineering (Major Fields)
Specialization / Specialization: Energy- and Environment Engineering (Major Field)
Specialization / Specialization: Vehicle Technology (Major Field)
Specialization / Specialization: Mechatronics and Microsystems Technology (Major Field)
Specialization / Specialization: Product Development and Engineering Design (Major Field)
Specialization / Specialization: Theoretical Mechanical Engineering (Major Field)
Specialization / Specialization: Materials and Structures for High Performance Systems (Major Field)

Credits	Grading scale	Recurrence	Duration	Language	Level	Version
16	Grade to a tenth	Each term	2 terms	German/English	4	6

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

Engineering Thermodynamics (K) (Election: at least 8 credits)			
T-MACH-105213	Fundamentals of Combustion I	4 CR	Maas
T-MACH-105325	Fundamentals of Combustion II	4 CR	Bykov, Maas
T-MACH-105396	Modeling of Thermodynamical Processes	6 CR	Maas, Schießl
T-MACH-105403	Flows and Heat Transfer in Energy Technology	4 CR	Cheng
Engineering Thermodynamics (E) (Election: at most 9 credits)			
T-MACH-105428	Selected Chapters of the Combustion Fundamentals	4 CR	Maas
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-111193	Data Driven Engineering 1: Machine Learning for Dynamical Systems	4 CR	Bauer
T-MACH-106373	Experimental techniques in thermo- and fluid-dynamics	4 CR	Cheng
T-MACH-105419	Mathematical Models and Methods in Combustion Theory	4 CR	Bykov
T-MACH-105167	Analysis Tools for Combustion Diagnostics	4 CR	Pfeil
T-MACH-105421	Reduction Methods for the Modeling and the Simulation of Combustion Processes	4 CR	Bykov
T-MACH-105422	Flows with Chemical Reactions	4 CR	Class
T-MACH-105363	Thermal Turbomachines I	6 CR	Bauer
T-MACH-105364	Thermal Turbomachines II	6 CR	Bauer
T-MACH-105429	Combustion Diagnositics	4 CR	Maas, Schießl
T-MACH-111585	Hydrogen and reFuels - Energy Conversion in Combustion Engines	4 CR	Kubach
T-MACH-105430	Heatpumps	4 CR	Maas, Wirbser

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
After completion of SP 45 students are able to:

- apply the thermodynamic fundamentals of reversible and irreversible processes.
- outline the fundamentals of experimental investigations, modeling and simulation of reacting flows.
- understand the working principle of technical systems applying thermodynamic processes and combustion.

Content
Thermodynamics is considered to be the basis of all processes in nature and engineering. The major subject in this SP extends the thermodynamic knowledge of the attendees in irreversible thermodynamic processes and provides insight into the fundamentals of reactive flows.

Workload
The work load is about 480 hours, corresponding to 16 credit points.

Learning type
Lectures, Tutorials

10.26 Module: Major Field: Fluid Mechanic (SP 41) [M-MACH-102634]

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

Part of: Specialization / Specialization: General Mechanical Engineering (Major Fields)
Specialization / Specialization: Energy- and Environment Engineering (Major Field)
Specialization / Specialization: Vehicle Technology (Major Field)
Specialization / Specialization: Product Development and Engineering Design (Major Field)
Specialization / Specialization: Theoretical Mechanical Engineering (Major Field (p))

Credits	Grading scale	Recurrence	Duration	Language	Level	Version
16	Grade to a tenth	Each term	2 terms	German/English	4	10

Fluid Mechanics (K) (Election: at least 2 items as well as at least 8 credits)			
T-MACH-105512	Experimental Fluid Mechanics	4 CR	Kriegseis
T-BGU-110841	Fluid Mechanics of Turbulent Flows	6 CR	Uhlmann
T-MACH-105425	Hydrodynamic Stability: From Order to Chaos	4 CR	Class
T-BGU-106758	Numerical Fluid Mechanics	6 CR	Uhlmann
T-MACH-105338	Numerical Fluid Mechanics	4 CR	Gatti, Magagnato
T-MACH-105400	Scaling in Fluid Dynamics	4 CR	Bühler
T-MACH-105784	Vortex Dynamics	4 CR	Kriegseis, Leister
Fluid Mechanics (E) (Election: at most 2 items)			
T-MACH-112029	Aerodynamics	4 CR	
T-MACH-105437	Aerothermodynamics	4 CR	Frohnapfel, Seiler
T-MACH-112719	Dynamics of Unsteady Flows - Modelling and Control of Industrial Processes	4 CR	Frohnapfel, Ohle
T-MACH-111507	Fluid-Structure-Interaction with Python	4 CR	Mühlhausen
T-MACH-111390	Advanced CFD with OpenFOAM	4 CR	Samkhaniani
T-MACH-105375	Industrial Aerodynamics	4 CR	Frohnapfel, Kröber
T-MACH-105426	Magnetohydrodynamics	4 CR	Bühler
T-MACH-105295	Mathematical Methods in Fluid Mechanics	6 CR	Frohnapfel
T-MACH-113144	Microscale Fluid Mechanics	4 CR	Marthaler
T-BGU-110842	Modeling of Turbulent Flows - RANS and LES	6 CR	Uhlmann
T-MACH-105420	Numerical Simulation of Multi-Phase Flows	4 CR	Wörner
T-MACH-105339	Numerical Simulation of Reacting Two Phase Flows	4 CR	Koch
T-MACH-105397	Numerical Simulation of Turbulent Flows	4 CR	Grötzbach
T-MACH-105422	Flows with Chemical Reactions	4 CR	Class
T-MACH-106372	Thermal-Fluid-Dynamics	4 CR	Ruck
T-MACH-105406	Two-Phase Flow and Heat Transfer	4 CR	Schulenberg, Wörner
Fluid Mechanics (P) (Election: at most 4 credits)			
T-MACH-110838	Numerical Fluid Mechanics with PYTHON *This item will not influence the grade calculation of this parent.*	4 CR	Frohnapfel

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
After having completed this module the student is capable of deriving the relevant fluid mechanical equations and interpret the governed physics. He/She can describe the characteristic properties of fluids and can analyze flow scenarios. According to the chosen lectures, the student can capture flow scenarios with analytical, numerical and/or experimental means and is capable to evaluate the acquired results thoroughly.

Content
See brick courses.

Workload
The work load is about 480 hours, corresponding to 16 credit points.

Learning type
Lectures, Tutorials

10.27 Module: Major Field: Fundamentals of Energy Technology (SP 15) [M-MACH-102623]

Responsible: Prof. Dr.-Ing. Hans-Jörg Bauer

Organisation: KIT Department of Mechanical Engineering
Institute of Thermal Turbomachinery

Part of: Specialization / Specialization: General Mechanical Engineering (Major Fields)
Specialization / Specialization: Energy- and Environment Engineering (mandatory)
Specialization / Specialization: Vehicle Technology (Major Field)
Specialization / Specialization: Mechatronics and Microsystems Technology (Major Field)
Specialization / Specialization: Product Development and Engineering Design (Major Field)

Credits	Grading scale	Recurrence	Duration	Language	Level	Version
16	Grade to a tenth	Each term	2 terms	German/English	4	9

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-111398	Design of Fuel Cell Systems	4 CR	Haußmann
T-MACH-111623	Fuels and Lubricants for Engine Powertrains	4 CR	Kehrwald, Kubach
T-MACH-111550	CO2-Neutral Combustion Engines and their Fuels I	4 CR	Koch
T-MACH-111193	Data Driven Engineering 1: Machine Learning for Dynamical Systems	4 CR	Bauer
T-MACH-111373	Data Driven Engineering 2: Advanced Topics	4 CR	Bauer
T-MACH-105151	Energy Efficient Intralogistic Systems	4 CR	Kramer, Schönung
T-MACH-105408	Energy Systems I: Renewable Energy	4 CR	Dagan
T-MACH-112755	Energy Topology and Resilience	4 CR	Ottenburger
T-MACH-105167	Analysis Tools for Combustion Diagnostics	4 CR	Pfeil
T-MACH-105557	Microenergy Technologies	4 CR	Kohl
T-MACH-105339	Numerical Simulation of Reacting Two Phase Flows	4 CR	Koch
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-105358	Sustainable Product Engineering	4 CR	Albers, Matthiesen, Ziegahn
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	Dagan
T-MACH-105363	Thermal Turbomachines I	6 CR	Bauer
T-MACH-105234	Windpower	4 CR	Lewald
Fundamentals of Energy Technology (P) (Election: at most 6 credits)			
T-MACH-105313	CFD-Lab Using OpenFOAM *This item will not influence the grade calculation of this parent.*	4 CR	Koch
T-MACH-105515	Introduction to Numerical Fluid Dynamics *This item will not influence the grade calculation of this parent.*	4 CR	Pritz

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
T-INFO-112030	Practical Course: Smart Energy System Lab	6 CR	Waczowicz

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
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
See brick courses.

Workload
The work load is about 480 hours, corresponding to 16 credit points.

Learning type
Lectures, tutorials.

M 10.28 Module: Major Field: Fusion Technology (SP 53) [M-MACH-102643]

Responsible: Prof. Dr.-Ing. Xu Cheng
Organisation: KIT Department of Mechanical Engineering

Part of: Specialization / Specialization: General Mechanical Engineering (Major Fields)
Specialization / Specialization: Energy- and Environment Engineering (Major Field)
Specialization / Specialization: Theoretical Mechanical Engineering (Major Field)

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

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

Fusion Technology (K) (Election: at least 8 credits)			
T-MACH-105411	Fusion Technology A	4 CR	Perez Martin, Weiss
T-MACH-105433	Fusion Technology B	4 CR	N.N.
Fusion Technology (E) (Election: at most 10 credits)			
T-MACH-111824	Applied Cryo-Technology	4 CR	Neumann, Weiss
T-MACH-105310	Design of Highly Stresses Components	4 CR	Aktaa
T-MACH-105407	CFD for Power Engineering	4 CR	Otic
T-MACH-112238	Holistic Approach of Managing Power Plant Operation under Uncertainty and Volatility	4 CR	Seidl
T-MACH-105408	Energy Systems I: Renewable Energy	4 CR	Dagan
T-MACH-105434	Magnet Technology of Fusion Reactors	4 CR	Weiss, Wolf
T-MACH-105426	Magnetohydrodynamics	4 CR	Bühler
T-MACH-105456	Ten Lectures on Turbulence	4 CR	Otic
T-MACH-106372	Thermal-Fluid-Dynamics	4 CR	Ruck
T-MACH-108784	Vacuum and Tritium Technology in Nuclear Fusion	4 CR	Giegerich, Größle
T-MACH-105406	Two-Phase Flow and Heat Transfer	4 CR	Schulenberg, Wörner

Competence Certificate
Oral exam: Acceptance for the oral test only by certification of attendance of excercises
(can be given in english)
Duration: approximately 30 minutes

no tools or reference materials may be used during the exam

Prerequisites
None

Competence Goal
Graduate in fusion technology acquire a fundamental knowledge of the fusion process and are enabled to deduce based on the physical boundary conditions technological and scientific engineering solutions to individual problems. Since fusion technology is intrinsically of interdisciplinary nature consisiting of physics, mechanics, thermal-hydraulics, material sciences and electrical engineering incorporates, the focus of this topic is mainly devoted to allow for the understanding of the underlying physics and moreover to enable the students of couple the different disciplines. Here, mainly mehtodologies and solution approaches are communicated to the gradiuates with the goal to capture critical issues within multi-physics problems, to identify central challenges within the given problem and to enable them to elaborate engineering solution concepts. Aside from the analysis of the relevance/importance of aspects within a complex multi-physics problem graduates are prepared to take decisions based on a solid physics basis and to formulate solution approaches.

The reliable handling of different physical phenomena from different disciplines and the methodological capability to tackle multi-physics questions and to extract from them central core issues qualifies the graduates for a competent and successful career not only in fusion technology but also in neighboring fields such energy energiering as well as process, chemical and environmental engineering both in the research and development context but also in the project management.

Content
Actual energy situation and perspectives. Elementary particle physics, principles of nuclear fusion and nuclear fission. What is a plasma and how it can be confined? How stable is a plasma and condtions for an ignition , control of a plasma and transport in plasmas. Plasmas are confined contactless by means of magnetic fields. Hence fundamentals of the magnet technology, super-conductivity, materials in super-conductivity, fabrication and design of magnets are elaborated.A fusion reactor breeds is own fuel Tritium, which is radioactive. Tritium poses specific requirements regarding separation, conditioning and the fuel cycle, for which the physical and technological basis are outlined. Fusion plasmas are characterized by a small particle density and hence a vacuum is required. Simultaneously plasmas generate high temperatures and heat loads necessitating dedicated designs of plasma facing components at a considerable neutron irradiation. in both technology fields the tasks, requirements and challenges are formulated and how they translate to the current "state of the art" are illustrated. Moreover, an introduction into design criteria and calculation methods to select adequate vacuum pumps and to design plasma facing components is provided.

Workload
The work load is about 480 hours, corresponding to 16 credit points.

Recommendation
appreciated is knowldege in heat ans mass transfer as well as in electrical engineering

Basic knowledge in fluid mechanics, material sciences and physics

Learning type
Lecture, presentation (transparencies nearly exclusivley in english) complemented by print-outs and exercises

M 10.29 Module: Major Field: Information Technology (SP 18) [M-MACH-102624]

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

Part of:
Specialization / Specialization: General Mechanical Engineering (Major Fields)
Specialization / Specialization: Energy- and Environment Engineering (Major Field)
Specialization / Specialization: Vehicle Technology (Major Field)
Specialization / Specialization: Mechatronics and Microsystems Technology (Major Field)
Specialization / Specialization: Product Development and Engineering Design (Major Field)
Specialization / Specialization: Production Technology (Major Field)
Specialization / Specialization: Theoretical Mechanical Engineering (Major Field)

Credits	Grading scale	Recurrence	Duration	Language	Level	Version
16	Grade to a tenth	Each term	2 terms	German/English	4	8

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	Meisenbacher, 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 8 credits)			
T-MACH-111193	Data Driven Engineering 1: Machine Learning for Dynamical Systems	4 CR	Bauer
T-MACH-111373	Data Driven Engineering 2: Advanced Topics	4 CR	Bauer
T-MACH-113597	Decision-Making and Motion Planning for Automated Driving	6 CR	Naumann, Werling
T-MACH-105218	Automotive Vision	6 CR	Lauer, Stiller
T-MACH-102128	Information Systems and Supply Chain Management	3 CR	Kilger
T-MACH-105187	IT-Fundamentals of Logistics	4 CR	Thomas
T-MACH-105169	Engine Measurement Techniques	4 CR	Bernhardt
T-MACH-105341	Lab Computer-Aided Methods for Measurement and Control	4 CR	Klemp, Stiller
T-MACH-111821	Control of Mobile Machines	4 CR	Becker, Geimer
T-MACH-111820	Control of Mobile Machines – Prerequisites	0 CR	Becker, Geimer
T-MACH-105185	Control Technology	4 CR	Gönnheimer
T-MACH-112115	Artificial Intelligence in Production	4 CR	Fleischer
T-MACH-112121	Seminar Application of Artificial Intelligence in Production	4 CR	Fleischer
Information Technology (Ü) (Election:)			
T-MACH-108889	BUS-Controls - Advance *This item will not influence the grade calculation of this parent.*	0 CR	Geimer

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

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

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 480 hours, corresponding to 16 credit points.

Learning type
Lectures, tutorials.

10.30 Module: Major Field: Information Technology of Logistic Systems (SP 19) [M-MACH-102625]

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

Part of: Specialization / Specialization: General Mechanical Engineering (Major Fields)
Specialization / Specialization: Product Development and Engineering Design (Major Field)
Specialization / Specialization: Production Technology (Major Field)

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

Mandatory			
T-MACH-110771	Logistics and Supply Chain Management	9 CR	Furmans
Information Technology of Logistic Systems (E) (Election:)			
T-MACH-102128	Information Systems and Supply Chain Management	3 CR	Kilger
T-MACH-105187	IT-Fundamentals of Logistics	4 CR	Thomas
T-MACH-105174	Warehousing and Distribution Systems	3 CR	Furmans
T-MACH-105218	Automotive Vision	6 CR	Lauer, 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:

- Describe and explain soft- and hardware for logistical systems including Supply-Chains,
- Choose control mechanisms and communication systems and describe their basic functions,
- Compare strength and weaknesses of different approaches and evaluate the fundamental suitability.

Content
This emphasis module focuses on automation technology in material flow as well as the information technology that has a direct relationship with it. Information sytems to support logistic processes are presented. It is shown how requirements of a supply chain can be identified and an appropriate information system can be choosen. Furthermore basic for the main topics of logistics are provided. To gain a deeper understanding, the courses are accompanied by exercises and partly by case studies.

Workload
The work load is about 480 hours, corresponding to 16 credit points.

Learning type
Lectures and practices; self-study

M 10.31 Module: Major Field: Innovation and Entrepreneurship (SP 59) [M-MACH-104323]

Responsible: apl. Prof. Dr. Andreas Class
Prof. Dr. Orestis Terzidis

Organisation: KIT Department of Mechanical Engineering

Part of: Specialization / Specialization: Energy- and Environment Engineering (Major Field)

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

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

Innovation und Entrepreneurship (K) (Election: at least 8 credits)			
T-WIWI-102866	Design Thinking	3 CR	Terzidis
T-WIWI-102864	Entrepreneurship	3 CR	Terzidis
T-MACH-109185	Innovative Project	6 CR	Class, Terzidis
Innovation und Entrepreneurship (E) (Election: at most 11,5 credits)			
T-WIWI-107501	Energy Market Engineering	4,5 CR	Weinhardt
T-WIWI-102865	Business Planning	3 CR	Terzidis
T-WIWI-100806	Renewable Energy-Resources, Technologies and Economics	4 CR	Jochem
T-MACH-111888	Re:Invent - Revolutionary Business Models as the Basis for Product Innovations	4 CR	Schneider

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

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

Prerequisites
none

Competence Goal
After completion of the module students

- know the principles of innovation and entrepreneurship
- can initiate patent research
- can name, compare and use the central methods and process models of product development within moderate complex technical systems.

Content
The module introduces the basic concepts of entrepreneurship and illustrates the different stages of the dynamic development of a company.

The topics include:

- introduction to methods for generating innovative business ideas
- translating patents into business concepts
- general principles of financial planning
- the design and implementation of service-oriented information systems for Entrepreneurs
- Technology Management and Business Model Generation and “Lean Startup” methods for the implementation of business ideas by the way of controlled experiments in the market
- basics of product development.

Workload
The work load is about 480 hours, corresponding to 16 credit points. 1 LP = 30 working hours

Learning type
Seminar, lecture, project

M 10.32 Module: Major Field: Integrated Product Development [M-MACH-102626]

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

Part of: Specialization / Specialization: General Mechanical Engineering (Major Fields)
Specialization / Specialization: Energy- and Environment Engineering (Major Field)
Specialization / Specialization: Vehicle Technology (Major Field)
Specialization / Specialization: Product Development and Engineering Design (Major Field (p))
Specialization / Specialization: Production Technology (Major Field)

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

Mandatory			
T-MACH-105401	Integrated Product Development	16 CR	Albers

Competence Certificate
oral examination (60 minutes)

Prerequisites
None

Competence Goal
By working practically in experience-based learning arrangements with industrial development tasks, graduates are able to succeed in new and unknown situations when developing innovative products by using methodological and systematic approaches. They can apply and adapt strategies of development and innovation management, technical system analysis and team leadership to the situation. As a result, they are able to foster the development of innovative products in industrial development teams in prominent positions, taking into account social, economic and ethical aspects.

Content
Organizational integration: integrated product development model, core team management and simultaneous engineering, informational integration: innovation management, cost management, quality management and knowledge management

Personal integration: team development and leadership

Guest lectures from the industry

Annotation
The participation in the course "Integrated Product Development" requires the simultaneous participation in the lecture(2145156), the workshop (2145157) and the product development project (2145300).

For organizational reasons, the number of participants for the product development project is limited. Therefore, a selection process will take place. Registration for the selection process is made by means of a registration form, which is available annually from April to July on the homepage of the IPEK. Afterwards the selection itself will be discussed in personal interviews with Professor Albers.

The rule here is:

- Students within the course of studies will be decided on the basis of their progress (not only with semesters), which will be determined in a personal interview. The personal selection interviews take place in addition, in order to make the students aware of the special project-oriented format and the time required in correlation with the ECTS points of the course before the final registration for the course.
- With the same study progress after waiting period
- With same waiting time by lot.
- The same procedure is used for students from other courses.

Workload
The work load is about 480 hours, corresponding to 16 credit points.

Learning type
lecture
tutorial
product development project

M 10.33 Module: Major Field: Lifecycle Engineering (SP 28) [M-MACH-102613]

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

Part of:
Specialization / Specialization: General Mechanical Engineering (Major Fields)
Specialization / Specialization: Vehicle Technology (Major Field)
Specialization / Specialization: Mechatronics and Microsystems Technology (Major Field)
Specialization / Specialization: Product Development and Engineering Design (Major Field (p))
Specialization / Specialization: Production Technology (Major Field (p))

Credits	Grading scale	Recurrence	Duration	Language	Level	Version
16	Grade to a tenth	Each term	2 terms	German/English	4	7

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

Mandatory			
T-MACH-102123	Virtual Engineering I	4 CR	Ovtcharova
T-MACH-102124	Virtual Engineering II	4 CR	Ovtcharova
Lifecycle Engineering (E) (Election:)			
T-MACH-109933	Business Administration for Engineers and IT Professionals	4 CR	Sebregondi
T-MACH-113669	Hot Research Topics in AI for Engineering Applications	4 CR	Meyer
T-MACH-105212	CAE-Workshop	4 CR	Albers, Matthiesen
T-MACH-105312	CATIA Advanced	4 CR	Ovtcharova
T-MACH-111298	Digital Transformation of Industrial Companies	4 CR	Deml
T-MACH-106374	Human-oriented Productivity Management: Personnel Management	4 CR	Stock
T-MACH-105388	Introduction to Industrial Production Economics	4 CR	Dürrschnabel
T-MACH-102209	Information Engineering	3 CR	Meyer, Ovtcharova
T-MACH-106743	IoT Platform for Engineering	4 CR	Ovtcharova
T-MACH-110954	Lightweight Constructions with Fiber-Reinforced-Polymers – Theory and Practice	4 CR	Kärger, Liebig
T-MACH-105189	Mathematical Models and Methods for Production Systems	6 CR	Baumann, Furmans
T-MACH-102181	PLM for Product Development in Mechatronics	4 CR	Eigner
T-MACH-105523	Productivity Management in Production Systems	4 CR	Stowasser
T-MACH-105171	Safety Engineering	4 CR	Kany
T-MACH-105971	Simulation of the Process Chain of Continuously Fiber Reinforced Composite Structure	4 CR	Kärger
T-MACH-105970	Structural Analysis of Composite Laminates	4 CR	Kärger
T-MACH-105358	Sustainable Product Engineering	4 CR	Albers, Matthiesen, Ziegahn
T-MACH-106740	Virtual Engineering Lab	4 CR	Ovtcharova
T-MACH-112115	Artificial Intelligence in Production	4 CR	Fleischer
T-MACH-112121	Seminar Application of Artificial Intelligence in Production	4 CR	Fleischer
Lifecycle Engineering, Practical Lab (Election: at most 1 item)			
T-MACH-102187	CAD-NX Training Course	2 CR	Ovtcharova

Competence Certificate
Written examination in "Virtual Engineering I" and written examination in "Virtual Engineering II" with a duration of 90 minutes each.
Depending on the selected courses in the elective area, further performance assessments take place as "written examination", "oral examination", "examination performance of another kind" (project work, written submissions, presentations) or as "study performance".

Prerequisites
None

Competence Goal
Student gain a basic understanding of holistic development, validation and production of products, components and systems.

Students are able to appreciate the product and process complexity of today’s products and manufacturing facilities. They know exemplary IT-Systems to support the complexity.

Students can describe the necessary information management for the product emergence process.

Students know the fundamental terms or virtual reality and are able to use a CAVE as tool to promote technical or management decisions.

Content
Virtual Engineering, methods of product development and production, CAD, CAE, CAx, Virtual and Augmented Reality, digital twin.

Workload
The work load is about 480 hours, corresponding to 16 credit points.

Learning type
Lectures, exercises, project work in teams, workshop, Learning by Doing

10.34 Module: Major Field: Lightweight Construction (SP 25) [M-MACH-102628]

Responsible: Prof. Dr.-Ing. Frank Henning
Organisation: KIT Department of Mechanical Engineering
Lightweight Design
Part of: Specialization / Specialization: General Mechanical Engineering (Major Fields)
Specialization / Specialization: Energy- and Environment Engineering (Major Field)
Specialization / Specialization: Vehicle Technology (Major Field)
Specialization / Specialization: Product Development and Engineering Design (Major Field)
Specialization / Specialization: Production Technology (Major Field)
Specialization / Specialization: Materials and Structures for High Performance Systems (Major Field)

Credits	Grading scale	Recurrence	Duration	Language	Level	Version
16	Grade to a tenth	Each term	2 terms	German/English	4	8

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

Mandatory			
T-MACH-105535	Composite Manufacturing - Polymers, Fibers, Semi-Finished Products, Manufacturing Technologies	4 CR	Henning
Lightweight Construction (K) (Election: at least 4 credits)			
T-MACH-105237	Vehicle Lightweight Design - Strategies, Concepts, Materials	4 CR	Henning
T-MACH-105970	Structural Analysis of Composite Laminates	4 CR	Kärger
Lightweight Construction (E) (Election:)			
T-MACH-105971	Simulation of the Process Chain of Continuously Fiber Reinforced Composite Structure	4 CR	Kärger
T-MACH-110954	Lightweight Constructions with Fiber-Reinforced-Polymers – Theory and Practice	4 CR	Kärger, Liebig
T-MACH-113367	Modeling of polymer and suspension flows for industrial manufacturing processes	4 CR	Kärger, Wittemann
T-MACH-105221	Lightweight Engineering Design	4 CR	Düser, Ott
T-MACH-105211	Materials of Lightweight Construction	4 CR	Liebig
T-MACH-102137	Polymer Engineering I	4 CR	Liebig
T-MACH-110937	Materials Recycling and Sustainability	4 CR	Liebig
T-MACH-108844	Automated Manufacturing Systems	8 CR	Fleischer
T-MACH-105212	CAE-Workshop	4 CR	Albers, Matthiesen
T-MACH-105320	Introduction to the Finite Element Method	3 CR	Böhlke, Langhoff
T-MACH-110330	Tutorial Introduction to the Finite Element Method	1 CR	Böhlke, Langhoff
T-MACH-110377	Continuum Mechanics of Solids and Fluids	3 CR	Böhlke, Frohnapfel
T-MACH-110333	Tutorial Continuum Mechanics of Solids and Fluids	1 CR	Böhlke, Frohnapfel
T-MACH-105330	Design with Plastics	4 CR	Liedel
T-MACH-113698	Beyond Conventional Materials - Metamaterials & Architected Structures	4 CR	Bauer
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-CHEMBIO-100294	Polymers	6 CR	
T-MACH-105151	Energy Efficient Intralogistic Systems	4 CR	Kramer, Schönung
T-MACH-105157	Foundry Technology	4 CR	Günther, Klan
T-MACH-108878	Laboratory Production Metrology	4 CR	Lanza, Stamer
T-MACH-110318	Product- and Production-Concepts for Modern Automobiles	4 CR	Kienzle, Steegmüller
T-MACH-110960	Project Internship Additive Manufacturing: Development and Production of an Additive Component	4 CR	Zanger
T-MACH-108721	Designing with Composites	4 CR	Schnack
T-MACH-108717	Mechanics of Laminated Composites	4 CR	Schnack

T-MACH-105164	Laser in Automotive Engineering	4 CR	Schneider
T-MACH-112763	Laser Material Processing	4 CR	Schneider
Lightweight Construction (P) (Election: at most 4 credits)			
T-MACH-111431	Programming in CAE-Applications	4 CR	Kärger

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
Lightweight design is the realization of a development strategy, which aims at fulfilling a required function over the product life under specified boundary conditions by a system of minimal weight.

Therefore, lightweight design can always be described as an optimization problem, that must be solved as efficiently as possible by suitable measures. With regard to the automotive industry, this means reducing the total vehicle weight without negatively affecting important properties such as the bodywork stiffness or crash characteristics.

In order to solve the optimization problem of lightweight design technically and economically efficient, an interdisciplinary approach is required. This means that specific know-how is required in many areas of materials science and engineering, as well as interdisciplinary thinking.

Exploiting the full potential of lightweight design therefore requires the systematic development of materials, the development and adaption of suitable manufacturing and finishing processes, as well as the development of simulation tools and design methods for innovative lightweight constructions.

Students acquire the skill to name the basics of lightweight design and to apply them to problems in various areas of mechanical engineering, in particular materials, methods and production.

As an elementary component of the module, the students can explain and apply the materials relevant for lightweight design. The students are able to describe and compare the materials important for lightweight design and to select the corresponding methods for construction, design and dimensioning under consideration of suitable manufacturing technologies.

Based on examples, which are also used in industry, the students learn to select suitable materials, to describe them with suitable methods and to develop products under consideration of the manufacturing process. The students learn to analyze processes and to assess their efficiency.

Content
See brick courses.

Workload
The work load is about 480 hours, corresponding to 16 credit points.

Recommendation
The following **courses** are recommended in the election block for:

1. Focus on methods and simulation
    - T-MACH-105970 Structural Analysis of Composite Laminates
    - T-MACH-105971 Simulation of the process chain of continuously fiber reinforced composite structure
    - T-MACH-110954 Lightweight constructions with fiber-reinforced-polymers – theory and practice
    - T-MACH-105221 Lightweight Engineering Design
2. Focus on materials science
    - T-MACH-105211 Materials of Lightweight Construction
    - T-MACH-102137 Polymer Engineering I
    - T-MACH-110954 Lightweight constructions with fiber-reinforced-polymers – theory and practice
    - T-MACH-110937 Materials Recycling and Sustainability (as of WS 20/21)
3. Focus on production science
    - T-MACH-108844 Automated Manufacturing Systems
    - T-MACH-110954 Lightweight constructions with fiber-reinforced-polymers – theory and practice

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The following **major fields** are recommended in combination with SP 25 "Lightweight Construction" for:

1. Focus on methods and simulation
    - SP 30 Applied Mechanics (Böhlke)
    - SP 56 Advanced Materials Modelling (Böhlke)
    - SP 41 Fluid Mechanic (Frohnapfel)
2. Focus on materials science
    - SP 36 Polymer Engineering (Elsner)
    - SP 26 Materials Science and Engineering (Heilmaier)
3. Focus on production science
    - SP 39 Production Technology (Schulze)

Learning type
Lectures, Tutorials

M 10.35 Module: Major Field: Logistics and Material Flow Theory (SP 29) [M-MACH-102629]

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

Part of: Specialization / Specialization: General Mechanical Engineering (Major Fields)
Specialization / Specialization: Product Development and Engineering Design (Major Field)
Specialization / Specialization: Production Technology (Major Field (p))

Credits	Grading scale	Recurrence	Duration	Language	Level	Version
16	Grade to a tenth	Each term	2 terms	German/English	4	7

Mandatory			
T-MACH-110771	Logistics and Supply Chain Management	9 CR	Furmans
Logistics and Material Flow Theory (E) (Election:)			
T-MACH-105317	Digital Control	4 CR	Knoop
T-MACH-105151	Energy Efficient Intralogistic Systems	4 CR	Kramer, Schönung
T-MACH-111003	Global Logistics	4 CR	Furmans
T-MACH-110991	Global Production	4 CR	Lanza
T-MACH-102128	Information Systems and Supply Chain Management	3 CR	Kilger
T-MACH-105174	Warehousing and Distribution Systems	3 CR	Furmans
T-MACH-105523	Productivity Management in Production Systems	4 CR	Stowasser
T-MACH-105346	Production Techniques Laboratory	4 CR	Deml, Fleischer, Furmans, Ovtcharova
T-MACH-113031	Rapid Industrialization of Immature Products using the Example of Electric Mobility	4 CR	Bauer
T-MACH-105171	Safety Engineering	4 CR	Kany

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

- acquire comprehensive and well-founded knowledge on the main topics of logistics, an overview of different logistic questions in practice and knows the functionality of material handling systems,
- are able to illustrate logistic systems with adequate accuracy by using simple models,
- are able to realize coherences within logistic systems,
- are able to evaluate logistic systems by using the learnt methods,
- are able to analyze and explain the phenomena of industrial material and value streams
- are able to plan logistic systems and evaluate their performance,
- can use approaches of Supply Chain Management within the operational practice,
- identify, analyse and evaluate risks within logistic systems.

Content
The emphasis module *Material Flow and Logistics* provides comprehensive and well-founded basics for the main topics of logistics. Within the lectures, the interaction between several components of logistic systems will be shown. The module focuses on technical characteristics of material handling systems as well as on methods for illustrating and evaluating logistics systems. Furthermore the main topics of logistics and industrial material and value streams can be focused on by queuing methods to model production systems. Another focus can be set on basic methods for planning and running logistic systems or special issues like supply chain management. To gain a deeper understanding, the courses are accompanied by exercises and partly by case studies.

Workload
The work load is about 480 hours, corresponding to 16 credit points.

Learning type
Lectures and practices; self-study

M 10.36 Module: Major Field: Man - Technology - Organisation (SP 03) [M-MACH-102600]

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

Part of: Specialization / Specialization: General Mechanical Engineering (Major Fields)
Specialization / Specialization: Energy- and Environment Engineering (Major Field)
Specialization / Specialization: Product Development and Engineering Design (Major Field)
Specialization / Specialization: Production Technology (Major Field (p))

Credits	Grading scale	Recurrence	Duration	Language	Level	Version
16	Grade to a tenth	Each term	2 terms	German/English	4	7

Mandatory			
T-MACH-105518	Human Factors Engineering I	4 CR	Deml
T-MACH-105519	Human Factors Engineering II	4 CR	Deml
Man - Technology - Organisation (E) (Election: at most 8 credits)			
T-MACH-105830	Human Factors Engineering III: Empirical Research Methods	4 CR	Deml
T-MACH-111298	Digital Transformation of Industrial Companies	4 CR	Deml
T-MACH-108374	Vehicle Ergonomics	4 CR	Ehrhardt
T-MACH-106374	Human-oriented Productivity Management: Personnel Management	4 CR	Stock
T-MACH-112115	Artificial Intelligence in Production	4 CR	Fleischer
T-MACH-105231	Leadership and Management Development	4 CR	Albers, Matthiesen, Ploch
T-MACH-113710	Lean Production, Principles and Improvement Tools	4 CR	Deml
T-MACH-105523	Productivity Management in Production Systems	4 CR	Stowasser
T-MACH-111888	Re:Invent - Revolutionary Business Models as the Basis for Product Innovations	4 CR	Schneider
T-MACH-113031	Rapid Industrialization of Immature Products using the Example of Electric Mobility	4 CR	Bauer
T-MACH-112121	Seminar Application of Artificial Intelligence in Production	4 CR	Fleischer
T-MACH-105171	Safety Engineering	4 CR	Kany
T-MACH-105361	Technical Design in Product Development	4 CR	Albers, Matthiesen, Schmid

Competence Certificate
See chosen brick course

Prerequisites
None

Competence Goal
The students acquire a basic knowledge in the field of 1. ergonomics and 2. work organisation:

1. 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.
2. Within this module the students gain also a fundamental knowledge in the field of structural, process, and production organization. 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. Finally, the students get to know also methods in the field of personnel selection, development, and assessment.

Further on they get to know basic methods of behavioral-science data acquisition (e. g. eye-tracking, ECG, dual-task-paradigm) and they gain a first insight into empirical research methods (e. g. experimental design, statistical data evaluation). Selected complementary subjects deepen or extend the above mentioned learning outcomes.

Content
See chosen brick courses.

Workload
The work load is about 480 hours, corresponding to 16 credit points.

Learning type
Lectures, Tutorials

10.37 Module: Major Field: Materials Science and Engineering (SP 26) [M-MACH-102611]

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

Part of:
Specialization / Specialization: General Mechanical Engineering (Major Fields)
Specialization / Specialization: Energy- and Environment Engineering (Major Field)
Specialization / Specialization: Vehicle Technology (Major Field)
Specialization / Specialization: Mechatronics and Microsystems Technology (Major Field)
Specialization / Specialization: Product Development and Engineering Design (Major Field)
Specialization / Specialization: Production Technology (Major Field)
Specialization / Specialization: Theoretical Mechanical Engineering (Major Field)
Specialization / Specialization: Materials and Structures for High Performance Systems (Major Field (p))

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

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

Compulsory Elective Subjects (Election: 1 item)			
T-MACH-110818	Plasticity of Metals and Intermetallics	8 CR	Heilmaier, Kauffmann
T-MACH-105301	Materials Science and Engineering III	8 CR	Heilmaier
Materials Science and Engineering (E) (Election: at most 10 credits)			
T-MACH-113412	Atomistic Simulations and Particle Dynamics	4 CR	Gumbsch, Schneider, Weygand
T-MACH-102141	Constitution and Properties of Wearresistant Materials	4 CR	Ulrich
T-MACH-105150	Constitution and Properties of Protective Coatings	4 CR	Ulrich
T-MACH-112158	Thin Films – Preparation, Structure, Thermodynamics	4 CR	Wagner
T-MACH-105984	Fatigue of Welded Components and Structures	3 CR	Farajian
T-MACH-107667	Solid State Reactions and Kinetics of Phase	4 CR	Franke, Seifert
T-MACH-105157	Foundry Technology	4 CR	Günther, Klan
T-MACH-102111	Principles of Ceramic and Powder Metallurgy Processing	4 CR	Schell
T-MACH-113598	High Temperature Corrosion	4 CR	Gorr
T-MACH-105459	High Temperature Materials	4 CR	Heilmaier
T-MACH-112159	Hydrogen in Materials – Exercises and Lab Course	4 CR	Wagner
T-MACH-110923	Hydrogen in Materials: from Energy Storage to Hydrogen Embrittlement	4 CR	Pundt
T-MACH-100287	Introduction to Ceramics	6 CR	Schell
T-MACH-105330	Design with Plastics	4 CR	Liedel
T-MACH-105164	Laser in Automotive Engineering	4 CR	Schneider
T-MACH-112763	Laser Material Processing	4 CR	Schneider
T-MACH-110954	Lightweight Constructions with Fiber-Reinforced-Polymers – Theory and Practice	4 CR	Kärger, Liebig
T-MACH-111826	Non-ferros metals and alloys	4 CR	Gorr, Heilmaier
T-MACH-110378	Mathematical Methods in Micromechanics	5 CR	Böhlke
T-MACH-108717	Mechanics of Laminated Composites	4 CR	Schnack
T-MACH-105333	Mechanics and Strength of Polymers	4 CR	von Bernstorff
T-MACH-105303	Modelling of Microstructures	5 CR	August, Nestler
T-MACH-111026	Nonlinear Continuum Mechanics	3 CR	Böhlke
T-MACH-111391	Phase Transformations in Materials	4 CR	Heilmaier, Kauffmann
T-MACH-105516	Multi-Scale Plasticity	4 CR	Greiner, Schulz
T-MACH-102137	Polymer Engineering I	4 CR	Liebig
T-MACH-111431	Programming in CAE-Applications	4 CR	Kärger

T-MACH-110960	Project Internship Additive Manufacturing: Development and Production of an Additive Component	4 CR	Zanger
T-MACH-102157	High Performance Powder Metallurgy Materials	4 CR	Schell
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-107670	Fundamentals in Materials Thermodynamics and Heterogeneous Equilibria	4 CR	Franke, Seifert
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-112942	Hydrogen in Materials – Exercises and Lab Course	4 CR	Wagner
T-MACH-110957	Hydrogen in Materials: from Energy Storage to Hydrogen Embrittlement	4 CR	Pundt
T-MACH-107684	Materials Characterization	4 CR	Gibmeier, Schneider
T-MACH-105211	Materials of Lightweight Construction	4 CR	Liebig
T-MACH-110165	Materials in Additive Manufacturing	4 CR	Dietrich, Schulze
T-MACH-105369	Materials Modelling: Dislocation Based Plasticity	4 CR	Weygand
T-MACH-110937	Materials Recycling and Sustainability	4 CR	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, Kauffmann
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: at most 1 item)			
T-MACH-111027	Tutorial Nonlinear Continuum Mechanics	1 CR	Böhlke
T-MACH-107632	Exercises for Solid State Reactions and Kinetics of Phase Transformations *This item will not influence the grade calculation of this parent.*	2 CR	Franke, Seifert
T-MACH-110379	Tutorial Mathematical Methods in Micromechanics	1 CR	Böhlke
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 individually 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 16 credit points in the master´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.

Workload
The work load is about 480 hours in the Master of Science program, whereof the presence time is 82 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 10.38 Module: Major Field: Mechatronics (SP 31) [M-MACH-102614]

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

Part of:
Specialization / Specialization: General Mechanical Engineering (Major Fields)
Specialization / Specialization: Energy- and Environment Engineering (Major Field)
Specialization / Specialization: Vehicle Technology (Major Field)
Specialization / Specialization: Mechatronics and Microsystems Technology (Major Field (p))
Specialization / Specialization: Product Development and Engineering Design (Major Field)
Specialization / Specialization: Production Technology (Major Field)
Specialization / Specialization: Theoretical Mechanical Engineering (Major Field)

Credits	Grading scale	Recurrence	Duration	Language	Level	Version
16	Grade to a tenth	Each term	2 terms	German/English	4	13

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

Mechatronics (K) (Election: at least 8 credits)			
T-MACH-105314	Computational Intelligence	4 CR	Meisenbacher, Mikut, Reischl
T-MACH-105694	Data Analytics for Engineers	5 CR	Meisenbacher, Mikut, Reischl
T-MACH-113597	Decision-Making and Motion Planning for Automated Driving	6 CR	Naumann, Werling
T-MACH-100535	Introduction into Mechatronics	6 CR	Orth, Reischl
T-MACH-105209	Introduction to Multi-Body Dynamics	5 CR	Römer
T-MACH-105218	Automotive Vision	6 CR	Lauer, Stiller
T-MACH-105539	Modern Control Concepts I	4 CR	Groell, Matthes
Mechatronics (E) (Election: at most 9 credits)			
T-MACH-105212	CAE-Workshop	4 CR	Albers, Matthiesen
T-MACH-111193	Data Driven Engineering 1: Machine Learning for Dynamical Systems	4 CR	Bauer
T-MACH-111373	Data Driven Engineering 2: Advanced Topics	4 CR	Bauer
T-MACH-105317	Digital Control	4 CR	Knoop
T-MACH-111260	Dynamics of Electro-Mechanical Systems	5 CR	Altoé, Fidlin
T-MACH-105514	Experimental Dynamics	5 CR	Fidlin
T-ETIT-100784	Hybrid and Electric Vehicles	4 CR	Doppelbauer
T-MACH-112882	Innovation2Business – Innovation Strategy in the Industrial Corporate Practice	4 CR	Albers
T-MACH-105187	IT-Fundamentals of Logistics	4 CR	Thomas
T-MACH-112115	Artificial Intelligence in Production	4 CR	Fleischer
T-MACH-108957	Mathematical Fundamentals of Numerical Mechanics	4 CR	Schnack
T-MACH-105294	Mathematical Methods of Vibration Theory	6 CR	Fidlin, Höllig, Römer
T-MACH-105210	Machine Dynamics	5 CR	Proppe
T-MACH-105224	Machine Dynamics II	4 CR	Proppe
T-INFO-101266	Human-Machine-Interaction	6 CR	Beigl
T-MACH-105334	Mechanics in Microtechnology	4 CR	Greiner, Gruber
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-111249	Optical Measuring Systems	4 CR	Sieber
T-MACH-105442	Intellectual Property Rights and Strategies in Industrial Companies	4 CR	Düser, Zacharias
T-MACH-111888	Re:Invent - Revolutionary Business Models as the Basis for Product Innovations	4 CR	Schneider

T-MACH-112121	Seminar Application of Artificial Intelligence in Production	4 CR	Fleischer
T-MACH-105990	Simulation of Optical Systems	4 CR	Sieber
T-MACH-105372	Theory of Stability	6 CR	Fidlin
T-MACH-111821	Control of Mobile Machines	4 CR	Becker, Geimer
T-MACH-111820	Control of Mobile Machines – Prerequisites	0 CR	Becker, Geimer
T-MACH-105358	Sustainable Product Engineering	4 CR	Albers, Matthiesen, Ziegahn
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
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
Mechatronics (P) (Election: at most 6 credits)			
T-MACH-105370	Laboratory Mechatronics	4 CR	Hagenmeyer, Stiller
T-MACH-108878	Laboratory Production Metrology	4 CR	Lanza, Stamer
T-INFO-112030	Practical Course: Smart Energy System Lab	6 CR	Waczowicz
T-MACH-105373	Practical Training in Measurement of Vibrations	4 CR	Fidlin
T-MACH-102149	Virtual Reality Practical Course	4 CR	Ovtcharova

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
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.

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
See brick courses.

Workload
The work load is about 480 hours, corresponding to 16 credit points.

Learning type
Lecture, tutorial.

10.39 Module: Major Field: Medical Technology (SP 32) [M-MACH-102615]

Responsible: apl. Prof. Dr. Christian Pylatiuk
Organisation: KIT Department of Mechanical Engineering

Part of: Specialization / Specialization: General Mechanical Engineering (Major Fields)
Specialization / Specialization: Mechatronics and Microsystems Technology (Major Field)
Specialization / Specialization: Product Development and Engineering Design (Major Field)

Credits	Grading scale	Recurrence	Duration	Language	Level	Version
16	Grade to a tenth	Each term	2 terms	German/English	4	8

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

Medical Technology (K) (Election: at least 8 credits)			
T-MACH-100966	BioMEMS - Microsystems Technologies for Life-Sciences and Medicine I	4 CR	Guber
T-MACH-100967	BioMEMS - Microsystems Technologies for Life-Sciences and Medicine II	4 CR	Guber
T-MACH-100968	BioMEMS - Microsystems Technologies for Life-Sciences and Medicine III	4 CR	Guber
T-MACH-105314	Computational Intelligence	4 CR	Meisenbacher, Mikut, Reischl
T-MACH-105694	Data Analytics for Engineers	5 CR	Meisenbacher, Mikut, Reischl
T-MACH-100535	Introduction into Mechatronics	6 CR	Orth, Reischl
T-MACH-105235	Principles of Medicine for Engineers	4 CR	Pylatiuk
T-ETIT-113607	Medical Measurement Technology	6 CR	Nahm
Medical Technology (E) (Election: at most 8 credits)			
T-GEISTSOZ-103287	Anatomy/Sports Medicine I	3 CR	Sell
T-GEISTSOZ-111188	Anatomy/Sports Medicine II	3 CR	Sell
T-ETIT-101956	Bioelectric Signals	3 CR	Loewe
T-MACH-111807	Introduction to Bionics	4 CR	Hölscher
T-MACH-105228	Organ Support Systems	4 CR	Pylatiuk
T-INFO-101262	Human Brain and Central Nervous System: Anatomy, Information Transfer, Signal Processing, Neurophysiology and Therapy	3 CR	Asfour, Spetzger
T-MACH-112882	Innovation2Business – Innovation Strategy in the Industrial Corporate Practice	4 CR	Albers
T-MACH-113698	Beyond Conventional Materials - Metamaterials & Architected Structures	4 CR	Bauer
T-MACH-105221	Lightweight Engineering Design	4 CR	Düser, Ott
T-ETIT-112147	Measurement Technology	5 CR	Heizmann
T-MACH-105334	Mechanics in Microtechnology	4 CR	Greiner, Gruber
T-ETIT-113625	Medical Imaging Technology	6 CR	Spadea
T-MACH-111249	Optical Measuring Systems	4 CR	Sieber
T-MACH-105442	Intellectual Property Rights and Strategies in Industrial Companies	4 CR	Düser, Zacharias
T-GEISTSOZ-103290	Physiology/Sports Medicine II	3 CR	Bub
T-MACH-102164	Practical Training in Basics of Microsystem Technology	4 CR	Last
T-MACH-110960	Project Internship Additive Manufacturing: Development and Production of an Additive Component	4 CR	Zanger
T-INFO-108014	Robotics I - Introduction to Robotics	6 CR	Asfour
T-MACH-105990	Simulation of Optical Systems	4 CR	Sieber
T-INFO-105723	Robotics II - Humanoid Robotics	3 CR	Asfour

T-INFO-101352	Robotics III - Sensors in Robotics	3 CR	Asfour
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

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

Prerequisites
None

Competence Goal
The Medical Engineering qualifies students to solve challenges in the field of complex medical and biomedical systems supporting human-centred diagnostics and therapy. Based on the specific requirements for medical products the following topics are taught within the major Medical Engineering:

- Broad basis of relevant medical and biological knowledge
- Measuring technology and signal processing
- Development and Manufacturing of medical products

Graduates of this major know all relevant methods to design modern medical devices and have the ability to efficiently and creatively develop solutions for leading edge medical applications.

Content
See brick courses.

Workload
The work load is about 480 hours, corresponding to 16 credit points.

Learning type
Lectures, Tutorials

M 10.40 Module: Major Field: Microactuators and Microsensors (SP 54) [M-MACH-102647]

Responsible: Prof. Dr. Manfred Kohl
Organisation: KIT Department of Mechanical Engineering

Part of:
Specialization / Specialization: General Mechanical Engineering (Major Fields)
Specialization / Specialization: Energy- and Environment Engineering (Major Field)
Specialization / Specialization: Vehicle Technology (Major Field)
Specialization / Specialization: Mechatronics and Microsystems Technology (Major Field)
Specialization / Specialization: Product Development and Engineering Design (Major Field)
Specialization / Specialization: Production Technology (Major Field)

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

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

Microactuators and Microsensors (K) (Election: at least 8 credits)			
T-MACH-101910	Microactuators	4 CR	Kohl
T-MACH-102152	Novel Actuators and Sensors	4 CR	Kohl, Sommer
Microactuators and Microsensors (E) (Election: at most 11 credits)			
T-MACH-105238	Actuators and Sensors in Nanotechnology	4 CR	Kohl
T-MACH-100966	BioMEMS - Microsystems Technologies for Life-Sciences and Medicine I	4 CR	Guber
T-MACH-111260	Dynamics of Electro-Mechanical Systems	5 CR	Altoé, Fidlin
T-MACH-105321	Introduction to Theory of Materials	4 CR	Kamlah
T-MACH-102166	Fabrication Processes in Microsystem Technology	4 CR	Bade
T-MACH-105182	Introduction to Microsystem Technology I	4 CR	Badilita, Jouda, Korvink
T-MACH-105183	Introduction to Microsystem Technology II	4 CR	Jouda, Korvink
T-MACH-105334	Mechanics in Microtechnology	4 CR	Greiner, Gruber
T-MACH-105557	Microenergy Technologies	4 CR	Kohl
T-MACH-105782	Micro Magnetic Resonannce	4 CR	Korvink, MacKinnon
T-MACH-105303	Modelling of Microstructures	5 CR	August, Nestler
T-INFO-108014	Robotics I - Introduction to Robotics	6 CR	Asfour
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-111814	Introduction to Nanotechnology	4 CR	Hölscher

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
The Students achieved the following competence goals:

- Knowledge of the principles of actuation and sensing including pros and cons
- Knowledge of the underlying concepts of materials science and technology
- on different lengths scales
- Explanation of layout and function of important actuators and sensors
- Calculation of important properties (time constants, forces, displacements,
- sensitivity, etc.)
- Development of a layout based on specifications

Content
See brick courses.

Workload
The work load is about 480 hours, corresponding to 16 credit points.

Learning type
Lecture, exercise.

M 10.41 Module: Major Field: Microsystem Technology (SP 33) [M-MACH-102616]

Responsible: Prof. Dr. Jan Gerrit Korvink
Organisation: KIT Department of Mechanical Engineering

Part of:
Specialization / Specialization: General Mechanical Engineering (Major Fields)
Specialization / Specialization: Energy- and Environment Engineering (Major Field)
Specialization / Specialization: Vehicle Technology (Major Field)
Specialization / Specialization: Mechatronics and Microsystems Technology (Major Field (p))
Specialization / Specialization: Product Development and Engineering Design (Major Field)
Specialization / Specialization: Production Technology (Major Field)

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

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

Mandatory			
T-MACH-105182	Introduction to Microsystem Technology I	4 CR	Badilita, Jouda, Korvink
T-MACH-105183	Introduction to Microsystem Technology II	4 CR	Jouda, Korvink
Microsystem Technology (E) (Election: at most 10 credits)			
T-MACH-105238	Actuators and Sensors in Nanotechnology	4 CR	Kohl
T-MACH-102176	Current Topics on BioMEMS	4 CR	Guber
T-MACH-100966	BioMEMS - Microsystems Technologies for Life-Sciences and Medicine I	4 CR	Guber
T-MACH-100967	BioMEMS - Microsystems Technologies for Life-Sciences and Medicine II	4 CR	Guber
T-MACH-100968	BioMEMS - Microsystems Technologies for Life-Sciences and Medicine III	4 CR	Guber
T-MACH-111807	Introduction to Bionics	4 CR	Hölscher
T-MACH-111814	Introduction to Nanotechnology	4 CR	Hölscher
T-MACH-102166	Fabrication Processes in Microsystem Technology	4 CR	Bade
T-MACH-105334	Mechanics in Microtechnology	4 CR	Greiner, Gruber
T-MACH-105557	Microenergy Technologies	4 CR	Kohl
T-MACH-101910	Microactuators	4 CR	Kohl
T-MACH-108383	Microsystem Simulation	4 CR	Korvink
T-MACH-105814	Microsystem Product Design for Young Entrepreneurs	6 CR	Korvink
T-MACH-108613	Miniaturized Heat Exchangers	4 CR	Brandner
T-MACH-102152	Novel Actuators and Sensors	4 CR	Kohl, Sommer
T-MACH-105442	Intellectual Property Rights and Strategies in Industrial Companies	4 CR	Düser, Zacharias
T-MACH-102192	Polymers in MEMS A: Chemistry, Synthesis and Applications	4 CR	Rapp
T-MACH-102191	Polymers in MEMS B: Physics, Microstructuring and Applications	4 CR	Worgull
T-MACH-102200	Polymers in MEMS C: Biopolymers and Bioplastics	4 CR	Rapp, Worgull
T-MACH-113827	Quantum Machines I	4 CR	Utz
T-MACH-113826	Quantum Machines II	4 CR	Utz
T-MACH-109122	X-ray Optics	4 CR	Last
Microsystem Technology (P) (Election: at most 4 credits)			
T-MACH-108407	NMR Micro Probe Hardware Conception and Construction *This item will not influence the grade calculation of this parent.*	4 CR	Korvink
T-MACH-105556	Practical Course Polymers in MEMS *This item will not influence the grade calculation of this parent.*	2 CR	Rapp, Worgull
T-MACH-102164	Practical Training in Basics of Microsystem Technology	4 CR	Last

T-MACH-105782	Micro Magnetic Resonannce *This item will not influence the grade calculation of this parent.*	4 CR	Korvink, MacKinnon

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
In this key area, attendees gain competence in the design, construction, production, and application of **micro and nano systems**. Microsystems comprise the **smallest human-made** components. These include sensors, actuators, and system components working together for form a more powerful whole. Micro and nano systems are the basis for numerous smart products, such as **smart dust**, smart buildings, the **internet of things**, smart consumer-ware, smart mobility, and smart production via **industry 4.0** concepts.

The **increasing control** over morphology at the nano and microscale is enabling the bottom up construction of **passive and active materials** with ideal and unheard-of properties, embedded in the devices that can make use of these, and are therefore **revolutionising** the world of products and scientific instrumentation.

Content
See brick courses.

Workload
The work load is about 480 hours, corresponding to 16 credit points.

Learning type
Lectures, Tutorials

M 10.42 Module: Major Field: Mobile Machines (SP 34) [M-MACH-102630]

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

Part of: Specialization / Specialization: General Mechanical Engineering (Major Fields)
Specialization / Specialization: Vehicle Technology (Major Field (p))
Specialization / Specialization: Mechatronics and Microsystems Technology (Major Field)
Specialization / Specialization: Product Development and Engineering Design (Major Field)
Specialization / Specialization: Production Technology (Major Field)

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

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

Mandatory			
T-MACH-105168	Mobile Machines	8 CR	Geimer
Mobile Machines (E) (Election:)			
T-MACH-105307	Drive Train of Mobile Machines	4 CR	Geimer
T-MACH-105311	Design and Development of Mobile Machines	4 CR	Geimer
T-MACH-105151	Energy Efficient Intralogistic Systems	4 CR	Kramer, Schönung
T-MACH-108374	Vehicle Ergonomics	4 CR	Ehrhardt
T-MACH-105218	Automotive Vision	6 CR	Lauer, Stiller
T-MACH-102093	Fluid Power Systems	4 CR	Geimer
T-MACH-111389	Fundamentals in the Development of Commercial Vehicles	4 CR	Weber
T-MACH-112882	Innovation2Business – Innovation Strategy in the Industrial Corporate Practice	4 CR	Albers
T-MACH-105441	Development of Oil-Hydraulic Powertrain Systems	4 CR	Geerling
T-MACH-105172	Simulation of Coupled Systems	4 CR	Geimer
T-MACH-111821	Control of Mobile Machines	4 CR	Becker, Geimer
T-MACH-105423	Tractors	4 CR	Geimer, Kremmer
T-MACH-102194	Combustion Engines I	4 CR	Koch, Kubach
T-MACH-113597	Decision-Making and Motion Planning for Automated Driving	6 CR	Naumann, Werling
Mobile Machines (Ü) (Election:)			
T-MACH-108888	Simulation of Coupled Systems - Advance *This item will not influence the grade calculation of this parent.*	0 CR	Geimer
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
T-MACH-111820	Control of Mobile Machines – Prerequisites	0 CR	Becker, Geimer

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

Prerequisites
None

Competence Goal
The student

- knows and understands the basic structure of the machines,
- masters the basic skills to develop the selected machines

Content

- Introduction of the required components and machines
- Basics of the structure of the whole system
- Practical insight in the development techniques

Workload
The work load is about 480 hours, corresponding to 16 credit points.

Learning type

- Research-oriented teaching
- lectures
- exercises

M 10.43 Module: Major Field: Modeling and Simulation in Dynamics (SP 61) [M-MACH-104434]

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

Part of: Specialization / Specialization: General Mechanical Engineering (Major Fields)
Specialization / Specialization: Energy- and Environment Engineering (Major Field)
Specialization / Specialization: Vehicle Technology (Major Field)
Specialization / Specialization: Mechatronics and Microsystems Technology (Major Field)
Specialization / Specialization: Product Development and Engineering Design (Major Field)
Specialization / Specialization: Production Technology (Major Field)
Specialization / Specialization: Theoretical Mechanical Engineering (Major Field (p))

Credits	Grading scale	Recurrence	Duration	Language	Level	Version
16	Grade to a tenth	Each term	2 terms	German/English	4	5

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

Modeling and Simulation in Dynamics (K) (Election: at least 8 credits)			
T-MACH-105209	Introduction to Multi-Body Dynamics	5 CR	Römer
T-MACH-105210	Machine Dynamics	5 CR	Proppe
T-MACH-105293	Mathematical Methods in Dynamics	6 CR	Proppe
T-MACH-105226	Dynamics of the Automotive Drive Train	5 CR	Fidlin
T-MACH-105290	Vibration Theory	5 CR	Fidlin
Modeling and Simulation in Dynamics (E) (Election: at most 9 credits)			
T-MACH-111260	Dynamics of Electro-Mechanical Systems	5 CR	Altoé, Fidlin
T-MACH-105514	Experimental Dynamics	5 CR	Fidlin
T-MACH-110834	Contact Mechanics for Dynamic Systems	4 CR	Römer
T-MACH-105224	Machine Dynamics II	4 CR	Proppe
T-MACH-105294	Mathematical Methods of Vibration Theory	6 CR	Fidlin, Höllig, Römer
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-113412	Atomistic Simulations and Particle Dynamics	4 CR	Gumbsch, Schneider, Weygand
Modeling and Simulation in Dynamics (E) (Election:)			
T-MACH-108888	Simulation of Coupled Systems - Advance *This item will not influence the grade calculation of this parent.*	0 CR	Geimer

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

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

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 procedure, 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
The work load is about 480 hours, corresponding to 16 credit points. 1 LP = 30 working hours.

Learning type
Lectures, Tutorials

10.44 Module: Major Field: Modeling and Simulation in Energy- and Fluid Engineering (SP 27) [M-MACH-102612]

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

Part of: Specialization / Specialization: General Mechanical Engineering (Major Fields)
Specialization / Specialization: Energy- and Environment Engineering (Major Field)
Specialization / Specialization: Vehicle Technology (Major Field)
Specialization / Specialization: Mechatronics and Microsystems Technology (Major Field)
Specialization / Specialization: Product Development and Engineering Design (Major Field)

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

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

Modeling and Simulation in Energy- and Fluid Engineering (K) (Election: at least 8 credits)			
T-MACH-105396	Modeling of Thermodynamical Processes	6 CR	Maas, Schießl
T-MACH-105339	Numerical Simulation of Reacting Two Phase Flows	4 CR	Koch
T-MACH-105338	Numerical Fluid Mechanics	4 CR	Gatti, Magagnato
Modeling and Simulation in Energy- and Fluid Engineering (E) (Election: at most 8 credits)			
T-MACH-105407	CFD for Power Engineering	4 CR	Otic
T-MACH-105313	CFD-Lab Using OpenFOAM	4 CR	Koch
T-MACH-111193	Data Driven Engineering 1: Machine Learning for Dynamical Systems	4 CR	Bauer
T-MACH-111373	Data Driven Engineering 2: Advanced Topics	4 CR	Bauer
T-MACH-105419	Mathematical Models and Methods in Combustion Theory	4 CR	Bykov
T-MACH-105167	Analysis Tools for Combustion Diagnostics	4 CR	Pfeil
T-MACH-105420	Numerical Simulation of Multi-Phase Flows	4 CR	Wörner
T-MACH-105397	Numerical Simulation of Turbulent Flows	4 CR	Grötzbach
T-MACH-105421	Reduction Methods for the Modeling and the Simulation of Combustion Processes	4 CR	Bykov
T-MACH-105422	Flows with Chemical Reactions	4 CR	Class
T-MACH-105403	Flows and Heat Transfer in Energy Technology	4 CR	Cheng
T-MACH-105456	Ten Lectures on Turbulence	4 CR	Otic
T-MACH-106372	Thermal-Fluid-Dynamics	4 CR	Ruck
T-MACH-102149	Virtual Reality Practical Course	4 CR	Ovtcharova

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
After completing the students can:

- formulate the governing equations for specific systems in energy and fluid mechanics.
- explain the different numerical schemes applied to solve the system of equations.
- use frequently applied simulation tools in a more efficient and successful way.

Content
See brick courses.

Workload
The work load is about 480 hours, corresponding to 16 credit points.

Learning type
Lectures, Tutorials

M 10.45 Module: Major Field: Nuclear Energy (SP 21) [M-MACH-102608]

Responsible: Prof. Dr.-Ing. Xu Cheng
Organisation: KIT Department of Mechanical Engineering

Part of: Specialization / Specialization: General Mechanical Engineering (Major Fields)
Specialization / Specialization: Energy- and Environment Engineering (Major Field)
Specialization / Specialization: Theoretical Mechanical Engineering (Major Field)

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

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

Nuclear Energy (K) (Election: at least 8 credits)			
T-MACH-105525	Introduction to Nuclear Energy	4 CR	Cheng
T-MACH-105402	Nuclear Power Plant Technology	4 CR	Badea, Cheng
Nuclear Energy (E) (Election: at most 8 credits)			
T-MACH-105310	Design of Highly Stresses Components	4 CR	Aktaa
T-MACH-105407	CFD for Power Engineering	4 CR	Otic
T-MACH-105530	Fundamentals of Reactor Safety for the Operation and Dismantling of Nuclear Power Pants	4 CR	Sanchez-Espinoza
T-MACH-105550	Energy Systems II: Reactor Physics	4 CR	Badea
T-MACH-105404	Innovative Nuclear Systems	4 CR	Cheng
T-MACH-105466	Introduction to Neutron Cross Section Theory and Nuclear Data Generation	4 CR	Dagan
T-MACH-105405	Reactor Safety I: Fundamentals	4 CR	Sanchez-Espinoza
T-MACH-105403	Flows and Heat Transfer in Energy Technology	4 CR	Cheng
T-MACH-105456	Ten Lectures on Turbulence	4 CR	Otic
T-MACH-105406	Two-Phase Flow and Heat Transfer	4 CR	Schulenberg, Wörner
T-MACH-110331	Nuclear Fusion Technology	4 CR	Badea
T-MACH-110332	Nuclear Power and Reactor Technology	4 CR	Badea

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 acquire the basic and advanced knowledge of nuclear technology and are able to apply the assimilated knowledge in practice and to analyze and solve by themselves important questions in the nuclear energy field.

The courses of this module are built on three levels. With the overview lecture "Introduction into Nuclear Power", the students acquire broad basic knowledge of nuclear energy and are able to further study in-depth courses in various disciplines, namely thermal-hydraulics, reactor physics and materials science. As a result, students will understand the important processes of nuclear technology, such as control, heat transport and material behavior in a nuclear reactor. The properties of various nuclear systems, especially nuclear power plants, are available for study on the third level of the lectures. The students will possess then the ability to compare and analyze different nuclear systems.

Content
See brick courses.

Workload
The work load is about 480 hours, corresponding to 16 credit points.

Learning type
Lectures, Tutorials

M 10.46 Module: Major Field: Polymer Engineering (SP 36) [M-MACH-102632]

Responsible: Dr.-Ing. Wilfried Liebig
Organisation: KIT Department of Mechanical Engineering

Part of: Specialization / Specialization: General Mechanical Engineering (Major Fields)
Specialization / Specialization: Energy- and Environment Engineering (Major Field)
Specialization / Specialization: Vehicle Technology (Major Field)
Specialization / Specialization: Product Development and Engineering Design (Major Field)
Specialization / Specialization: Production Technology (Major Field)
Specialization / Specialization: Materials and Structures for High Performance Systems (Major Field)

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

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

Polymer Engineering (K) (Election: at least 8 credits)			
T-MACH-102137	Polymer Engineering I	4 CR	Liebig
T-MACH-102138	Polymer Engineering II	4 CR	Liebig
Polymer Engineering (E) (Election: at most 8 credits)			
T-MACH-105237	Vehicle Lightweight Design - Strategies, Concepts, Materials	4 CR	Henning
T-MACH-105535	Composite Manufacturing - Polymers, Fibers, Semi-Finished Products, Manufacturing Technologies	4 CR	Henning
T-MACH-105330	Design with Plastics	4 CR	Liedel
T-MACH-110954	Lightweight Constructions with Fiber-Reinforced-Polymers – Theory and Practice	4 CR	Kärger, Liebig
T-MACH-105333	Mechanics and Strength of Polymers	4 CR	von Bernstorff
T-MACH-113367	Modeling of polymer and suspension flows for industrial manufacturing processes	4 CR	Kärger, Wittemann
T-MACH-111431	Programming in CAE-Applications	4 CR	Kärger
T-MACH-105971	Simulation of the Process Chain of Continuously Fiber Reinforced Composite Structure	4 CR	Kärger
T-MACH-105970	Structural Analysis of Composite Laminates	4 CR	Kärger
T-MACH-110937	Materials Recycling and Sustainability	4 CR	Liebig

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
The students...

- are able to choose polymers for abblications in mechanical engineering in target-oriented way and are able to justify their selection.
- are able to describe and compare production processes for polymers and PMCs exemplarily.
- are able to describe the mechanical behaviour of polymers and PMC based on scientific theories, principles and methods.
- are able to solve tasks in the field of polymer engineering and proceed adequate to the situation.
- are able to integrate intra-modular knowledge at the solution of given problems.
- have the ability to develop polymer parts in a constructive way under consideration of technical and economic conditions.

Content

The field of Polymer Engineering includes synthesis, material science, processing, construction, design, tool engineering, production technology, surface engineering and recycling. The aim is, that the students gather knowledge and technical skills to use the material “polymer” meeting its requirements in an economical and ecological way.

Workload

The work load is about 480 hours, corresponding to 16 credit points.

Learning type

Lectures, Tutorials

M 10.47 Module: Major Field: Power Plant Technology (SP 23) [M-MACH-102610]

Responsible: Prof. Dr.-Ing. Hans-Jörg Bauer
Organisation: KIT Department of Mechanical Engineering
Institute of Thermal Turbomachinery
Part of: Specialization / Specialization: General Mechanical Engineering (Major Fields)
Specialization / Specialization: Energy- and Environment Engineering (Major Field)
Specialization / Specialization: Product Development and Engineering Design (Major Field)

Credits	Grading scale	Recurrence	Duration	Language	Level	Version
16	Grade to a tenth	Each term	2 terms	German/English	4	9

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

Power Plant Technology (K) (Election: at least 8 credits)			
T-MACH-105410	Coal Fired Power Plants	4 CR	Schulenberg
T-MACH-105444	Combined Cycle Power Plants	4 CR	Banuti, Schulenberg
T-MACH-105326	Hydraulic Fluid Machinery	8 CR	Pritz
T-MACH-105402	Nuclear Power Plant Technology	4 CR	Badea, Cheng
T-MACH-105363	Thermal Turbomachines I	6 CR	Bauer
T-MACH-105364	Thermal Turbomachines II	6 CR	Bauer
Power Plant Technology (E) (Election:)			
T-MACH-105310	Design of Highly Stresses Components	4 CR	Aktaa
T-MACH-113359	Boosting the Modern Energy Landscape via Turbo Machines & Machine Learning	4 CR	Bauer
T-MACH-111193	Data Driven Engineering 1: Machine Learning for Dynamical Systems	4 CR	Bauer
T-MACH-111373	Data Driven Engineering 2: Advanced Topics	4 CR	Bauer
T-MACH-105525	Introduction to Nuclear Energy	4 CR	Cheng
T-MACH-105411	Fusion Technology A	4 CR	Perez Martin, Weiss
T-MACH-105213	Fundamentals of Combustion I	4 CR	Maas
T-MACH-112882	Innovation2Business – Innovation Strategy in the Industrial Corporate Practice	4 CR	Albers
T-MACH-105404	Innovative Nuclear Systems	4 CR	Cheng
T-MACH-105338	Numerical Fluid Mechanics	4 CR	Gatti, Magagnato
T-MACH-105442	Intellectual Property Rights and Strategies in Industrial Companies	4 CR	Düser, Zacharias
T-MACH-112106	Fatigue of Materials	4 CR	Guth
T-MACH-105445	Simulator Exercises Combined Cycle Power Plants	2 CR	Banuti, Schulenberg
T-MACH-111382	Technical Acoustics	4 CR	Pantle, Walter
T-MACH-106372	Thermal-Fluid-Dynamics	4 CR	Ruck
T-MACH-113145	Thermodynamics of the energy transition	4 CR	Banuti
T-MACH-105416	Hydrogen Technologies	4 CR	Jedicke, Jordan
T-MACH-105234	Windpower	4 CR	Lewald
T-MACH-105406	Two-Phase Flow and Heat Transfer	4 CR	Schulenberg, Wörner
T-MACH-113362	Heat Transfer and Cooling at Thermally Highly Loaded Components	4 CR	Bauer, Schulz
T-MACH-106493	Solar Thermal Energy Systems	4 CR	Dagan
Power Plant Technology (P) (Election:)			
T-MACH-105313	CFD-Lab Using OpenFOAM	4 CR	Koch
T-MACH-105515	Introduction to Numerical Fluid Dynamics *This item will not influence the grade calculation of this parent.*	4 CR	Pritz
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 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
After completion of SP 23 students are able:

- to name the different types of centralized and distributed power plants,
- to explain the operational principle of well-established power plants as well as of power plants based on renewable energies.
- to predict the electric, respectively thermal efficiency of power plants,
- to assess the economics of power plants,
- to highlight the environmental impact of conventional power plants and of renewable energies,
- to assess the availability, operational safety and flexibility of different types of power plants,
- to develop advanced power plants based on thermodynamic, fluid mechanical and other basics.

Content
See brick courses.

Workload
The work load is about 480 hours, corresponding to 16 credit points.

Learning type
Lectures, tutorials.

10.48 Module: Major Field: Powertrain Systems (SP 02) [M-MACH-102599]

Responsible: Prof. Dr.-Ing. Tobias Düser
Organisation: KIT Department of Mechanical Engineering

Part of: Specialization / Specialization: General Mechanical Engineering (Major Fields)
Specialization / Specialization: Vehicle Technology (Major Field)
Specialization / Specialization: Product Development and Engineering Design (Major Field)
Specialization / Specialization: Production Technology (Major Field)

Credits	Grading scale	Recurrence	Duration	Language	Level	Version
16	Grade to a tenth	Each term	2 terms	German/English	4	5

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
T-MACH-105216	Powertrain Systems Technology B: Stationary Machinery	4 CR	Düser, Ott
T-MACH-113405	Drive System Engineering A: Automotive Systems	4 CR	Düser, Ott
T-MACH-105226	Dynamics of the Automotive Drive Train	5 CR	Fidlin
Powertrain Systems (E) (Election: at most 8 credits)			
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-111398	Design of Fuel Cell Systems	4 CR	Haußmann
T-MACH-105209	Introduction to Multi-Body Dynamics	5 CR	Römer
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-112882	Innovation2Business – Innovation Strategy in the Industrial Corporate Practice	4 CR	Albers
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	Düser, Zacharias
T-MACH-110984	Production Technology for E-Mobility	4 CR	Fleischer
T-MACH-105441	Development of Oil-Hydraulic Powertrain Systems	4 CR	Geerling
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-111821	Control of Mobile Machines	4 CR	Becker, Geimer
T-MACH-111820	Control of Mobile Machines – Prerequisites	0 CR	Becker, Geimer
T-MACH-105185	Control Technology	4 CR	Gönnheimer
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

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
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 brick courses

Workload
The work load is about 480 hours, corresponding to 16 credit points.

Learning type
Lectures, Tutorials

M 10.49 Module: Major Field: Production Technology (SP 39) [M-MACH-102618]

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

Part of: Specialization / Specialization: General Mechanical Engineering (Major Fields)
Specialization / Specialization: Vehicle Technology (Major Field)
Specialization / Specialization: Product Development and Engineering Design (Major Field)
Specialization / Specialization: Production Technology (Major Field (p))

Credits	Grading scale	Recurrence	Duration	Language	Level	Version
16	Grade to a tenth	Each term	2 terms	German/English	4	10

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

Production Technology (K) (Election: at least 8 credits)			
T-MACH-108844	Automated Manufacturing Systems	8 CR	Fleischer
T-MACH-102105	Manufacturing Technology	8 CR	Schulze
T-MACH-110337	Global Production and Logistics	8 CR	Furmans, Lanza
T-MACH-108849	Integrated Production Planning in the Age of Industry 4.0	8 CR	Lanza
T-MACH-110962	Machine Tools and High-Precision Manufacturing Systems	8 CR	Fleischer
Production Technology (E) (Election:)			
T-MACH-113647	Digitalization from Product Concept to Production	4 CR	Wawerla
T-MACH-102159	Elements and Systems of Technical Logistics	4 CR	Fischer, Mittwollen
T-MACH-108946	Elements and Systems of Technical Logistics - Project	2 CR	Fischer, Mittwollen
T-MACH-105151	Energy Efficient Intralogistic Systems	4 CR	Kramer, Schönung
T-MACH-105157	Foundry Technology	4 CR	Günther, Klan
T-MACH-111003	Global Logistics	4 CR	Furmans
T-MACH-110991	Global Production	4 CR	Lanza
T-MACH-109919	Basics of Technical Logistics I	4 CR	Mittwollen, Oellerich
T-MACH-109920	Basics of Technical Logistics II	6 CR	Furmans
T-MACH-106374	Human-oriented Productivity Management: Personnel Management	4 CR	Stock
T-MACH-105388	Introduction to Industrial Production Economics	4 CR	Dürrschnabel
T-MACH-105188	Integrative Strategies in Production and Development of High Performance Cars	4 CR	Schlichtenmayer
T-MACH-110334	International Production Engineering A	4 CR	Fleischer
T-MACH-110335	International Production Engineering B	4 CR	Fleischer
T-MACH-112115	Artificial Intelligence in Production	4 CR	Fleischer
T-MACH-105174	Warehousing and Distribution Systems	3 CR	Furmans
T-MACH-105231	Leadership and Management Development	4 CR	Albers, Matthiesen, Ploch
T-MACH-110954	Lightweight Constructions with Fiber-Reinforced-Polymers – Theory and Practice	4 CR	Kärger, Liebig
T-MACH-105783	Learning Factory “Global Production“	6 CR	Lanza
T-MACH-105189	Mathematical Models and Methods for Production Systems	6 CR	Baumann, Furmans
T-MACH-105442	Intellectual Property Rights and Strategies in Industrial Companies	4 CR	Düser, Zacharias
T-MACH-110318	Product- and Production-Concepts for Modern Automobiles	4 CR	Kienzle, Steegmüller
T-MACH-110984	Production Technology for E-Mobility	4 CR	Fleischer
T-MACH-105523	Productivity Management in Production Systems	4 CR	Stowasser
T-MACH-105441	Development of Oil-Hydraulic Powertrain Systems	4 CR	Geerling
T-MACH-102107	Quality Management	4 CR	Lanza
T-MACH-113031	Rapid Industrialization of Immature Products using the Example of Electric Mobility	4 CR	Bauer

T-MACH-105170	Welding Technology	4 CR	Farajian
T-MACH-112121	Seminar Application of Artificial Intelligence in Production	4 CR	Fleischer
T-MACH-108737	Seminar Data-Mining in Production	3 CR	Lanza
T-MACH-105185	Control Technology	4 CR	Gönnheimer
T-MACH-113372	Strategic Decision-Making in Global Production Network Design: A Seminar on Optimization and Simulation	4 CR	Benfer, Lanza
T-MACH-105362	Technology of Steel Components	4 CR	Schulze
T-MACH-105177	Metal Forming	4 CR	Herlan
T-MACH-102148	Gear Cutting Technology	4 CR	Klaiber
T-MACH-110937	Materials Recycling and Sustainability	4 CR	Liebig
Production Technology (P) (Election: at most 4 credits)			
T-MACH-102099	Experimental Lab Class in Welding Technology, in Groups *This item will not influence the grade calculation of this parent.*	4 CR	Dietrich
T-MACH-102154	Laboratory Laser Materials Processing *This item will not influence the grade calculation of this parent.*	4 CR	Schneider
T-MACH-108878	Laboratory Production Metrology	4 CR	Lanza, Stamer
T-MACH-105346	Production Techniques Laboratory *This item will not influence the grade calculation of this parent.*	4 CR	Deml, Fleischer, Furmans, Ovtcharova
T-MACH-110960	Project Internship Additive 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 analyze new situations and choose methods of production science target-oriented based on the analyses, as well as justifying their selection.
- are able to describe and compare complex production processes exemplarily.
- are able to generate new solutions 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 the results of others at the solution of given problems.
- have the ability to state results in written form developed in a team, and are able to interpret and present them with self-chosen methods.
- 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 480 hours, corresponding to 16 credit points.

Learning type
Lectures, seminars, workshops, excursions

10.50 Module: Major Field: Rail System Technology (SP 50) [M-MACH-102641]

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

Part of: Specialization / Specialization: General Mechanical Engineering (Major Fields)
Specialization / Specialization: Vehicle Technology (Major Field (p))
Specialization / Specialization: Mechatronics and Microsystems Technology (Major Field)
Specialization / Specialization: Product Development and Engineering Design (Major Field)

Credits	Grading scale	Recurrence	Duration	Language	Level	Version
16	Grade to a tenth	Each term	2 terms	German/English	4	5

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

Mandatory			
T-MACH-106424	Rail System Technology	4 CR	Cichon
T-MACH-105353	Rail Vehicle Technology	4 CR	Cichon
Rail System Technology (E) (Election: at most 10 credits)			
T-MACH-105540	Railways in the Transportation Market	4 CR	Cichon
T-MACH-113016	Digitization in the Railway System	4 CR	Cichon
T-MACH-105237	Vehicle Lightweight Design - Strategies, Concepts, Materials	4 CR	Henning
T-MACH-105218	Automotive Vision	6 CR	Lauer, Stiller
T-MACH-113069	Vehicle Systems for Urban Mobility	4 CR	Cichon
T-MACH-105535	Composite Manufacturing - Polymers, Fibers, Semi-Finished Products, Manufacturing Technologies	4 CR	Henning
T-MACH-113068	Innovation and Project Management in Rail Vehicle Engineering	4 CR	Cichon
T-MACH-105350	Computational Vehicle Dynamics	4 CR	Proppe
T-MACH-108692	Seminar for Rail System Technology	3 CR	Cichon

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

- 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 16 ECTS (M.Sc.): about 480 hours
- Regular attendance: 84 hours
- Self-study: 84 hours
- Exam and preparation: 312 hours

Learning type
Lectures in the core part.

Lectures and seminars are offered in the supplementary part.

10.51 Module: Major Field: Reliability in Mechanical Engineering (SP 49) [M-MACH-102602]

Responsible: Prof. Dr. Peter Gumbsch
Organisation: KIT Department of Mechanical Engineering

Part of:
Specialization / Specialization: General Mechanical Engineering (Major Fields)
Specialization / Specialization: Energy- and Environment Engineering (Major Field)
Specialization / Specialization: Vehicle Technology (Major Field)
Specialization / Specialization: Mechatronics and Microsystems Technology (Major Field)
Specialization / Specialization: Product Development and Engineering Design (Major Field)
Specialization / Specialization: Production Technology (Major Field)
Specialization / Specialization: Theoretical Mechanical Engineering (Major Field)
Specialization / Specialization: Materials and Structures for High Performance Systems (Major Field (p))

Credits	Grading scale	Recurrence	Duration	Language	Level	Version
16	Grade to a tenth	Each term	2 terms	German/English	4	7

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

Mandatory			
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
Reliability in Mechanical Engineering (E) (Election:)			
T-MACH-105310	Design of Highly Stresses Components	4 CR	Aktaa
T-MACH-105321	Introduction to Theory of Materials	4 CR	Kamlah
T-MACH-105334	Mechanics in Microtechnology	4 CR	Greiner, Gruber
T-MACH-105516	Multi-Scale Plasticity	4 CR	Greiner, Schulz
T-MACH-105724	Failure Analysis	4 CR	Greiner, Schneider
T-MACH-105369	Materials Modelling: Dislocation Based Plasticity	4 CR	Weygand
T-MACH-100532	Scientific Computing for Engineers	4 CR	Gumbsch, Weygand
T-MACH-110378	Mathematical Methods in Micromechanics	5 CR	Böhlke
T-MACH-105971	Simulation of the Process Chain of Continuously Fiber Reinforced Composite Structure	4 CR	Kärger
T-MACH-110954	Lightweight Constructions with Fiber-Reinforced-Polymers – Theory and Practice	4 CR	Kärger, Liebig
T-MACH-105970	Structural Analysis of Composite Laminates	4 CR	Kärger
T-MACH-112106	Fatigue of Materials	4 CR	Guth
T-MACH-113742	Particle Dynamics and Atomistic Simulation	4 CR	Gumbsch, Schneider, Weygand
Reliability in Mechanical Engineering (P) (Election: at most 4 credits)			
T-MACH-105392	FEM Workshop - Constitutive Laws *This item will not influence the grade calculation of this parent.*	4 CR	Schulz, Weygand
T-MACH-105417	Finite Element Workshop *This item will not influence the grade calculation of this parent.*	4 CR	Mattheck, Weygand
Reliability in Mechanical Engineering (Ü) (Election:)			
T-MACH-110379	Tutorial Mathematical Methods in Micromechanics	1 CR	Böhlke

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
After attending the core subjects "failure of structural materials: fatigue and creep" (T-MACH-102139) and "failure of structural materials: deformation and fracture"(T-MACH-102140) the students will gain the following skills:

- They have the basic understanding of mechanical processes to explain the relationship between externally applied load and materials strength.
- They 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.
- They can decribe the main empirical materials models for fatigue and creep as well as for deformation and fracture and can apply them.
- They have the physical understanding to describe and explain phenomena of failure.
- They can use statistical approaches for reliability predictions.
- They can use its acquired skills, to select and develop materials for specific applications.

The additional competence goals depend on which further lectures are selected and are explicitly described there.

Content
In addition to the core subjects "failure of structural materials: fatigue and creep" (T-MACH-102139) and "failure of structural materials: deformation and fracture" (T-MACH-102140), the student has to choose two more lectures, which deal with specific problems of reliability of components and systems in mechanical engineering.

For detailed information see the description of the different courses of the module.

Annotation
The module Reliability in Mechanical Engineering consists of 16 credit points in the master´s program. Within that module, the students have to pass bricks T-MACH-105531 and T-MACH-109303 from the core area (8 credit points) and can select from a broad variation of courses within the supplementary area.

In the core area of the major field Materials Science and Engineering the students have to pass bricks T-MACH-102139 and T-MACH-102140 (obligatory).

Workload
The work load is about 480 hours, corresponding to 16 credit points.

Recommendation
preliminary knowlegde in mathematics, mechanics and materials science

Learning type
Lectures, Tutorials, Lab Courses and Seminars.

10.52 Module: Major Field: Robotics (SP 40) [M-MACH-102633]

Responsible: apl. Prof. Dr. Ralf Mikut
Organisation: KIT Department of Mechanical Engineering

Part of: Specialization / Specialization: General Mechanical Engineering (Major Fields)
Specialization / Specialization: Mechatronics and Microsystems Technology (Major Field (p))
Specialization / Specialization: Product Development and Engineering Design (Major Field)
Specialization / Specialization: Production Technology (Major Field)
Specialization / Specialization: Theoretical Mechanical Engineering (Major Field)

Credits	Grading scale	Recurrence	Duration	Language	Level	Version
16	Grade to a tenth	Each term	2 terms	German/English	4	7

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

Robotics (K) (Election: at least 8 credits)			
T-MACH-105314	Computational Intelligence	4 CR	Meisenbacher, Mikut, Reischl
T-MACH-105694	Data Analytics for Engineers	5 CR	Meisenbacher, Mikut, Reischl
T-MACH-113597	Decision-Making and Motion Planning for Automated Driving	6 CR	Naumann, Werling
T-MACH-100535	Introduction into Mechatronics	6 CR	Orth, Reischl
T-MACH-105218	Automotive Vision	6 CR	Lauer, Stiller
T-INFO-108014	Robotics I - Introduction to Robotics	6 CR	Asfour
T-INFO-105723	Robotics II - Humanoid Robotics	3 CR	Asfour
Robotics (E) (Election: at most 8 credits)			
T-MACH-105216	Powertrain Systems Technology B: Stationary Machinery	4 CR	Düser, Ott
T-MACH-108844	Automated Manufacturing Systems	8 CR	Fleischer
T-INFO-101351	Biologically Inspired Robots	3 CR	Rönnau
T-MACH-105317	Digital Control	4 CR	Knoop
T-INFO-105142	Humanoid Robots - Practical Course	3 CR	Asfour
T-MACH-105378	Cognitive Automobiles - Laboratory	6 CR	Kitt, Lauer, Stiller
T-MACH-105221	Lightweight Engineering Design	4 CR	Düser, Ott
T-MACH-112115	Artificial Intelligence in Production	4 CR	Fleischer
T-INFO-101377	Localization of Mobile Agents	6 CR	Hanebeck
T-MACH-105223	Machine Vision	8 CR	Lauer, Stiller
T-MACH-105189	Mathematical Models and Methods for Production Systems	6 CR	Baumann, Furmans
T-MACH-105335	Measurement II	4 CR	Stiller
T-MACH-105539	Modern Control Concepts I	4 CR	Groell, Matthes
T-MACH-102152	Novel Actuators and Sensors	4 CR	Kohl, Sommer
T-MACH-111249	Optical Measuring Systems	4 CR	Sieber
T-MACH-105442	Intellectual Property Rights and Strategies in Industrial Companies	4 CR	Düser, Zacharias
T-INFO-109931	Robotics III - Sensors and Perception in Robotics	3 CR	Asfour
T-MACH-112121	Seminar Application of Artificial Intelligence in Production	4 CR	Fleischer
T-MACH-105990	Simulation of Optical Systems	4 CR	Sieber
T-MACH-105185	Control Technology	4 CR	Gönnheimer
T-MACH-105358	Sustainable Product Engineering	4 CR	Albers, Matthiesen, Ziegahn
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-102149	Virtual Reality Practical Course	4 CR	Ovtcharova
T-MACH-113838	Biologically Inspired Robots	3 CR	Rönnau

Robotics (P) (Election: at most 4 credits)			
T-MACH-105370	Laboratory Mechatronics	4 CR	Hagenmeyer, Stiller
T-MACH-108878	Laboratory Production Metrology	4 CR	Lanza, Stamer
T-MACH-105341	Lab Computer-Aided Methods for Measurement and Control	4 CR	Klemp, 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
The Robotics offers extensive knowledge to develop, design and manufacture future intelligent robots. The following scientific disciplines are covered during the major Robotics:

- Control systems and control theory
- Actuators and sensors
- Mathematical and descriptive methods

The students of the major Robotics have the essential skills necessary to develop future robotic systems for modern applications.

Content
See brick courses.

Workload
The work load is about 480 hours, corresponding to 16 credit points.

Learning type
Lecture, tutorial.

M 10.53 Module: Major Field: Technical Ceramics and Powder Materials (SP 43) [M-MACH-102619]

Responsible: Prof. Dr. Michael Hoffmann
Organisation: KIT Department of Mechanical Engineering

Part of: Specialization / Specialization: General Mechanical Engineering (Major Fields)
Specialization / Specialization: Energy- and Environment Engineering (Major Field)
Specialization / Specialization: Vehicle Technology (Major Field)
Specialization / Specialization: Product Development and Engineering Design (Major Field)
Specialization / Specialization: Materials and Structures for High Performance Systems (Major Field)

Credits	Grading scale	Recurrence	Duration	Language	Level	Version
16	Grade to a tenth	Each term	2 terms	German/English	4	1

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

Technical Ceramics and Powder Materials (K) (Election: at least 8 credits)			
T-MACH-102111	Principles of Ceramic and Powder Metallurgy Processing	4 CR	Schell
T-MACH-100287	Introduction to Ceramics	6 CR	Schell
Technical Ceramics and Powder Materials (E) (Election: at most 8 credits)			
T-MACH-102182	Ceramic Processing Technology	4 CR	Binder
T-MACH-102157	High Performance Powder Metallurgy Materials	4 CR	Schell
T-MACH-102170	Structural and Phase Analysis	4 CR	Wagner
T-MACH-102140	Failure of Structural Materials: Deformation and Fracture	4 CR	Gumbsch, Weygand
Technical Ceramics and Powder Materials (P) (Election: at most 4 credits)			
T-MACH-105178	Practical Course Technical Ceramics *This item will not influence the grade calculation of this parent.*	4 CR	Schell

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
The students acquire comprehensive and fundamental knowledge of preparation, processing and characterization of technical powders, their consolidation by various shaping techiques and the densification by sintering. They know the manifold possibilities of microstructural design of powdermetallurgical parts and are able to discuss the microstructure property relationships.

Content
See brick courses.

Workload
The work load is about 480 hours, corresponding to 16 credit points.

Learning type
Lectures, Tutorials

10.54 Module: Major Field: Technical Logistics (SP 44) [M-MACH-102640]

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

Part of: Specialization / Specialization: General Mechanical Engineering (Major Fields)
Specialization / Specialization: Product Development and Engineering Design (Major Field)
Specialization / Specialization: Production Technology (Major Field)

Credits	Grading scale	Recurrence	Duration	Language	Level	Version
16	Grade to a tenth	Each term	2 terms	German/English	4	9

Election notes
In the core area of 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-112841	Basics of Technical Logistics I	4 CR	Mittwollen, Oellerich
T-MACH-109920	Basics of Technical Logistics II	6 CR	Furmans
Technical Logistics (E) (Election: at most 8 credits)			
T-MACH-112114	Dynamic Systems of Technical Logistics - Project	4 CR	Mittwollen
T-MACH-105151	Energy Efficient Intralogistic Systems	4 CR	Kramer, Schönung
T-MACH-111003	Global Logistics	4 CR	Furmans
T-MACH-105187	IT-Fundamentals of Logistics	4 CR	Thomas
T-MACH-105174	Warehousing and Distribution Systems	3 CR	Furmans
T-MACH-105171	Safety Engineering	4 CR	Kany
T-MACH-108844	Automated Manufacturing Systems	8 CR	Fleischer
T-MACH-113597	Decision-Making and Motion Planning for Automated Driving	6 CR	Naumann, Werling
T-MACH-105378	Cognitive Automobiles - Laboratory	6 CR	Kitt, Lauer, Stiller
T-MACH-102107	Quality Management	4 CR	Lanza
T-MACH-113031	Rapid Industrialization of Immature Products using the Example of Electric Mobility	4 CR	Bauer

Competence Certificate
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 480 hours, corresponding to 16 credit points.

Learning type
Lectures and practices; self-study

10.55 Module: Major Field: Thermal Turbomachines (SP 46) [M-MACH-102636]

Responsible: Prof. Dr.-Ing. Hans-Jörg Bauer

Organisation: KIT Department of Mechanical Engineering
Institute of Thermal Turbomachinery

Part of: Specialization / Specialization: General Mechanical Engineering (Major Fields)
Specialization / Specialization: Energy- and Environment Engineering (Major Field)
Specialization / Specialization: Vehicle Technology (Major Field)
Specialization / Specialization: Theoretical Mechanical Engineering (Major Field)
Specialization / Specialization: Materials and Structures for High Performance Systems (Major Field)

Credits	Grading scale	Recurrence	Duration	Language	Level	Version
16	Grade to a tenth	Each term	2 terms	German/English	4	6

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

Mandatory			
T-MACH-105363	Thermal Turbomachines I	6 CR	Bauer
T-MACH-105364	Thermal Turbomachines II	6 CR	Bauer
Thermal Turbomachines (E) (Election:)			
T-MACH-105310	Design of Highly Stresses Components	4 CR	Aktaa
T-MACH-113359	Boosting the Modern Energy Landscape via Turbo Machines & Machine Learning	4 CR	Bauer
T-MACH-111193	Data Driven Engineering 1: Machine Learning for Dynamical Systems	4 CR	Bauer
T-MACH-111373	Data Driven Engineering 2: Advanced Topics	4 CR	Bauer
T-MACH-105512	Experimental Fluid Mechanics	4 CR	Kriegseis
T-MACH-105444	Combined Cycle Power Plants	4 CR	Banuti, Schulenberg
T-MACH-105221	Lightweight Engineering Design	4 CR	Düser, Ott
T-MACH-105210	Machine Dynamics	5 CR	Proppe
T-MACH-105224	Machine Dynamics II	4 CR	Proppe
T-MACH-105339	Numerical Simulation of Reacting Two Phase Flows	4 CR	Koch
T-MACH-105442	Intellectual Property Rights and Strategies in Industrial Companies	4 CR	Düser, Zacharias
T-MACH-112106	Fatigue of Materials	4 CR	Guth
T-MACH-105171	Safety Engineering	4 CR	Kany
T-MACH-105290	Vibration Theory	5 CR	Fidlin
T-MACH-105366	Turbo Jet Engines	4 CR	Bauer
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-105784	Vortex Dynamics	4 CR	Kriegseis, Leister
T-MACH-113362	Heat Transfer and Cooling at Thermally Highly Loaded Components	4 CR	Bauer, Schulz
Thermal Turbomachines (P) (Election: at most 4 credits)			
T-MACH-105313	CFD-Lab Using OpenFOAM	4 CR	Koch
T-MACH-106707	Workshop on Computer-based Flow Measurement Techniques *This item will not influence the grade calculation of this parent.*	4 CR	Bauer
T-MACH-105445	Simulator Exercises Combined Cycle Power Plants	2 CR	Banuti, Schulenberg

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
After completion of SP 46 students are able to:

- identify and quantify the specific requirements of different applications in the fields of energy technology, aeronautics, car and motor technology and process technology on thermal turbo machines,
- apply the basics of thermodynamics, fluid mechanics and of other generic disciplines to analyse and design turbo machines and their components,
- explain the governing processes in turbo machines such as compression, combustion and expansion,
- Recognise and exploit the potentials to further improve the economics and environmental friendliness of turbo machines, their components and in their interaction with the overarching systems, like power plant or airplane,
- Explain the operational principle of turbo machines and the related generics.

Content
Thermal turbo machines are driving generators of power plants to generate electric energy. In aeronautics turbofan, turboprop and turboshaft engines are the dominating propulsion systems for airplanes and helicopters due to their high specific power-to-weight ratio and efficiency. Turbochargers are providing increased power and efficiency to internal combustion engines. Turbocompressors are used in multiple applications in chemical and process industry. In the major subject “Thermal Turbo Machines” students learn to apply their basic knowledge in thermodynamics, fluid mechanics, technical mechanics and other generic disciplines to analyse and develop challenging applications.

Workload
The work load is about 480 hours, corresponding to 16 credit points.

Learning type
Lectures, Tutorials

M 10.56 Module: Major Field: Tribology (SP 47) [M-MACH-102637]

Responsible: Prof. Dr. Martin Dienwiebel
Organisation: KIT Department of Mechanical Engineering

Part of:
Specialization / Specialization: General Mechanical Engineering (Major Fields)
Specialization / Specialization: Energy- and Environment Engineering (Major Field)
Specialization / Specialization: Vehicle Technology (Major Field)
Specialization / Specialization: Mechatronics and Microsystems Technology (Major Field)
Specialization / Specialization: Product Development and Engineering Design (Major Field)
Specialization / Specialization: Production Technology (Major Field)
Specialization / Specialization: Theoretical Mechanical Engineering (Major Field)
Specialization / Specialization: Materials and Structures for High Performance Systems (Major Field)

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

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

Mandatory			
T-MACH-105531	Tribology	8 CR	Dienwiebel, Scherge
T-MACH-109303	Exercices - Tribology	0 CR	Dienwiebel
Tribology (E) (Election:)			
T-MACH-105215	Applied Tribology in Industrial Product Development	4 CR	Albers, Lorentz, Matthiesen
T-MACH-102141	Constitution and Properties of Wearresistant Materials	4 CR	Ulrich
T-MACH-105786	Contact Mechanics	4 CR	Greiner
T-MACH-102167	Nanotribology and -Mechanics	4 CR	Dienwiebel, Hölscher
T-MACH-102137	Polymer Engineering I	4 CR	Liebig
T-MACH-105724	Failure Analysis	4 CR	Greiner, Schneider
T-MACH-102103	Superhard Thin Film Materials	4 CR	Ulrich
T-MACH-111814	Introduction to Nanotechnology	4 CR	Hölscher
T-MACH-113412	Atomistic Simulations and Particle Dynamics	4 CR	Gumbsch, Schneider, Weygand
T-MACH-113405	Drive System Engineering A: Automotive Systems	4 CR	Düser, Ott
Tribology (P) (Election: at most 4 credits)			
T-MACH-105813	Practical Course “Tribology” *This item will not influence the grade calculation of this parent.*	4 CR	Dienwiebel, 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 individually choice.

Prerequisites
None

Competence Goal
After attending the core subject "tribology" (2181114) the students have the following skills:

- They can describe the fundamental friction and wear mechanisms, which occur in tribologically stressed systems.
- They can evaluate the friction and wear behavior of tribological systems.
- They can explain the effects of lubricants and their most important additives.
- They can identify suitable approaches to optimize tribological systems.
- They 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.
- They can 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.
- The can describe the most important surface-analytical methods and their physical principles for the characterization of tribologically stressed sliding surfaces.

The additional learning outcomes depend on which further lectures are selected and are explicitly described there.

Content
In addition to the core subject "tribology" (bricks T-MACH-105531 and T-MACH-109303), the student has to choose two more lectures, which deal with specific problems of tribology, e.g. in the field of product deveolpment, simulation or materials selection.

For detailed information see the description of the different courses of the module.

Annotation
The module Tribology consists of 16 credit points in the master´s program. Within that module, the students have to pass bricks T-MACH-105531 and T-MACH-109303 from the core area (8 credit points) and can select from a broad variation of courses within the supplementary area.

Workload
The work load is about 480 hours, corresponding to 16 credit points.

Learning type
In the core area of the major field Materials Science and Engineering the students have to pass bricks T-MACH-105531 and T-MACH-109303 (obligatory).

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

M 10.57 Module: Major Field: Vehicle Technology (SP 12) [M-MACH-102607]

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

Part of: Specialization / Specialization: General Mechanical Engineering (Major Fields)
Specialization / Specialization: Vehicle Technology (Major Field (p))
Specialization / Specialization: Product Development and Engineering Design (Major Field)

Credits	Grading scale	Recurrence	Duration	Language	Level	Version
16	Grade to a tenth	Each term	2 terms	German/English	4	11

Mandatory			
T-MACH-100092	Automotive Engineering I	8 CR	Gauterin, Gießler
Automotive Technology (E) (Election:)			
T-MACH-105655	Alternative Powertrain for Automobiles	4 CR	Noreikat
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-112126	Data-Driven Algorithms in Vehicle Technology	4 CR	Scheubner
T-MACH-108719	Designing with numerical methods in product development	4 CR	Schnack
T-MACH-108721	Designing with Composites	4 CR	Schnack
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	Ehrhardt
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, Gießler
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-ETIT-100784	Hybrid and Electric Vehicles	4 CR	Doppelbauer
T-MACH-105375	Industrial Aerodynamics	4 CR	Frohnapfel, Kröber
T-MACH-112882	Innovation2Business – Innovation Strategy in the Industrial Corporate Practice	4 CR	Albers
T-MACH-105188	Integrative Strategies in Production and Development of High Performance Cars	4 CR	Schlichtenmayer
T-MACH-105221	Lightweight Engineering Design	4 CR	Düser, Ott
T-MACH-105164	Laser in Automotive Engineering	4 CR	Schneider
T-MACH-112763	Laser Material Processing	4 CR	Schneider
T-MACH-110954	Lightweight Constructions with Fiber-Reinforced-Polymers – Theory and Practice	4 CR	Kärger, Liebig
T-MACH-108717	Mechanics of Laminated Composites	4 CR	Schnack

T-MACH-105169	Engine Measurement Techniques	4 CR	Bernhardt
T-MACH-111578	Sustainable Vehicle Drivetrains	4 CR	Koch, Toedter
T-MACH-108720	Numerical Mechanics for Industrial Applications	4 CR	Schnack
T-MACH-105442	Intellectual Property Rights and Strategies in Industrial Companies	4 CR	Düser, Zacharias
T-MACH-110984	Production Technology for E-Mobility	4 CR	Fleischer
T-MACH-102155	Product, Process and Resource Integration in the Automotive Industry	4 CR	Mbang
T-MACH-110318	Product- and Production-Concepts for Modern Automobiles	4 CR	Kienzle, Steegmüller
T-MACH-102156	Project Workshop: Automotive Engineering	6 CR	Frey, Gauterin, Gießler
T-MACH-105441	Development of Oil-Hydraulic Powertrain Systems	4 CR	Geerling
T-MACH-110796	Python Algorithm for Vehicle Technology	4 CR	Rhode
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-102148	Gear Cutting Technology	4 CR	Klaiber
T-MACH-111585	Hydrogen and reFuels - Energy Conversion in Combustion Engines	4 CR	Kubach
T-MACH-113597	Decision-Making and Motion Planning for Automated Driving	6 CR	Naumann, Werling
T-MACH-113405	Drive System Engineering A: Automotive Systems	4 CR	Düser, Ott
T-MACH-105162	Fundamentals of Automobile Development I	2 CR	Harrer
T-MACH-105163	Fundamentals of Automobile Development II	2 CR	Harrer
T-MACH-113713	Practical Course: Autonomous Driving	6 CR	Frey, Gießler

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
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
See brick courses.

Workload
The work load is about 480 hours, corresponding to 16 credit points.

Learning type
Lectures, tutorials.

10.58 Module: Major Field: Vibration Theory (SP 60) [M-MACH-104443]

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

Part of:
Specialization / Specialization: General Mechanical Engineering (Major Fields)
Specialization / Specialization: Energy- and Environment Engineering (Major Field)
Specialization / Specialization: Vehicle Technology (Major Field)
Specialization / Specialization: Mechatronics and Microsystems Technology (Major Field)
Specialization / Specialization: Product Development and Engineering Design (Major Field)
Specialization / Specialization: Production Technology (Major Field)
Specialization / Specialization: Theoretical Mechanical Engineering (Major Field (p))

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

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

Vibration Theory (K) (Election: at least 8 credits)			
T-MACH-105290	Vibration Theory	5 CR	Fidlin
T-MACH-105210	Machine Dynamics	5 CR	Proppe
T-MACH-105294	Mathematical Methods of Vibration Theory	6 CR	Fidlin, Höllig, Römer
T-MACH-105372	Theory of Stability	6 CR	Fidlin
Vibration Theory (E) (Election: at most 9 credits)			
T-MACH-105224	Machine Dynamics II	4 CR	Proppe
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-105439	Introduction to Nonlinear Vibrations	7 CR	Fidlin
T-MACH-110834	Contact Mechanics for Dynamic Systems	4 CR	Römer
T-MACH-105349	Computational Dynamics	4 CR	Proppe
T-MACH-105373	Practical Training in Measurement of Vibrations	4 CR	Fidlin

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

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

Prerequisites
none

Competence Goal
The students know different methods which may be applied for the analysis of investigation of vibrations problems. They are able to treat one or multiple degrees 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.

Workload
The work load is about 480 hours, corresponding to 16 credit points. 1 LP = 30 working hours

Learning type
Lectures, Tutorials

M 10.59 Module: Master's Thesis [M-MACH-102858]

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

Part of: Master's Thesis

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

Mandatory			
T-MACH-105299	Master's Thesis	30 CR	Heilmaier

Competence Certificate
The module Master Thesis consists of a written master thesis and an oral presentation of a scientific subject chosen by the student himself/herself or given by the supervisor. The master 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 maximal processing time of the master thesis takes six months. With consent of the examiner the thesis can be written in another language than German as well. 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 master 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 three months. If the master thesis is not completed in time, this examination is "failed" (5,0), unless the student is not responsible.

The master 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 master thesis is graded by the examination board within this assessment; another expert can be appointed too. The master 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 master thesis. The presentation should last around 30 minutes and is followed by a scientific discussion with the present expert audience.

Prerequisites
The prerequisite for admission to the master's thesis module is that the student has successfully passed module examinations totaling 74 CP and has met all requirements according to the notification of admission / access statutes (e.g. proof of professional internship).

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 74 credits in the following fields:
    - Advanced Engineering Fundamentals
    - Specialization

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 independently, 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 the given scientific question, is able to choose sophisticated scientific methods and techniques, and use them to solve this question and to identify further potentials, respectively. In addition, 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 in a more sophisticated way. He/she is able to clearly structure his scientific work and (a) to communicate it in written form using state-of-the-art 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 master 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 master thesis is about 900 hours.

M 10.60 Module: Mathematical Methods (MSc-Modul 08, MM) [M-MACH-102594]

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

Part of: Advanced Engineering Fundamentals

Credits	Grading scale	Recurrence	Duration	Language	Level	Version
6	Grade to a tenth	Each term	1 term	German/English	4	2

Mathematical Methods (Election: 1 item)			
T-MACH-105293	Mathematical Methods in Dynamics	6 CR	Proppe
T-MACH-105294	Mathematical Methods of Vibration Theory	6 CR	Fidlin, Höllig, Römer
T-MACH-105295	Mathematical Methods in Fluid Mechanics	6 CR	Frohnapfel
T-MACH-105189	Mathematical Models and Methods for Production Systems	6 CR	Baumann, Furmans
T-MATH-102242	Numerical Mathematics for Students of Computer Science	6 CR	Rieder, Weiß, Wieners
T-MATH-109620	Probability Theory and Statistics	6 CR	Bäuerle, Ebner, Fasen-Hartmann, Hug, Klar, Last, Trabs, Winter
T-MACH-110375	Mathematical Methods in Continuum Mechanics	4 CR	Böhlke
T-MACH-110378	Mathematical Methods in Micromechanics	5 CR	Böhlke
Tutorial Mathematical Methods (Election:)			
T-MACH-110376	Tutorial Mathematical Methods in Continuum Mechanics	2 CR	Böhlke
T-MACH-110379	Tutorial Mathematical Methods in Micromechanics	1 CR	Böhlke

Competence Certificate
written exam, duration 3 h

Prerequisites
none

Competence Goal
Students will deepen and explain mathematical methods and transfer them to a variety of engineering problems. They are able to select suitable methods and transfer them to new problems.

Content
see chosen brick course.

Workload
The work load is about 180 hours, corresponding to 6 credit points.

Learning type
Lectures, Tutorials

M 10.61 Module: Modeling and Simulation (MSc-Modul 05, MS) [M-MACH-102592]

Responsible: Prof. Dr.-Ing. Kai Furmans
Prof. Dr.-Ing. Marcus Geimer
Prof. Dr.-Ing. Luise Kärger
Prof. Dr.-Ing. Carsten Proppe

Organisation: KIT Department of Mechanical Engineering

Part of: Advanced Engineering Fundamentals

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

Mandatory			
T-MACH-105297	Modeling and Simulation	7 CR	Furmans, Geimer, Kärger, Proppe

Competence Certificate
written exam, 3 hours

Prerequisites
none

Competence Goal
Students are able to explain models and simulations as part of many disciplines of mechanical engineering. They are able to reproduce the interdisciplinary aspects of typical modeling and simulation techniques in mechanical engineering. The students are proficient in simulation studies from problem formulation to modeling, simulation, verification and validation, ie:

- They are able to formulate the steps necessary to resolve problems arising in engineering, to create appropriate conceptual and mathematical models and to analyze them.

- They are able to develop and implement algorithms for the solution of mathematical models.

- They are able to perform comprehensive and interdisciplinary simulation studies to assess the simulation results and to critically evaluate the quality of the simulation results.

Content
Introduction: Overview, concept formulation, simulation studies.

Time/event-discrete models, event-orientated/process orientated/transaction orientated view, typical model classes (operation/maintenance, storekeeping, loss-susceptible systems).

Time-continuous models with concentrated parameters, model characteristics and model analysis , numerical treatment of ordinary differential equations and differential-algebraic sets of equations. Coupled simulations with concentrated parameters.

Time-continuous models with distributed parameters, description of systems by means of partial differential equations, model reduction, numerical solution procedures for partial differential equations.

Annotation
From SoSe 25, the previous course (7 ECTS) will be replaced by two courses (4 ECTS + 3 ECTS).
One course will be offered in summer semester (Numerical Methods for Engineering Applications (NuMIA), T-MACH-113699, Kärger, 4 ECTS)
and one course is offered in winter semester (Geimer, 3 ECTS, from WiSe 25/26)

Workload
Regular attendance: 42 hours

Self-study: 168 hours

Learning type
Lecture and Tutorials

M 10.62 Module: Product Development - Dimensioning of Components (MSc-Modul 06, PE-B) [M-MACH-102593]

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

Part of: Advanced Engineering Fundamentals

Credits	Grading scale	Recurrence	Duration	Language	Level	Version
7	Grade to a tenth	Each summer term	1 term	German/English	4	1

Mandatory			
T-MACH-105383	Product Development - Dimensioning of Components	7 CR	Dietrich, Schulze

Competence Certificate
The assessment is carried out as a written exam (2 hours).

Prerequisites
none

Competence Goal
The students…

- are capable to design and dimension components according to their load.
- can include mechanical material properties from the mechanical material test in the dimensioning process.
- can identify superimposed total loads and critical loads on simple components and to compute them.
- acquire the skill to select materials based on the application area of the components and respective loads.

Content
The aim of the lecture is to present the topics of the dimensioning and the material science in their connection and to learn how to deal with corresponding methods and the combination thereof.
For the prospective engineer the most important educational objective is to understand the interaction of these topics while the interplay of the individual material stresses in the component are clarified.

The topics in detail are

- Structural dimensioning: basic stresses, superimposed stresses, notch influence, fatigue limit, fatigue strength, assessment of cracked components, operational strength, residual stresses, high temperature stress and corrosion
- Material selection: Basics, material indices, material selection diagrams, Ashby procedure, multiple boundary conditions, target conflicts, shape and efficiency.

Workload
The workload for the lecture “Product Development - Dimensioning of Components” is 210 h per semester and consists of the presence during the lectures (50 h) including tutorials, preparation and rework time at home (80 h) and preparation time for the oral exam (80 h).

Learning type
Lectures
Tutorials

10.63 Module: Product Development – Methods of Product Engineering [M-MACH-102718]

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

Part of: Advanced Engineering Fundamentals

Credits	Grading scale	Recurrence	Duration	Language	Level	Version
6	Grade to a tenth	Each summer term	1 term	German/English	4	2

Mandatory			
T-MACH-109192	Methods and Processes of PGE - Product Generation Engineering	6 CR	Albers, Burkardt, Matthiesen

Competence Certificate
Written examination (processing time: 120 min + 10 min reading time)

Prerequisites
None

Competence Goal
The students are able to ...

- classify product development in companies and differentiate between different types of product development.
- name the relevant influencing factors of a market for product development.
- name, compare and use the central methods and process models of product development within moderate complex technical systems.
- explain problem solving techniques and associated development methods.
- explain product profiles and to differentiate and choose suitable creative techniques of solution/idea generation finding on this basis.
- use design guidelines to create simple technical systems and to explain these guidelines.
- name and compare quality assurance methods; to choose and use suitable methods for particular applications.
- explain the differents methods of design of experiment.
- explain the costs in development process.

Content
Basics of Product Development: Basic Terms, Classification of the Product
Development into the industrial environment, generation of costs / responsibility for costs
Concept Development: List of demands / Abstraction of the Problem Definition / Creativity Techniques / Evaluation and selection of solutions
Drafting : Prevailing basic rules of Design / Design Principles as a
problem oriented accessory
Rationalization within the Product Development: Basics of Development
Management/ Simultaneous Engineering and Integrated Product Development/Development of Product
Lines and Modular Construction Systems
Quality Assurance in early Development Phases : Methods of Quality Assurance
in an overview/QFD/FMEA

Workload
1. Time of presence lecture: 15 * 3h= 45 h

2. Prepare/follow-up lecture: 15 * 4,5 h = 67,5 h

3. Time of presence exercise: 4 * 1,5h = 6 h

4. Prepare/follow-up exercise: 4 * 3 h = 12 h

5. Exam preparation and time of presence: 49,5 h
Total: 180 h = 6 LP

Learning type
Lecture

Tutorial

Literature
Lecture documents
Pahl, Beitz: Konstruktionslehre, Springer-Verlag 1997
Hering, Triemel, Blank: Qualitätssicherung für Ingenieure; VDI-Verlag, 1993

10.64 Module: Supplementary Studies on Science, Technology and Society [M-FORUM-106753]

Responsible: Dr. Christine Mielke
Christine Myglas

Organisation:

Part of: Additional Examinations (Usage from 10/1/2024)

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

Election notes
Students have to self-record the achievements obtained in the Supplementary Studies on Science, Technology and Society in their study plan. FORUM (formerly ZAK) records the achievements as "non-assigned" under "ÜQ/SQ-Leistungen". Further instructions on self-recording of achievements can be found in the FAQ at https://campus.studium.kit.edu/ and on the FORUM homepage at https://www.zak.kit.edu/english/16495.php. The title of the examination and the amount of credits override the modules placeholders.

If you want to use FORUM achievements for both your Interdisciplinary Qualifications and for the Supplementary Studies, please record them in the Interdisciplinary Qualifications first. You can then get in contact with the FORUM study services (stg@zak.kit.edu) to also record them in your Supplementary Studies.

In the Advanced Unit you can choose examinations from three subject areas: "About Knowledge and Science", "Science in Society" and "Science in Social Debates". It is advised to complete courses from each of the three subject areas in the Advanced Unit.

To self-record achievements in the Advanced Unit, you have to select a free placeholder partial examination first. The placeholders' title do *not* affect which achievements the placeholder can be used for!

Mandatory			
T-FORUM-113578	Lecture Series Supplementary Studies on Science, Technology and Society - Self Registration	2 CR	Mielke, Myglas
T-FORUM-113579	Basic Seminar Supplementary Studies on Science, Technology and Society - Self Registration	2 CR	Mielke, Myglas
Advanced Unit Supplementary Studies on Science, Technology and Society (Election: at least 12 credits)			
T-FORUM-113580	Elective Specialization Supplementary Studies on Science, Technology and Society / About Knowledge and Science - Self-Registration	3 CR	Mielke, Myglas
T-FORUM-113581	Elective Specialization Supplementary Studies on Science, Technology and Society / Science in Society - Self-Registration	3 CR	Mielke, Myglas
T-FORUM-113582	Elective Specialization Supplementary Studies on Science, Technology and Society / Science in Public Debates - Self Registration	3 CR	Mielke, Myglas
Mandatory			
T-FORUM-113587	Registration for Certificate Issuance - Supplementary Studies on Science, Technology and Society	0 CR	Mielke, Myglas

Competence Certificate
The monitoring is explained in the respective partial achievement.

They are composed of:
- Protocols
- Reflection reports
- Presentations
- Preparation of a project work
- An individual term paper
- An oral examination
- A written exam

Upon successful completion of the supplementary studies, graduates receive a graded report and a certificate issued by the FORUM.

Prerequisites
The course is offered during the course of study and does not have to be completed within a defined period. Enrollment is required for all assessments of the modules in the supplementary studies.
Participation in the supplementary studies is regulated by § 3 of the statutes. KIT students register for the supplementary studies by selecting this module in the student portal and booking a performance themselves. Registration for courses, assessments, and exams is regulated by § 8 of the statutes and is usually possible shortly before the start of the semester.
The course catalog, module description (module manual), statutes (study regulations), and guidelines for creating the various written performance requirements can be downloaded from the FORUM homepage at https://www.zak.kit.edu/begleitstudium-wtg.

Competence Goal
Graduates of the Supplementary Studies on Science, Technology, and Society gain a solid foundation in understanding the interplay between science, the public, business, and politics. They develop practical skills essential for careers in media, political consulting, or research management. The program prepares them to foster innovation, influence social processes, and engage in dialogue with political and societal entities. Participants are introduced to interdisciplinary perspectives, encompassing social sciences and humanities, to enhance their understanding of science, technology, and society. The teaching objectives of this supplementary degree program include equipping participants with both subject-specific knowledge and insights from epistemological, economic, social, cultural, and psychological perspectives on scientific knowledge and its application in various sectors. Students are trained to critically assess and balance the implications of their actions at the intersection of science and society. This training prepares them for roles as students, researchers, future decision-makers, and active members of society.

Through the program, participants learn to contextualize in-depth content within broader frameworks, independently analyze and evaluate selected course materials, and communicate their findings effectively in both written and oral formats. Graduates are adept at analyzing social issues and problem areas, reflecting on them critically from a socially responsible and sustainable standpoint.

Content

The Supplementary Studies on Science, Technology and Society can be started in the 1st semester of the enrolled degree programme and is not limited in time. The wide range of courses offered by FORUM makes it possible to complete the program usually within three semesters. The supplementary studies comprises 16 or more credit points (LP). It consists of two modules: the Basic Module (4 LP) and the Advanced Module (12 LP).

The Advanced Module is divided into 3 thematic subject areas:

Subject area 1: About Knowledge and Science

This is about the internal perspective of science: students explore the creation of knowledge, distinguishing between scientific and non-scientific statements (e.g., beliefs, pseudo-scientific claims, ideological statements), and examining the prerequisites, goals, and methods of knowledge generation. They investigate how researchers address their own biases, analyze the structure of scientific explanatory and forecasting models in various disciplines, and learn about the mechanisms of scientific quality assurance.

After completing courses in the "Knowledge and Science" area, students can critically reflect on the ideals and realities of contemporary science. They will be able to address questions such as: How robust is scientific knowledge? What are the capabilities and limitations of predictive models? How effective is quality assurance in science, and how can it be improved? What types of questions can science answer, and what questions remain beyond its scope?

Subject area 2: Science in Society

This focuses on the interactions between science and different areas of society, such as how scientific knowledge influences social decision-making and how social demands impact scientific research. Students learn about the specific functional logics of various societal sectors and, based on this understanding, estimate where conflicts of goals and actions might arise in transfer processes—for example, between science and business, science and politics, or science and journalism. Typical questions in this subject area include: How and under what conditions does an innovation emerge from a scientific discovery? How does scientific policy advice work? How do business and politics influence science, and when is this problematic? According to which criteria do journalists incorporate scientific findings into media reporting? Where does hostility towards science originate, and how can social trust in science be strengthened?

After completing courses in the "Sciene in Society" area, students can understand and assess the goals and constraints of actors in different societal sectors. This equips them to adopt various perspectives of communication and action partners in transfer processes and to act competently at various social interfaces with research in their professional lives.

Subject area 3: Science in Public Debates

The courses in this subject area provide insights into current debates on major social issues such as sustainability, digitalization, artificial intelligence, gender equality, social justice, and educational opportunities. Public debates on complex challenges are often polarized, leading to oversimplifications, defamation, or ideological thinking. This can hinder effective social solution-finding processes and alienate people from the political process and from science. Debates about sustainable development are particularly affected, as they involve a wide range of scientific and technological knowledge in both problem diagnosis (e.g., loss of biodiversity, climate change, resource consumption) and solution development (e.g., nature conservation, CCS, circular economy).

By attending courses in "Science in Public Debates," students are trained in an application-oriented way to engage in factual debates—exchanging arguments, addressing their own prejudices, and handling contradictory information. They learn that factual debates can often be conducted more deeply and with more nuance than is often seen in public discourse. This training enables them to handle specific factual issues in their professional lives independently of their own biases and to be open to differentiated, fact-rich arguments.

Module grade calculation

The overall grade of the supplementary course is calculated as a credit-weighted average of the grades that were achieved in the advanced module.

Annotation
Climate change, biodiversity crisis, antibiotic resistance, artificial intelligence, carbon capture and storage, and gene editing are just a few areas where science and technology can diagnose and address numerous social and global challenges. The extent to which scientific findings are considered in politics and society depends on various factors, such as public understanding and trust, perceived opportunities and risks, and ethical, social, or legal considerations.
To enable students to use their expertise as future decision-makers in solving social and global challenges, we aim to equip them with the skills to navigate the interfaces between science, business, and politics competently and reflectively. In the Supplementary Studies, they acquire foundational knowledge about the interactions between science, technology, and society.

They learn:
- How reliable scientific knowledge is produced,
- how social expectations and demands influence scientific research, and
- how scientific knowledge is adopted, discussed, and utilized by society.

The program integrates essential insights from psychology, philosophy, economics, social sciences, and cultural studies into these topics. After completing the supplementary studies programme, students can place the content of their specialized studies within a broader social context. This prepares them, as future decision-makers, to navigate competently and reflectively at the intersections between science and various sectors of society, such as politics, business, or journalism, and to contribute effectively to innovation processes, public debates, or political decision-making.

Additional credit points (supplementary achievements), up to a maximum of 12, can be earned from interdisciplinary achievements and can be included in the supplementary course. Upon request, these supplementary achievements are listed in the certificate of the accompanying course, marked as such, and recorded with their grades as specified in paragraph 9. However, these supplementary achievements are **not** included in the calculation of the overall grade for the accompanying course.
The statutes for the accompanying study programme Science, Technology and Society apply.

Workload
The workload is made up of the number of hours of the individual modules:

- Basic Module approx. 120 hours
- Advanced Module approx. 390 hours

\> Total: approx. 510 hours

In the form of supplementary services, up to approximately 390 hours of work can be added.

Recommendation
It is recommended to complete the supplementary study program in three or more semesters, beginning with the lecture series on science, technology, and society in the summer semester. Alternatively, you can start with the basic seminar in the winter semester and then attend the lecture series in the summer semester.

Courses in the Advanced Module can be taken simultaneously. It is also advised to complete courses from each of the three subject areas in the advanced unit.

Learning type
- Lectures
- Seminars/Project Seminars
- Workshops

11 Courses

T 11.1 Course: Actuators and Sensors in Nanotechnology [T-MACH-105238]

Responsible: Prof. Dr. Manfred Kohl
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102616 - Major Field: Microsystem Technology
M-MACH-102647 - Major Field: Microactuators and Microsensors

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

Exams			
ST 2024	76-T-MACH-105238	Actuators and Sensors in Nanotechnology	Kohl, Sommer

Competence Certificate
oral exam

Prerequisites
none

T 11.2 Course: Advanced CFD with OpenFOAM [T-MACH-111390]

Responsible: Dr. Nima Samkhaniani
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102634 - Major Field: Fluid Mechanic

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

Events					
WT 24/25	2153470	Advanced CFD with OpenFOAM	2 SWS	Lecture / Blended	Stroh, Gatti
Exams					
ST 2024	76-T-MACH-111390	Advanced CFD with OpenFOAM			Frohnapfel, Stroh

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

Competence Certificate
oral exam, app. 30 min

Prerequisites
None

Recommendation
The content of lecture "Introduction to Computational Fluid Dynamis" (LVNr. 2157444)

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

V Advanced CFD with OpenFOAM
2153470, WS 24/25, 2 SWS, Language: English, Open in study portal

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

Content
OpenFOAM ® software toolbox provides a collection of ready-to-go solvers and libraries for application in different fields of fluid mechanics. In spite of the great variety of available tools, research-oriented application of OpenFOAM ® is often linked to the necessity of significant modifications in boundary conditions and governing transport equations due to the novelty of the proposed models rarely available “out-of-the-box”. In this course we approach the development and extension of numerical models in the framework of OpenFOAM ®. The course focuses on:
● modification/implementation of boundary conditions
(e.g. time-dependent boundary conditions),
● extension of implemented transport equations
(e.g. extension of momentum equation with a source term for representation of a solid body in the fluid domain - porosity or immersed boundary method),
● solver extension with additional transport equations
(e.g. solver extension with passive scalar equation for computation of temperature),
● implementation of new models
(e.g. modification or implementation of a new turbulence model).
The course is based on lectures, tutorials and assignments, which will have to be independently accomplished by the course participants.
Course content:
● basic OpenFOAM ® mathematics (tensorial operations, discretization),
● advanced customization of boundary conditions and pre/post-processing with third-party tools (swak4Foam: groovyBC, funkySetField, funkyDoCalc),
● introduction to C++,
● advanced run-time OpenFOAM ® modification with codeStream,
● customizing solvers or developing new solvers in OpenFOAM ®,
● git for code development.

Literature

Moukalled, Fadl, L. Mangani, and Marwan Darwish. The finite volume method in computational fluid dynamics. Vol. 113. Berlin, Germany:: Springer, 2016.
Versteeg, Henk Kaarle, and Weeratunge Malalasekera. An introduction to computational fluid dynamics: the finite volume method. Pearson education, 2007.

T 11.3 Course: Aerodynamics [T-MACH-112029]

Organisation: KIT Department of Mechanical Engineering
Part of: M-MACH-102634 - Major Field: Fluid Mechanic

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

Events					
WT 24/25	2153481	Aerodynamics	3 SWS	Lecture / Practice (/	Kriegseis, Gatti
Exams					
ST 2024	76-T-MACH-111032	Aerodynamics I			Kriegseis, Gatti

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

Competence Certificate
oral exam of 30 minutes

Recommendation
Contents of the following lectures:

- "Mathematical Methods in Fluid Mechanics" (LVNr. 2154432)
- "Vortex Dynamics" (LVNr. 2153438)
- "Fluid Mechanics I" (LVNr. 3154510)
- "Fluid Mechanics II" (LVNr. 3153511)

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

V Aerodynamics
2153481, WS 24/25, 3 SWS, Language: German, Open in study portal

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

Content
The students are able to derive, understand phenomenologically and apply the basic equation of incompressible aerodynamics based on the potential and boundary layer theory and vortex dynamics. The students are able to calculate the forces and moments occurring on an airfoil or wing with the airfoil theory and the finite wing theory and to justify them physically. The design principles, operation and factors that can limit the performance of airfoils and wings are discussed. The students know the limitations of these theories and know approaches to circumvent them. The students can explain the effects of different unsteady effects on the lift and drag characteristics of wings with the basics of transient aerodynamics and also discuss and describe them using the example of wind turbines.

Students will be able to use their knowledge of the fundamentals of flight mechanics to explain how different manoeuvres are performed for an aircraft and how the available measurement technology from the cockpit perspective can support the correct executions of such manoeuvres. Weather permitting, students will have the opportunity to experience and solidify the fundamentals of aircraft aerodynamics and flight mechanics themselves by flying in a glider.

This lecture is designed and carried out jointly with the student university group "Akaflieg".

Literature
Literatur:

Anderson, J.D.: Fundamentals of Aerodynamics, McGraw-Hill 2017
Tropea, C., Eder, S., Weismüller, M.: Aerodynamik I, Shaker 2011

T 11.4 Course: Aerothermodynamics [T-MACH-105437]

Responsible: Prof. Dr.-Ing. Bettina Frohnapfel
Prof. Dr.-Ing. Friedrich Seiler

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102597 - Compulsory Elective Module Mechanical Engineering
M-MACH-102634 - Major Field: Fluid Mechanic

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

Competence Certificate
oral exam 30 minutes

Prerequisites
none

T 11.5 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-102607 - Major Field: Vehicle Technology

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

Events					
WT 24/25	2133132	Sustainable Vehicle Drivetrains	2 SWS	Lecture / 🗣	Toedter
Exams					
ST 2024	76-T-MACH-105655	Sustainable Vehicle Drivetrains (Alternative Powertrain for Automobiles)			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 24/25, 2 SWS, Language: German, Open in study portal

Content

Sustainability

Environmental balance

Legislation

Alternative fuels

BEV

Fuel cell

Hybrid drives

T 11.6 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-102597 - Compulsory Elective Module Mechanical Engineering
M-MACH-102650 - Major Field: Combustion Engines Based Powertrains

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

Events					
ST 2024	2134150	Gas, lubricating oil and operating media analysis in drive train development	2 SWS	Lecture / 🗣	Gohl

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

2134150, SS 2024, 2 SWS, Language: German, Open in study portal

Lecture (V)
On-Site

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

T 11.7 Course: Analysis Tools for Combustion Diagnostics [T-MACH-105167]

Responsible: Jürgen Pfeil
Organisation: KIT Department of Mechanical Engineering

Part of:
M-MACH-102597 - Compulsory Elective Module Mechanical Engineering
M-MACH-102612 - Major Field: Modeling and Simulation in Energy- and Fluid Engineering
M-MACH-102623 - Major Field: Fundamentals of Energy Technology
M-MACH-102635 - Major Field: Engineering Thermodynamics
M-MACH-102650 - Major Field: Combustion Engines Based Powertrains
M-MACH-102650 - Major Field: Combustion Engines Based Powertrains

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

Events					
ST 2024	2134134	Analysis tools for combustion diagnostics	2 SWS	Lecture / 🗣	Pfeil
Exams					
ST 2024	76-T-MACH-105167	Analysis Tools for Combustion Diagnostics			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 Analysis tools for combustion diagnostics
2134134, SS 2024, 2 SWS, Language: German, Open in study portal

Lecture (V)
On-Site

Literature
Skript, erhältlich in der Vorlesung

T 11.8 Course: Anatomy/Sports Medicine I [T-GEISTSOZ-103287]

Responsible: Prof. Dr. Stefan Sell
Organisation:
Part of: M-MACH-102615 - Major Field: Medical Technology

Type	Credits	Grading scale	Version
Written examination	3	Grade to a third	1

Exams			
ST 2024	7400126	Anatomy/Sports Medicine II	Sell
WT 24/25	7400066	Anatomy/sports medicine II	Sell

T 11.9 Course: Anatomy/Sports Medicine II [T-GEISTSOZ-111188]

Responsible: Prof. Dr. Stefan Sell
Organisation:

Part of: M-MACH-102615 - Major Field: Medical Technology

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

Events					
ST 2024	5016107	Foundations of anatomy/sports medicine II	2 SWS	Lecture / 🗣	Sell
Exams					
ST 2024	7400126	Anatomy/Sports Medicine II			Sell
WT 24/25	7400066	Anatomy/sports medicine II			Sell

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

T 11.10 Course: Appliance and Power Tool Design [T-MACH-105229]

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

Part of: M-MACH-102642 - Major Field: Development of Innovative Appliances and Power Tools

Type	Credits	Grading scale	Recurrence	Version
Oral examination	2	Grade to a third	Each summer term	3

Events					
ST 2024	2145164	Appliance and Power Tool Design	2 SWS	Lecture / 🗣	Matthiesen
Exams					
ST 2024	76-T-MACH-105229	Appliance and Power Tool Design			Matthiesen

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

Competence Certificate
Approx. 30 min oral exam

The Appliance and Power Tool Design Project Work will be examined in conjunction with the concurrent lecture. To ensure that the impact on the overall grade is appropriate, the weighting of the exam is 8 credits.

Prerequisites
The participationin “ Appliance and power tool design”” requires the concurrent project work.

Due to organizational reasons, the number of participants is limited. At the beginning of august, a registration form will be available at the IPEK website. In the case of too many applicants, a selection process will be taking place. An early application is advantageous.

Modeled Conditions
The following conditions have to be fulfilled:

1. The course T-MACH-110767 - Appliance and Power Tool Design Project Work must have been started.

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

V Appliance and Power Tool Design

2145164, SS 2024, 2 SWS, Language: German, Open in study portal

Lecture (V)
On-Site

Organizational issues

- Teilnahme an der Lehrveranstaltung Gerätekonstruktion bedingt die gleichzeitige Teilnahme an der Projektarbeit Gerätetechnik.
- Aus organisatorischen Gründen ist die Teilnehmerzahl begrenzt. Ein Anmeldeformular wird Anfang August auf der Homepage des IPEK bereitgestellt. Bei zu großer Zahl an Bewerbern findet ein Auswahlverfahren statt. Eine frühe Anmeldung ist von Vorteil.

T 11.11 Course: Appliance and Power Tool Design Project Work [T-MACH-110767]

Responsible: Prof. Dr.-Ing. Sven Matthiesen
Organisation: KIT Department of Mechanical Engineering
Part of: M-MACH-102642 - Major Field: Development of Innovative Appliances and Power Tools

Type	Credits	Grading scale	Recurrence	Expansion	Version
Completed coursework	6	pass/fail	Each summer term	1 terms	2

Events					
ST 2024	2145165	Appliance and Power Tool Design Project Work	4 SWS	Project (P / 🗣	Matthiesen
Exams					
ST 2024	76-T-MACH-110767	Appliance and Power Tool Design Project Work			Matthiesen

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

Competence Certificate

The Appliance and Power Tool Design Project Work will be examined in conjunction with the concurrent lecture.

Prerequisites

The participation in the project work requires the participation in “Appliance and power tool design”.
Due to organizational reasons, the number of participants is limited. At the beginning of august, a registration form will be available at the IPEK website. In the case of too many applicants, a selection process will be taking place. An early application is advantageous

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

V Appliance and Power Tool Design Project Work

2145165, SS 2024, 4 SWS, Open in study portal

Project (PRO)
On-Site

Organizational issues

- Teilnahme an der Lehrveranstaltung Gerätekonstruktion bedingt die gleichzeitige Teilnahme an der Projektarbeit Gerätetechnik.
- Aus organisatorischen Gründen ist die Teilnehmerzahl begrenzt. Ein Anmeldeformular wird Anfang August auf der Homepage des IPEK bereitgestellt. Bei zu großer Zahl an Bewerbern findet ein Auswahlverfahren statt. Eine frühe Anmeldung ist von Vorteil.

T 11.12 Course: Application of Advanced Programming Languages in Mechanical Engineering [T-MACH-105390]

Responsible: Dr. Daniel Weygand
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102604 - Major Field: Computational Mechanics

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

Exams			
WT 24/25	76-T-MACH-105390	Application of Advanced Programming Languages in Mechanical Engineering	Weygand

Competence Certificate
oral exam ca. 30 minutes

Prerequisites
It is not possible, to combine this brick with brick Scientific computing for Engineers [T-MACH-100532].

Modeled Conditions
The following conditions have to be fulfilled:

1. The course T-MACH-100532 - Scientific Computing for Engineers must not have been started.

Annotation
The lecture is no longer offered.

Remaining examinations must be taken by summer semester 2022 at the latest.

T 11.13 Course: Applied Chemistry [T-CHEMBIO-100302]

Organisation: KIT Department of Chemistry and Biosciences
Part of: M-MACH-102595 - Compulsory Elective Module Natural Science/Computer Science/Electrical Engineering

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

Exams			
ST 2024	7100019	Applied Chemistry, 1st written exam	Deutschmann, Grunwaldt, Meier, Théato
WT 24/25	7100006	Applied Chemistry, 2nd written exam	Grunwaldt, Théato, Deutschmann, Meier

T 11.14 Course: Applied Cryo-Technology [T-MACH-111824]

Responsible: Dr. Holger Neumann
Dr. Klaus-Peter Weiss

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102643 - Major Field: Fusion Technology

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

Events					
ST 2024	2190421	Applied Cryo-Technology	2 SWS	Lecture / 🗣	Weiss, Neumann
Exams					
ST 2024	76-T-MACH-111824	Applied Cryo-Technology			Weiss

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 Applied Cryo-Technology
2190421, SS 2024, 2 SWS, Language: German/English, Open in study portal

Lecture (V)
On-Site

Content
Description

Cryogenic technology is an indispensable part of an industrialized society with continuous growing importance. Until a few decades ago cryo-technology was essentially limited to specific applications in medicine, aerospace, superconducting magnets, and diagnostics, today the spectrum has expanded substantially including food-sector, energy transport, and energy storage, for example LNG (at ≈ 110 Kelvin) or liquid hydrogen (at ≈ 20 Kelvin). It is foreseeable that the operation of cryogenic infrastructures will be of central importance to society.

The term cryogenics describes the techniques for generating and operating systems with fluids at temperatures below 120 Kelvin and covers a wide range of liquids as well as gaseous cryogens such as helium (4.2 Kelvin), hydrogen (20 Kelvin) up to natural gas (LNG 110 Kelvin).

The operation of cryo-plants requires fundamental knowledge of the heat and phase transition of fluids in order to be able to map energetically efficient processes and plan them technically. This requires basic knowledge from various disciplines of systems engineering, process technology, and metrology with special consideration of low temperatures. The effects of low temperatures not only influence the design and dimensioning of components and piping, but also affect the dynamics of cryogenic systems and must be taken into account accordingly in process measuring and control technology. The safety engineering of cryogenic systems also differs from that of conventional piping or chemical carrier networks. For example, high pressures can build up in cryogenic systems in the event of a thermal collapse, so suitable measures must be taken into account at the planning stage.

Another aspect in the realization of cryogenic plants is the consideration of the specific material properties at low temperatures, which differ from those of conventional engineering. Thermal and mechanical parameters for further design can be derived from the thermodynamic relationships as well as the microstructural properties. In addition to metallic alloys, composite materials are also considered as structural and functional materials.

Scope

The aim of the lecture is to teach the basics of refrigeration and liquefaction of fluids with a boiling temperature below 120 K. For this purpose, the essentials of thermodynamics, phase transitions and heat transfer mechanisms must be understood and it should be possible to balance the main components of such a cryogenic system.

The relationship of thermal and mechanical material properties at cryogenic temperatures to the physical background is established. Practical examples are used to illustrate the influence on the design.

The basic design of cryostats is explained in detail and illustrated by examples. The essential design principles and standard components of the measurement and control technology, as well as the essential standards and safety devices are explained.

Content

- Introduction to cryo-technology

- Thermodynamic process and technology of cryogenic generation (Joule-Thompson/Brayton/Claude/Stirling)
- Cryogenic fluids
- Examples of cryogenic applications and their components (bath-, forced-flow-, contact cooling)

- Thermal insulation (vacuum-, super-insulation) and thermal shields
- Storage and transfer of cryogenic fluids (e.g. canister, truck, pipeline, ship)
- Requirements for process measuring and control technology within cryogenic environment
- Specific design features for cryostat systems

- Impact of low temperature on metallic alloys and composite materials
- Requirements and qualification of structural and functional materials for cryogenic temperature regime
- Equipment for material characterization at low temperature

T 11.15 Course: Applied Materials Simulation [T-MACH-105527]

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

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102597 - Compulsory Elective Module Mechanical Engineering

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

Events					
ST 2024	2182614	Applied Materials Simulation	4 SWS	Lecture / Practice (/ 🖥	Gumbsch
Exams					
ST 2024	76-T-MACH-105527	Applied Materials Modelling			Gumbsch, Schulz
WT 24/25	76-T-MACH-105527	Applied Materials Modelling			Gumbsch, Schulz

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

Competence Certificate
oral exam ca. 30 minutes

no tools or reference materials

Prerequisites
The successful participation in Übungen zu Angewandte Werkstoffsimulation is the condition for the admittance to the oral exam in Angewandte Werkstoffsimulation.

T-MACH-110928 – Exercises for Applied Materials Simulation has not been started.

T-MACH-110929 – Applied Materials Modelling has not been started.

Modeled Conditions
The following conditions have to be fulfilled:

1. The course T-MACH-107671 - Exercises for Applied Materials Simulation must have been passed.
2. The course T-MACH-110929 - Applied Materials Simulation must not have been started.
3. The course T-MACH-110928 - Exercises for Applied Materials Simulation must not have been started.

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

V Applied Materials Simulation

2182614, SS 2024, 4 SWS, Language: German, Open in study portal

Lecture / Practice (VÜ)
Online

Content
This lecture should give the students an overview of different simulation methods in the field of materials science and engineering. Numerical methods are presented and their use in different fields of application and size scales shown and discussed. On the basis of theoretical as well as practical aspects, a critical examination of the opportunities and challenges of numerical material simulation shall be carried out.

The student can

- define different numerical methods and distinguish their range of application
- approach issues by applying the finite element method and discuss the processes and results
- understand complex processes of metal forming and crash simulation and discuss the structural and material behavior
- define and apply the physical fundamentals of particle-based simulation techniques to applications of materials science
- illustrate the range of application of atomistic simulation methods and distinguish between different models

preliminary knowlegde in mathematics, physics and materials science recommended

regular attendance: 34 hours

exercise: 11 hours

self-study: 165 hours

oral exam ca. 35 minutes

no tools or reference materials

admission to the exam only with successful completion of the exercises

Organizational issues
Die Vorlesung wir nur als Aufzeichnung angeboten!

Bitte besuchen Sie die englischsprachige Veranstaltung "Applied Materials Simulation" (2182616)!

Weitere Informationen finden Sie in ILIAS.

Kontakt: johannes.schneider@kit.edu

Literature

1. D. Frenkel, B. Smit: Understanding Molecular Simulation: From Algorithms to Applications, Academic Press, 2001
2. W. Kurz, D.J. Fisher: Fundamentals of Solidification, Trans Tech Publications, 1998
3. P. Haupt: Continuum Mechanics and Theory of Materials, Springer, 1999
4. M. P. Allen, D. J. Tildesley: Computer simulation of liquids, Clarendon Press, 1996

T 11.16 Course: Applied Materials Simulation [T-MACH-110929]

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

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102597 - Compulsory Elective Module Mechanical Engineering

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

Events					
ST 2024	2182616	Applied Materials Simulation	4 SWS	Lecture / Practice (/ 🗣	Gumbsch
Exams					
ST 2024	76-T-MACH-110929	Applied Materials Simulation			Gumbsch
WT 24/25	76-T-MACH-110929	Applied Materials Simulation			Gumbsch, Schulz

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

Competence Certificate
oral exam ca. 30 minutes

no tools or reference materials

Prerequisites
The successful participation in Exercises for Applied Materials Simulation is the condition for the admittance to the oral exam in Applied Materials Simulation.

T-MACH-107671 – Übungen zu Angewandte Werkstoffsimulation has not been started.

T-MACH-105527 – Angewandte Werkstoffsimulation has not been started.

Modeled Conditions
The following conditions have to be fulfilled:

1. The course T-MACH-110928 - Exercises for Applied Materials Simulation must have been passed.
2. The course T-MACH-105527 - Applied Materials Simulation must not have been started.
3. The course T-MACH-107671 - Exercises for Applied Materials Simulation must not have been started.

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

V Applied Materials Simulation

2182616, SS 2024, 4 SWS, Language: English, Open in study portal

Lecture / Practice (VÜ)
On-Site

Content
This lecture should give the students an overview of different simulation methods in the field of materials science and engineering. Numerical methods are presented and their use in different fields of application and size scales shown and discussed. On the basis of theoretical as well as practical aspects, a critical examination of the opportunities and challenges of numerical material simulation shall be carried out.

The student can

- define different numerical methods and distinguish their range of application
- approach issues by applying the finite element method and discuss the processes and results
- understand complex processes of metal forming and crash simulation and discuss the structural and material behavior
- define and apply the physical fundamentals of particle-based simulation techniques to applications of materials science
- illustrate the range of application of atomistic simulation methods and distinguish between different models

preliminary knowlegde in mathematics, physics and materials science recommended

regular attendance: 34 hours

exercise: 11 hours

self-study: 165 hours

oral exam ca. 35 minutes

no tools or reference materials

admission to the exam only with successful completion of the exercises

Literature

1. D. Frenkel, B. Smit: Understanding Molecular Simulation: From Algorithms to Applications, Academic Press, 2001
2. W. Kurz, D.J. Fisher: Fundamentals of Solidification, Trans Tech Publications, 1998
3. P. Haupt: Continuum Mechanics and Theory of Materials, Springer, 1999
4. M. P. Allen, D. J. Tildesley: Computer simulation of liquids, Clarendon Press, 1996

11.17 Course: Applied Mathematics in Natural Science: Flows with chemical reactions [T-MACH-108847]

Responsible: apl. Prof. Dr. Andreas Class
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102595 - Compulsory Elective Module Natural Science/Computer Science/Electrical Engineering

Type	Credits	Grading scale	Recurrence	Version
Completed coursework (oral)	6	pass/fail	Each winter term	1

Events					
WT 24/25	2153406	Flows with chemical reactions	2 SWS	Lecture / Blended	Class
Exams					
ST 2024	76-T-MACH-105422	Flows with Chemical Reactions			Class

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

Competence Certificate
The study performance is considered to have been passed if all exercise assignments have been successfull processed and the final colloquium (30 minutes) has been successfully passed.

no auxiliary mean

Prerequisites
none

Recommendation
Fluid Mechanics (T-MACH-105207)

Mathematical Methods in Fluid Mechanics (T-MACH-105295)

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

V Flows with chemical reactions
2153406, WS 24/25, 2 SWS, Language: German/English, Open in study portal

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

Content
The students can describe flow scenarios, where a chemical reaktion is confined to a thin layer. They can choose simplifying approaches for the underlying chemistry and discuss the problems with focus on the fluid mechanic aspects. The students are able to solve simple problems analytically. Furthermore, they are qualified to discuss simplifications as relevant for an efficent numerical solution of complex problems.

In the lecture we mainly consider problems, where chemical reaktion is confined to a thin layer.
The problems are solved analytically or they are at least simplified allowing for efficent numerical sollution procedures. We apply simplified chemistry and focus on the fluid mechanic aspects of the problems.

Literature
Vorlesungsskript

Buckmaster, J.D.; Ludford, G.S.S.: Lectures on Mathematical Combustion, SIAM 1983

T 11.18 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-102597 - Compulsory Elective Module Mechanical Engineering
M-MACH-102599 - Major Field: Powertrain Systems
M-MACH-102605 - Major Field: Engineering Design
M-MACH-102637 - Major Field: Tribology

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 11.19 Course: Artificial Intelligence in Production [T-MACH-112115]

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

Part of:
M-MACH-102597 - Compulsory Elective Module Mechanical Engineering
M-MACH-102600 - Major Field: Man - Technology - Organisation
M-MACH-102601 - Major Field: Automation Technology
M-MACH-102609 - Major Field: Cognitive Technical Systems
M-MACH-102613 - Major Field: Lifecycle Engineering
M-MACH-102614 - Major Field: Mechatronics
M-MACH-102618 - Major Field: Production Technology
M-MACH-102624 - Major Field: Information Technology
M-MACH-102633 - Major Field: Robotics

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

Events					
WT 24/25	2149921	Artificial Intelligence in Production	2 SWS	Lecture / 🗣	Fleischer
Exams					
ST 2024	76-T-MACH-112115	Artificial Intelligence in Production			Fleischer

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 Artificial Intelligence in Production — **Lecture (V) On-Site**
2149921, WS 24/25, 2 SWS, Language: German, Open in study portal

Content

The module AI in Production is designed to teach students the practical, holistic integration of machine learning and artificial intelligence methods in production. The course is oriented towards the phases of the CRISP-DM process with the aim of developing a deep understanding of the necessary steps and content-related aspects (methods) within the individual phases. In addition to teaching the practical aspects of integrating the most important machine learning methods, the focus is primarily on the necessary steps for data generation and data preparation as well as the implementation and validation of the methods in an industrial environment.

The lecture"Artificial Intelligence in Production" deals with the theoretical basics in a practical context. Here, the six phases of the CRISP-DM process are run through sequentially and the necessary basics for the implementation of the respective phases are taught. The course first deals with the data sources that are prevalent in the production environment. Subsequently, possibilities for target-oriented data acquisition as well as data transfer and data storage are introduced. Possibilities for data filtering and data preprocessing are discussed and production-relevant aspects are pointed out. The course then covers in detail the necessary algorithms and procedures for implementing AI in production, before techniques and fundamentals for making the models permanent in production (deployment) are discussed.

Learning Outcomes:

The students

- understand the relevance for the application of AI in production and know the main drivers and challenges.
- will understand the CRISP-DM process for implementing AI projects in manufacturing. Students will be able to name the main data sources, data ingestion methods, communication architectures, models and methods for data processing.
- will understand the main machine learning techniques and be able to contrast and select them in the context of industrial issues.
- are able to assess whether a specific problem in the context of production can be solved in a target-oriented manner using machine learning methods, as well as what the necessary steps are for implementation.
- are able to assess the most important challenges and name possible approaches to solve them.
- are able to apply the phases of the CRISP-DM to a problem in production. Students will know the steps necessary to build a data pipeline and will be able to do so theoretically in the context of a real-world use case.
- are able to evaluate the results of common deep learning methods and, based on this, to theoretically elaborate and theoretically apply proposed solutions (from the field of machine learning).

Workload:

MACH:
regular attendance: 31,5 hours
self-study: 88,5 hours
WING:
regular attendance: 31,5 hours
self-study: 118,5 hours

Organizational issues

Vorlesungstermine freitags 14:00 Uhr, begleitet durch Online-Programmierübungen.

Zur Vertiefung des im Rahmen der Lehrveranstaltung erworbenen Wissens werden die theoretischen Vorlesungseinheiten durch Praxiseinheiten im Umfeld der Karlsruher Forschungsfabrik (https://www.karlsruher-forschungsfabrik.de) unterstützt.

The theoretical lectures are complemented by practical lectures in the Karlsruhe Research Factory (https://www.karlsruher-forschungsfabrik.de/en.html) to deepen the acquired knowledge.

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 11.20 Course: Atomistic Simulations and Particle Dynamics [T-MACH-113412]

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

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102597 - Compulsory Elective Module Mechanical Engineering
M-MACH-102604 - Major Field: Computational Mechanics
M-MACH-102611 - Major Field: Materials Science and Engineering
M-MACH-102637 - Major Field: Tribology
M-MACH-104434 - Major Field: Modeling and Simulation in Dynamics
M-MACH-105904 - Major Field: Advanced Materials Modelling and Data Management

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

Events					
ST 2024	2181740	Particle Dynamics and Atomistic Simulations	3 SWS	Lecture / Practice (/ 🗣	Weygand, Gumbsch
Exams					
ST 2024	76-T-MACH-105308	Atomistic Simulations and Particle Dynamics			Gumbsch, Weygand
ST 2024	76-T-MACH-105308-W	Atomistic Simulations and Particle 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 Particle Dynamics and Atomistic Simulations

Lecture / Practice (VÜ)
On-Site

2181740, SS 2024, 3 SWS, Language: English, Open in study portal

Content
Particle-based methods are numerical techniques used to simulate and analyse systems consisting of many discrete particles. They are particularly useful in fields where traditional continuum mechanical approaches are insufficient, such as granular materials, complex fluids, and defects in solids. In the lecture, the Discrete Element Method (DEM) for particles and Molecular Dynamics (MD) for the atomistic description of material behaviour will be covered. These methods span different length and time scales.

1. Introduction to Particle-Based Methods
   a) origin and application
   b) classification of particle-based methods
2. Fundamentals of Particle Dynamics
   a) Newtonian mechanics and conservation laws
   b) contact mechanics and friction laws
   c) kinematics and dynamics of particles
3. Discrete Element Method (DEM)
   a) principles and fundamentals
   b) numerical implementation: discretizing space and time
   c) particle detection and contact modelling
   d) application examples
4. Atomistic Methods: Molecular Dynamics (MD) and Statics (MS)
   a) fundamentals of atomistic models
   b) interaction: interatomic potentials
      i. pair potentials and their limits
      ii. many-body potentials
   c) integration methods (e.g., Verlet, Leap-Frog)
   d) periodic boundary conditions and neighbour lists
   e) applications in materials scienc
5. Structural Analysis:
   a) classification of neighbourhoods, distribution functions
   b) defect energy
   c) stresses, strains
6. Statistical Aspects of Atomistic Models
   a) phase space
   b) physical ensembles: microcanonical, canonical, grand canonical
   c) control of temperature, pressure, stresses: thermostats and barostats
   d) fluctuations and physical properties

The lecture covers both fundamental and advanced aspects of particle-based methods, with a particular focus on simple atomistic approaches. The accompanying computer exercises are designed to deepen and complement the lecture content through practical examples using the freely available particle simulation tool "LAMMPS" and to serve as a forum for detailed questions from students.

Objective: The student will be able to

- explain the physical principles of particle-based simulations,
- describe the application areas of particle-based simulation methods,
- apply particle-based simulation methods to address problems in materials science, materials engineering, and process engineering.

Recommended Prerequisites: mathematics, physics, and materials science

Lecture: 22.5 hours

Exercises: 12 hours

Self-study: 85.5 hours

Oral exam: approximately 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.
3. Computational Granular Dynamics. T. Pöschel, T. Schwager, Springer, 2005. Diskrete Element Methoden.
4. Lecture Slides and Exercises.

T 11.21 Course: Automated Manufacturing Systems [T-MACH-108844]

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

Part of:
M-MACH-102598 - Major Field: Advanced Mechatronics
M-MACH-102601 - Major Field: Automation Technology
M-MACH-102607 - Major Field: Vehicle Technology
M-MACH-102618 - Major Field: Production Technology
M-MACH-102628 - Major Field: Lightweight Construction
M-MACH-102633 - Major Field: Robotics
M-MACH-102640 - Major Field: Technical Logistics
M-MACH-102650 - Major Field: Combustion Engines Based Powertrains

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

Events					
ST 2024	2150904	Automated Manufacturing Systems	6 SWS	Lecture / Practice (/ 🗣	Fleischer
Exams					
ST 2024	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 — **Lecture / Practice (VÜ) On-Site**
2150904, SS 2024, 6 SWS, Language: German, Open in study portal

Content

The lecture gives an overview of the structure and functioning of automated production plants. In a basic chapter, fundamental elements for the realisation of automated production systems are taught. These include:

- Drive and control technology
- Handling technology for handling workpieces and tools
- Industrial robot technology
- Quality assurance in automated production plants
- Automated machines, cells, centres and systems for production and assembly
- Structures of multi-machine systems
- Project planning of automated production plants

An interdisciplinary view of these sub-areas results in interfaces to Industry 4.0 approaches. The basic chapters are supplemented by practical application examples and live demonstrations in the Karlsruhe Forschungsfabrik.

In the second part of the lecture, the fundamentals taught will be clarified using practically executed production processes for manufacturing and disassembling components, and the automated production facilities for manufacturing these components will be analyzed. In the field of automotive powertrain technology, the automated production process for both the manufacture and disassembly of batteries is considered. In the powertrain area, automated production facilities for the disassembly of electric motors are considered. Furthermore, automated production systems for the field of additive manufacturing are considered.

Within tutorials, the contents from the lecture are deepened and applied to concrete 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

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

Zur Vertiefung des im Rahmen der Lehrveranstaltung erworbenen Wissens werden die theoretischen Vorlesungseinheiten durch Praxiseinheiten im Umfeld der Karlsruher Forschungsfabrik (https://www.karlsruher-forschungsfabrik.de) unterstützt.

The theoretical lectures are complemented by practical lectures in the Karlsruhe Research Factory (https://www.karlsruher-forschungsfabrik.de/en.html) to deepen the acquired knowledge.

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 11.22 Course: Automated Visual Inspection and Image Processing [T-INFO-101363]

Responsible: Prof. Dr.-Ing. Jürgen Beyerer
Organisation: KIT Department of Informatics
Part of: M-MACH-102595 - Compulsory Elective Module Natural Science/Computer Science/Electrical Engineering

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

Events					
WT 24/25	24169	Automated Visual Inspection and Image Processing	4 SWS	Lecture / 🗣	Beyerer, Zander
Exams					
ST 2024	7500003	Automated Visual Inspection and Image Processing			Beyerer
WT 24/25	7500008	Automated Visual Inspection and Image Processing			Beyerer

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

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

V Automated Visual Inspection and Image Processing

24169, WS 24/25, 4 SWS, Language: German, Open in study portal

Lecture (V)
On-Site

Content
Topics covered:

- sensors and concepts for image acquisition
- light and colour
- image signals (system theory, Fourier transformation, stochastic processes)
- excursion to wave optics
- pre-processing and image enhancement
- image restoration
- segmentation
- morphological image processing
- texture analysis
- detection
- image pyramids, multi scale analysis and wavelet-transform

Educational objective:

- Students have a sound knowledge regarding the basic concepts and methods of image processing (pre-processing and image enhancement, image restoration, image segmentation, morphological filtering, texture analysis, detection, image pyramids, multi-scale analysis and the wavelet transform)
- Students are in the position to work out and to evaluate solution concepts for problems of automated visual inspection
- Students have a sound knowledge of the different sensors and methods for the acquisition of image data as well as of the relevant optical principles
- Students know different concepts to describe image data and they know the essential system theoretical concepts and interrelations

Organizational issues
Die Erfolgskontrolle wird in der Modulbeschreibung erläutert.

Empfehlungen:

Grundkenntnisse der Optik und der Signalverarbeitung sind hilfreich.

Literature
Weiterführende Literatur

- R. C. Gonzalez und R. E. Woods, Digital Image Processing, Prentice-Hall, Englewood Cliffs, New Jersey, 2002
- B. Jähne, Digitale Bildverarbeitung, Springer, Berlin, 2002

T 11.23 Course: Automotive Engineering I [T-MACH-100092]

Responsible: Prof. Dr. Frank Gauterin
Dr.-Ing. Martin Gießler

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102605 - Major Field: Engineering Design
M-MACH-102607 - Major Field: Vehicle Technology
M-MACH-102650 - Major Field: Combustion Engines Based Powertrains

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

Events					
WT 24/25	2113805	Automotive Engineering I	4 SWS	Lecture / 🗣	Gießler
WT 24/25	2113809	Automotive Engineering I	4 SWS	Lecture / 🗣	Gießler
Exams					
ST 2024	76-T-MACH-100092	Automotive Engineering			Gauterin, Gießler
WT 24/25	76-T-MACH-100092	Automotive Engineering			Gießler

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 24/25, 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 24/25, 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 11.24 Course: Automotive Engineering II [T-MACH-102117]

Responsible: Prof. Dr. Frank Gauterin
Dr.-Ing. Martin Gießler

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102597 - Compulsory Elective Module Mechanical Engineering
M-MACH-102607 - Major Field: Vehicle Technology
M-MACH-102650 - Major Field: Combustion Engines Based Powertrains

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

Events					
ST 2024	2114835	Automotive Engineering II	2 SWS	Lecture / 🗣	Gießler
ST 2024	2114855	Automotive Engineering II	2 SWS	Lecture / 🗣	Gießler
Exams					
ST 2024	76-T-MACH-102117	Automotive Engineering II			Gauterin, Gießler
ST 2024	76T-MACH-102117_mdl.	Automotive Engineering II			Gießler
WT 24/25	76-T-MACH-102117	Automotive Engineering II			Gießler
WT 24/25	76T-MACH-102117-2	Automotive Engineering II			Gießler

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
2114835, SS 2024, 2 SWS, Language: German, Open in study portal

Lecture (V)
On-Site

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
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 2024, 2 SWS, Language: English, Open in study portal

Lecture (V)
On-Site

Content

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

Learning Objectives:

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

Literature
Elective literature:

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

T 11.25 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-102597 - Compulsory Elective Module Mechanical Engineering
M-MACH-102598 - Major Field: Advanced Mechatronics
M-MACH-102607 - Major Field: Vehicle Technology
M-MACH-102609 - Major Field: Cognitive Technical Systems
M-MACH-102614 - Major Field: Mechatronics
M-MACH-102624 - Major Field: Information Technology
M-MACH-102625 - Major Field: Information Technology of Logistic Systems
M-MACH-102630 - Major Field: Mobile Machines
M-MACH-102633 - Major Field: Robotics
M-MACH-102641 - Major Field: Rail System Technology

Type	Credits	Grading scale	Recurrence	Version
Written examination	6	Grade to a third	Each summer term	3

Events					
ST 2024	2138340	Automotive Vision	3 SWS	Lecture / 🗣	Lauer, Fehler
Exams					
ST 2024	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 2024, 3 SWS, Language: English, Open in study portal

Lecture (V)
On-Site

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 11.26 Course: Basic Seminar Supplementary Studies on Science, Technology and Society - Self Registration [T-FORUM-113579]

Responsible: Dr. Christine Mielke
Christine Myglas

Organisation:

Part of: M-FORUM-106753 - Supplementary Studies on Science, Technology and Society

Type	Credits	Grading scale	Recurrence	Expansion	Version
Completed coursework	2	pass/fail	Each summer term	1 terms	1

Competence Certificate
Study achievement in the form of a presentation or a term paper or project work in the selected course.

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:

- Studium Generale. Forum Wissenschaft und Gesellschaft (FORUM) (ehem. ZAK)
- FORUM (ehem. ZAK) Begleitstudium

Recommendation
It is recommended that the basic seminar be completed during the same semester as the lecture series "Science in Society". If it is not possible to attend the lecture series and the basic seminar in the same semester, the basic seminar can also be attended in the semesters before the lecture series.
However, attending courses in the advanced unit before attending the basic seminar should be avoided.

Annotation

T 11.27 Course: Basics of Technical Logistics I [T-MACH-112841]

Responsible: Dr.-Ing. Martin Mittwollen
Dr.-Ing. Jan Oellerich

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102640 - Major Field: Technical Logistics

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

Events					
WT 24/25	2117095	Basics of Technical Logistics I	4 SWS	Lecture / Practice (/ 🗣	Mittwollen

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

Competence Certificate
The assessment consists of an oral exam (duration approx. 20 minutes).

Prerequisites
none

Modeled Conditions
The following conditions have to be fulfilled:

1. The course T-MACH-109919 - Basics of Technical Logistics I must not have been started.

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 24/25, 4 SWS, Language: German, Open in study portal

Lecture / Practice (VÜ)
On-Site

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 11.28 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-102405 - Fundamentals and Methods of General Mechanical Engineering
M-MACH-102575 - Fundamentals and Methods of Energy and Environmental Engineering
M-MACH-102597 - Compulsory Elective Module Mechanical Engineering
M-MACH-102618 - Major Field: Production Technology
M-MACH-102739 - Fundamentals and Methods of Automotive Engineering
M-MACH-102740 - Fundamentals and Methods of Mechatronics and Microsystem Technology
M-MACH-102741 - Fundamentals and Methods of Product Development and Construction
M-MACH-102742 - Fundamentals and Methods of Production Technology
M-MACH-102744 - Fundamentals and Methods of Materials and Structures for High Performance Systems

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

Events					
WT 24/25	2117095	Basics of Technical Logistics I	4 SWS	Lecture / Practice (/ 🗣	Mittwollen
Exams					
ST 2024	76-T-MACH-109919	Basics of Technical Logistics I			Mittwollen
ST 2024	76-T-MACH-109919-mPr	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

Modeled Conditions
The following conditions have to be fulfilled:

1. The course T-MACH-112841 - Basics of Technical Logistics I must not have been started.

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 24/25, 4 SWS, Language: German, Open in study portal

Lecture / Practice (VÜ)
On-Site

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

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

Part of:
M-MACH-102405 - Fundamentals and Methods of General Mechanical Engineering
M-MACH-102597 - Compulsory Elective Module Mechanical Engineering
M-MACH-102618 - Major Field: Production Technology
M-MACH-102640 - Major Field: Technical Logistics
M-MACH-102739 - Fundamentals and Methods of Automotive Engineering
M-MACH-102741 - Fundamentals and Methods of Product Development and Construction
M-MACH-102742 - Fundamentals and Methods of Production Technology

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

Events					
WT 24/25	2117098	Basics of Technical Logistics II	3 SWS	Lecture / Practice (/ 🗣	Mittwollen
Exams					
ST 2024	76-T-MACH-109920	Basics of Technical Logistics II			Oellerich, Mittwollen
ST 2024	76-T-MACH-109920-mPr	Basics of Technical Logistics II			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 11.30 Course: Beyond Conventional Materials - Metamaterials & Architected Structures [T-MACH-113698]

Responsible: Jun.-Prof. Dr. Jens Bauer
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102615 - Major Field: Medical Technology
M-MACH-102628 - Major Field: Lightweight Construction

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

Events					
WT 24/25	2186100	Beyond Conventional Materials - Metamaterials & Architected Structures	2 SWS	Lecture / Blended	Bauer

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

Competence Certificate
oral examination (approx. 30 min)

no tools or reference materials

Prerequisites
none

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

V Beyond Conventional Materials - Metamaterials & Architected Structures

2186100, WS 24/25, 2 SWS, Language: English, Open in study portal

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

Content
Conventional material design focuses on engineering the chemistry and microstructure of solids. Metamaterials go beyond these classical approaches. They are artificial materials that are built from spatially structured building blocks, like lattice-truss architectures. The integration of these rational architectures at the material level grants metamaterials unique unconventional properties which are inaccessible with classical material designs.

The course covers the fundamentals of the mechanics of different metamaterial architectures, discusses design principles and applicable fabrication techniques from the macro- to the nanoscale, as well as their interdependency, and considers emerging application scenarios in medicine, aerospace, microsystem technology, and mobility.

The students learn

- to design beam, shell and plate-based spatial architectures, such as for extreme strength & stiffness, programmable/adaptive behaviors and negative effective properties.
- to mathematically describe and predict the mechanical behavior of such architectural designs.
- the fundamentals of applicable fabrication techniques, including foaming, assembly and 3D-printing, and their design and material implications
- the relationship between architecture & size and how micro- and nanoscale architectures can leverage extreme physical size effects.

preliminary knowledge in mathematics, physics and materials science recommended

regular attendance: 22,5 hours

self-study: 97,5 hours

oral exam: ca. 30 minutes

no tools or reference materials

Literature

Gibson, L. J. & Ashby, M. F. Cellular Solids: Structure and properties. (Cambridge Univ. Pr., 2001).

Fleck, N. A., Deshpande, V. S. & Ashby, M. F. Micro-architectured materials: past, present and future. Proc. R. Soc. A Math. Phys. Eng. Sci. 466, 2495–2516 (2010).

Bauer, J. et al. Nanolattices: An Emerging Class of Mechanical Metamaterials. Adv. Mater. 29, 1701850 (2017).

Jiao, P., Mueller, J., Raney, J. R., Zheng, X. (Rayne) & Alavi, A. H. Mechanical metamaterials and beyond. Nat. Commun. 2023 141 14, 1–17 (2023).

T 11.31 Course: Bioelectric Signals [T-ETIT-101956]

Responsible: Dr.-Ing. Axel Loewe
Organisation: KIT Department of Electrical Engineering and Information Technology
Part of: M-MACH-102595 - Compulsory Elective Module Natural Science/Computer Science/Electrical Engineering
M-MACH-102615 - Major Field: Medical Technology

Type	Credits	Grading scale	Recurrence	Version
Written examination	3	Grade to a third	Each summer term	2

Events					
ST 2024	2305264	Bioelectric Signals	2 SWS	Lecture / 🗣	Loewe
Exams					
ST 2024	7305264	Bioelectric Signals			Loewe

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

Competence Certificate
The examination is a written examination with a duration of 90 minutes.

Prerequisites
none

T 11.32 Course: Biologically Inspired Robots [T-INFO-101351]

Responsible: Prof. Dr.-Ing. Arne Rönnau
Organisation: KIT Department of Informatics
Part of: M-MACH-102633 - Major Field: Robotics

Type	Credits	Grading scale	Recurrence	Version
Oral examination	3	Grade to a third	Each summer term	1

Events					
ST 2024	24619	Biologisch Motivierte Roboter	2 SWS	Lecture /	Rönnau
Exams					
ST 2024	7500237	Biologically Inspired Robot			Rönnau

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

T 11.33 Course: Biologically Inspired Robots [T-MACH-113838]

Responsible: Prof. Dr.-Ing. Arne Rönnau
Organisation: KIT Department of Mechanical Engineering
Part of: M-MACH-102633 - Major Field: Robotics

Type	Credits	Grading scale	Expansion	Version
Oral examination	3	Grade to a third	1 terms	2

Modeled Conditions
The following conditions have to be fulfilled:

1. The course T-INFO-101351 - Biologically Inspired Robots must not have been started.

T 11.34 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-102611 - Major Field: Materials Science and Engineering

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

Events					
ST 2024	2181708	Biomechanics: Design in Nature and Inspired by Nature	3 SWS	/ 🗣	Mattheck
Exams					
ST 2024	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.

Annotation
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 2024, 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

Organizational issues
Die Veranstaltung findet als Blockvorlesung von 09.07. bis 12.07.2024 statt.

T 11.35 Course: Biomedical Engineering for Engineers - Fundamentals of Project Management in Medical Engineering [T-MACH-112817]

Responsible: Dr. Ralf Ahrens
Prof. Dr. Andreas Guber
Dr. Taleieh Rajabi

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102597 - Compulsory Elective Module Mechanical Engineering

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

Events					
WT 24/25	2141104	Biomedical Engineering for Engineers - Fundamentals of Project Management in Medical Engineering	2 SWS	Lecture / 🖥	Rajabi, Guber, Ahrens
Exams					
ST 2024	76-T-MACH-112817	BioMEMS - Microfludic Chipsystems V			Guber, Ahrens

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

Competence Certificate
oral exam (approx. 20 Min)

Prerequisites
none

T 11.36 Course: BioMEMS - Microsystems Technologies for Life-Sciences and Medicine I [T-MACH-100966]

Responsible: Prof. Dr. Andreas Guber
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102597 - Compulsory Elective Module Mechanical Engineering
M-MACH-102598 - Major Field: Advanced Mechatronics
M-MACH-102615 - Major Field: Medical Technology
M-MACH-102616 - Major Field: Microsystem Technology
M-MACH-102647 - Major Field: Microactuators and Microsensors

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

Events					
WT 24/25	2141864	BioMEMS - Microsystems Technologies for Life-Sciences and Medicine I	2 SWS	Lecture / 🗣	Guber, Ahrens
Exams					
ST 2024	76-T-MACH-100966	BioMEMS - Microsystems Technologies for Life-Sciences and Medicine I			Guber

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

Competence Certificate
written exam (75 Min.)

Prerequisites
none

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

V BioMEMS - Microsystems Technologies for Life-Sciences and Medicine I

2141864, WS 24/25, 2 SWS, Language: German, Open in study portal

Lecture (V)
On-Site

Organizational issues
schriftliche Prüfung:

18.03.2024, 10:00 - 12:00; 30.46 Chemie, Neuer Hörsaal

Literature
Menz, W., Mohr, J., O. Paul: Mikrosystemtechnik für Ingenieure, VCH-Verlag, Weinheim, 2005

M. Madou
Fundamentals of Microfabrication
Taylor & Francis Ltd.; Auflage: 3. Auflage. 2011

11.37 Course: BioMEMS - Microsystems Technologies for Life-Sciences and Medicine II [T-MACH-100967]

Responsible: Prof. Dr. Andreas Guber
Organisation: KIT Department of Mechanical Engineering

Part of:
M-MACH-102597 - Compulsory Elective Module Mechanical Engineering
M-MACH-102598 - Major Field: Advanced Mechatronics
M-MACH-102615 - Major Field: Medical Technology
M-MACH-102616 - Major Field: Microsystem Technology

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

Events					
ST 2024	2142883	BioMEMS - Microsystems Technologies for Life-Sciences and Medicine II	2 SWS	Lecture / 🗣	Guber, Ahrens
Exams					
ST 2024	76-T-MACH-100967	BioMEMS - Microsystems Technologies for Life-Sciences and Medicine II			Guber

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

Competence Certificate
Written exam (75 Min.)

Prerequisites
none

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

BioMEMS - Microsystems Technologies for Life-Sciences and Medicine II

Lecture (V)
On-Site

2142883, SS 2024, 2 SWS, Language: German, Open in study portal

Content
Examples of use in Life-Sciences and biomedicine: Microfluidic Systems:
LabCD, Protein Cristallisation
Microarrys
Tissue Engineering
Cell Chip Systems
Drug Delivery Systems
Micro reaction technology
Microfluidic Cells for FTIR-Spectroscopy
Microsystem Technology for Anesthesia, Intensive Care and Infusion
Analysis Systems of Person´s Breath
Neurobionics and Neuroprosthesis
Nano Surgery

Organizational issues
Zu jedem Vorlesungstermin werden via ILIAS die jeweiligen Folien im PDF-Format zur Verfügung gestellt.

schriftl. Prüfung: Mo, 09.09.2024, 8 - 10 Uhr; 10.21 Carl-Benz-Hörsaal

Literature
Menz, W., Mohr, J., O. Paul: Mikrosystemtechnik für Ingenieure, VCH-Verlag, Weinheim, 2005

Buess, G.: Operationslehre in der endoskopischen Chirurgie, Band I und II;
Springer-Verlag, 1994

M. Madou
Fundamentals of Microfabrication

T 11.38 Course: BioMEMS - Microsystems Technologies for Life-Sciences and Medicine III [T-MACH-100968]

Responsible: Prof. Dr. Andreas Guber
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102597 - Compulsory Elective Module Mechanical Engineering
M-MACH-102598 - Major Field: Advanced Mechatronics
M-MACH-102615 - Major Field: Medical Technology
M-MACH-102616 - Major Field: Microsystem Technology

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

Events					
ST 2024	2142879	BioMEMS - Microsystems Technologies for Life-Sciences and Medicine III	2 SWS	Lecture / 🗣	Guber, Ahrens
Exams					
ST 2024	76-T-MACH-100968	BioMEMS - Microsystems Technologies for Life-Sciences and Medicine III			Guber

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

Competence Certificate
Written exam (75 Min.)

Prerequisites
none

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

V BioMEMS - Microsystems Technologies for Life-Sciences and Medicine III

Lecture (V)
On-Site

2142879, SS 2024, 2 SWS, Language: German, Open in study portal

Content
Examples of use in minimally invasive therapy
Minimally invasive surgery (MIS)
Endoscopic neurosurgery
Interventional cardiology
NOTES
OP-robots and Endosystems
License of Medical Products and Quality Management

Organizational issues
Zu jedem Vorlesungstermin werden via ILIAS die jeweiligen Folien im PDF-Format zur Verfügung gestellt.

schriftl. Prüfung: Mo, 23.09.2024, 10:30 - 12:30 Uhr; 30.21 Christian-Gerthsen-Hörsaal

Literature
Menz, W., Mohr, J., O. Paul: Mikrosystemtechnik für Ingenieure, VCH-Verlag, Weinheim, 2005

Buess, G.: Operationslehre in der endoskopischen Chirurgie, Band I und II;
Springer-Verlag, 1994

M. Madou
Fundamentals of Microfabrication

T 11.39 Course: BioMEMS - Microsystems Technologies for Life-Sciences and Medicine IV [T-MACH-106877]

Responsible: Dr. Ralf Ahrens
Prof. Dr. Andreas Guber

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102597 - Compulsory Elective Module Mechanical Engineering

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

Events					
ST 2024	2142893	BioMEMS IV - Microsystems technology for Life Sciences and Medicine	2 SWS	/ ✕	Guber, Ahrens, Länge, Doll
WT 24/25	2141102	BioMEMS IV - Microsystems technology for Life Sciences and Medicine	2 SWS	Lecture / 🗣	Guber, Ahrens, Länge

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

Competence Certificate
Oral examination (45 Min.)

Prerequisites
none

T 11.40 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-102597 - Compulsory Elective Module Mechanical Engineering

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

Events					
ST 2024	2134153	Boosting of Combustion Engines	2 SWS	/ 🗣	Kech
Exams					
ST 2024	76-T-MACH-105649	Boosting of Combustion Engines			Koch

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

Competence Certificate
oral exam, 20 min

Prerequisites
none

T 11.41 Course: Boosting the Modern Energy Landscape via Turbo Machines & Machine Learning [T-MACH-113359]

Responsible: Prof. Dr.-Ing. Hans-Jörg Bauer

Organisation: KIT Department of Mechanical Engineering
Institute of Thermal Turbomachinery

Part of: M-MACH-102597 - Compulsory Elective Module Mechanical Engineering
M-MACH-102610 - Major Field: Power Plant Technology
M-MACH-102636 - Major Field: Thermal Turbomachines

Type	Credits	Grading scale	Recurrence	Version
Completed coursework (oral)	4	Grade to a third	Each winter term	1

Events					
WT 24/25	2169558	Boosting the Modern Energy Landscape via Turbo Machines & Machine Learning	2 SWS	Lecture / 🗣	Bauer
Exams					
WT 24/25	76-T-MACH-113359	Boosting the Modern Energy Landscape via Turbo Machines & Machine Learning			Bauer

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

Competence Certificate
Oral exam, approximately 30 minutes

Prerequisites
Students successfully passed courses on fluid dynamics and thermodynamics.

Recommendation
- Profound knowledge on thermodynamics and fluid mechanics is mandatory.
- Machine and processes lecture (LVNr. 3134140) is highly recommended before taking this course.
- The course requires basic knowledge in engineering mathematics and computer programming at an undergraduate level. Basic knowledge in python is strongly recommended.
- We expect students to be interested in applying theoretical knowledge and translate it into real world experiments.

Annotation
Lectures: 90 min; Lab sessions: 90 minutes (6 weeks)

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

V Boosting the Modern Energy Landscape via Turbo Machines & Machine Learning

Lecture (V)
On-Site

2169558, WS 24/25, 2 SWS, Language: English, Open in study portal

Content

This lecture provides a comprehensive exploration of how small radial flow turbo machines contribute to the modern energy landscape. A typical application of such machines are pressurized fuel cells used as drive train for cars and trucks. From understanding the thermodynamics and flow characteristics of centrifugal compressors and centripetal turbines to practical experiments and the integration of machine learning techniques, students will gain a holistic understanding of the potential of turbo machines for energy conversion efficiency, emissions reduction, and performance optimization. The lecture further provides a hands on sample application of machine learning, with a specific focus on its pivotal role in developing digital twins that utilize sensory data.

During an integrated lab course, learned theoretical A.I. frameworks are applied to a turbo machine test rig for the accurate prediction of the operation and proactive prevention of surge and stall. By engaging in these experimental lab, students explore how sensory data can be leveraged to monitor and optimize the performance of centrifugal compressors. By combining theory and practical lab experience, this course equips students with the knowledge and skills necessary to leverage turbomachinery technology in shaping a sustainable and efficient future energy ecosystem.

The lecture features a distinctive structure consisting of three interconnected layers:

1. Fundamental Learning: This initial phase takes place in a traditional classroom setting where students establish a solid understanding of the subject matter.
2. Hands-On Practical Application: Students then transition to two dedicated laboratory sessions where they apply the acquired knowledge using real-life equipment, gaining valuable hands-on experience.
3. Data Analysis and Interpretation: Following the practical sessions, the lecture moves into two virtual laboratory sessions focused on data-driven techniques. Here, students analyze and interpret the data collected during the hands-on sessions, applying their newfound skills.

This unique approach endows the lecture with a marathon-like nature, requiring students to progress through these phases in sync with their peers. Collaboration is key, as lab sessions are conducted in groups, and students will consolidate and utilize data from all groups. Effective in-group and between-group communication becomes essential for the overall success of the learning experience.

The lecture duration is 21 hours, divided into theory and practical sessions.

pon completing this lecture, students will:

- Gain a comprehensive understanding of radial flow turbo machinery technology and its significance in the modern energy landscape.
- Learn the characteristics of centrifugal compressors and centripetal turbines and how they contribute to energy conversion efficiency, emissions reduction, and performance optimization.
- Engage in practical experiments to explore compressor characteristics, radial flow compressors and turbines, and surge and stall phenomena in radial compressors.
- Be introduced to machine learning principles and applications in turbomachinery technology.
- Gain hands-on experience in building digital twins from sensory data to monitor and optimize centrifugal compressor performance.
- Understand the importance of data-driven predictive maintenance and outlier detection in radial flow turbo machines.
- Learn how to use machine learning techniques to predict and prevent surge and stall issues in centrifugal compressor applications.
- Develop the knowledge and skills necessary to leverage turbomachinery technology in shaping a sustainable and efficient future energy ecosystem.

Organizational issues

Vorlesung ersetzt Vorlesung-Nr. 2169462 (Turbinen und Verdichterkonstruktionen) ab WS 2023/24

Number of participants are limited due to physical constraints of the integrated lab sessions. To enroll in the lecture, kindly complete the form below. Registration is open from **16.10.2023 (00:00:00)** to **23.10.2023 (23:59:00) (Note: The registration period will be extended until 25.10.2023 (23:59:00))**. Following the closure of the registration period, applicants will receive notifications regarding their selection, considering the limited number of available spots.

- Only master level students can be admitted to the course.
- Profound knowledge on thermodynamics and fluid mechanics is mandatory.
- Basic knowledge in python is strongly recommended.
- Machine and processes lecture is highly recommended before taking this course.
- We expect students to be interested in applying theoretical knowledge and translate it into real world experiments.
- Lecture is offered in English.

The lecture is part of the "Research Infrastructures in Research-Oriented Teaching (RIRO)" initative at KIT.

Literature

- Münzberg, H.G.: Gasturbinen - Betriebsverhalten und Optimierung, Springer Verlag, 1977.

- Traupel, W.: Thermische Turbomaschinen, Bd. I-II, Springer Verlag, 1977, 1982.

- Saravanamuttoo, H.I.H. et al: Gas Turbine Theory, 7th edition, Pearson, 2018.

- Brunton, S., Kutz, J. : Data-Driven Science and Engineering: Machine Learning, Dynamical Systems, and Control. Cambridge: Cambridge University Press. doi:10.1017/9781108380690

- gitlab.kit.edu/cihan.ates/data-driven-engineering

T 11.42 Course: BUS-Controls - Advance [T-MACH-108889]

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

Part of: M-MACH-102597 - Compulsory Elective Module Mechanical Engineering
M-MACH-102614 - Major Field: Mechatronics
M-MACH-102624 - Major Field: Information Technology

Type	Credits	Grading scale	Recurrence	Version
Completed coursework	0	pass/fail	Each summer term	1

Competence Certificate
Creation of control program

Prerequisites
none

T 11.43 Course: Business Administration for Engineers and IT Professionals [T-MACH-109933]

Responsible: Heinz-Peter Sebregondi
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102597 - Compulsory Elective Module Mechanical Engineering
M-MACH-102613 - Major Field: Lifecycle Engineering

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

Events					
ST 2024	2122303	Business Administration for Engineers and IT professionals	2 SWS	Seminar / 🗣	Sebregondi
WT 24/25	2122303	Business Administration for Engineers and IT professionals	2 SWS	Seminar / 🗣	Sebregondi
Exams					
ST 2024	76-T-MACH-109933	Business Administration for Engineers and IT professionals			Sebregondi

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

Competence Certificate
Assessment of another type. Two presentations and six written compositions in team work. Grading: each composition 1/8 and each presentation 1/8.

Prerequisites
None

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

V Business Administration for Engineers and IT professionals
2122303, SS 2024, 2 SWS, Language: German/English, Open in study portal

Seminar (S)
On-Site

Content
Learning content

- Competitive strategies, customer value, corporate cultures, lifecycles (technology, business, product), market leadership dynamics.
- Continuum commoditization/differentiation.
- Value chain, core and support functions.
- A company’s business portfolio.
- Profit margin sensitivity.
- Profitable and non-profitable products, customers and businesses.
- Drivers of a company’s value (McKinsey model), return on invested capital (ROIC), ROIC value driver tree.
- Strategic planning
- Capital investments, discounted cash flow analysis, quantifying of and dealing with risks, cost-estimating methodologies per planning stage.
- Sales, procurement/purchasing, negotiation strategies

Learning objectives

- better understand a company’s business, financials and their executives/decision makers
- use the language and metrics of senior executives and hold effective conversations with them
- more effectively sell a solution’s or project’s operational and financial value to executives and decision makers

Organizational issues
Teilnehmerzahl ist begrenzt. / Number of participants is limited.

Literature
Understanding a company's business and financials made easy; Heinz-Peter Sebregondi (Amazon 2017)

Erfolgsfaktoren für die nachhaltige Business-Karriere: Die menschliche und die Business-Perspektive; Heinz-Peter Sebregondi (Amazon 2018)

V **Business Administration for Engineers and IT professionals** **Seminar (S) On-Site**

2122303, WS 24/25, 2 SWS, Language: German/English, Open in study portal

Content

Learning content

- Competitive strategies, customer value, corporate cultures, lifecycles (technology, business, product), market leadership dynamics.
- Continuum commoditization/differentiation.
- Value chain, core and support functions.
- A company's business portfolio.
- Profit margin sensitivity.
- Profitable and non-profitable products, customers and businesses.
- Drivers of a company's value (McKinsey model), return on invested capital (ROIC), ROIC value driver tree.
- Strategic planning
- Capital investments, discounted cash flow analysis, quantifying of and dealing with risks, cost-estimating methodologies per planning stage.
- Sales, procurement/purchasing, negotiation strategies

Learning objectives

- better understand a company's business, financials and their executives/decision makers
- use the language and metrics of senior executives and hold effective conversations with them
- more effectively sell a solution's or project's operational and financial value to executives and decision makers

Organizational issues

Teilnehmerzahl ist begrenzt. Zeit und Ort siehe ILIAS / Number of participants is limited. Time and place see ILIAS.

Literature

Understanding a company's business and financials made easy; Heinz-Peter Sebregondi (Amazon 2017)

Erfolgsfaktoren für die nachhaltige Business-Karriere: Die menschliche und die Business-Perspektive; Heinz-Peter Sebregondi (Amazon 2018)

T 11.44 Course: Business Planning [T-WIWI-102865]

Responsible: Prof. Dr. Orestis Terzidis
Organisation: KIT Department of Economics and Management
Part of: M-MACH-104323 - Major Field: Innovation and Entrepreneurship

Type	Credits	Grading scale	Recurrence	Version
Examination of another type	3	Grade to a third	Irregular	1

Events					
ST 2024	2545109	Business Planning for Founders	2 SWS	Seminar / 🗣	Terzidis, Tittel, Rosales Bravo
WT 24/25	2500109	Business Planning for Founders - Startup CFO	2 SWS	Seminar / 🗣	Terzidis, Tittel, Rosales Bravo
Exams					
ST 2024	7900234	Business Planning for Founders			Terzidis

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

Competence Certificate
Alternative exam assessment.

Prerequisites
None

Recommendation
None

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

V Business Planning for Founders

2545109, SS 2024, 2 SWS, Language: English, Open in study portal

Seminar (S)
On-Site

Content
Content

Embark on a transformative journey into the dynamic realm of startup finance with our comprehensive course designed for Master's students interested in the task of aspiring to become future Chief Financial Officers (CFOs) or Chief Executive Officers (CEOs) in the startup. Particularly, students who previously attended classes on entrepreneurship or developed their business ideas in Design Thinking Seminars will work on the financial viability and, therefore, the potential for realizing their business ideas. The three-day seminar develops the financial literacy needed to start and operate an entrepreneurial venture, including analyzing and determining the cost and revenue structure of the firm and creating a financial strategy to execute the business plan successfully. Additionally, students will learn about the sources and conditions of different investment types and develop tailored fundraising strategies. The seminar is not restricted to the financial aspects but follows the Triple Bottom Line philosophy (3BL).

Throughout the course, real-world case studies and guest lectures, professional experts will provide valuable insights into the practical application of financial concepts.By the end of this course, you will be well-equipped to take on leadership roles in startups and startup ecosystems, armed with the managerial understanding required to drive success in dynamic and competitive markets.

Learning Objectives

Upon completion of this seminar, course participants will be able to

1. Analyze, forecast, and plan the cost structure and revenue streams of the venture project.
2. Reflect on the sustainability of a business based on the Triple Bottom Line theory.
3. Develop the essential financial statements for a startup.
4. Recall and reflect on investment strategies for startups.
5. Discover business stakeholders and prepare a tailored communication strategy.
6. Reflect on the role of information technology.
7. Apply negotiation techniques essential for securing favorable terms and agreements.
8. Have a brief overview of the related topic.

Credentials:

ONLY ONE of the two options - Business Planning for founders OR Business Planning for founders in the field of IT-Security - can be taken and credited under the in CAS mentioned partial credit, as they cover similar content. Registration must take place in the CAS for the respective examination.

Organizational issues
Wednesday, 05.06.2024
Wednesday, 19.06.2024
Wednesday, 17.07.2024

Registration is via the Wiwi-Portal.

In the seminar you will work on a project in teams of max. 5 persons. Team applications are welcome but not a prerequisite for participation. The seminars will be held in English.

V **Business Planning for Founders - Startup CFO** — **Seminar (S) On-Site**
2500109, WS 24/25, 2 SWS, Language: English, Open in study portal

Content
Content

Embark on a transformative journey into the dynamic realm of startup finance with our comprehensive course designed for Master's students interested in the task of aspiring to become future Chief Financial Officers (CFOs) or Chief Executive Officers (CEOs) in the startup. Particularly, students who previously attended classes on entrepreneurship or developed their business ideas in Design Thinking Seminars will work on the financial viability and, therefore, the potential for realizing their business ideas. The three-day seminar develops the financial literacy needed to start and operate an entrepreneurial venture, including analyzing and determining the cost and revenue structure of the firm and creating a financial strategy to execute the business plan successfully. Additionally, students will learn about the sources and conditions of different investment types and develop tailored fundraising strategies. The seminar is not restricted to the financial aspects but follows the Triple Bottom Line philosophy (3BL).

Throughout the course, real-world case studies and guest lectures, professional experts will provide valuable insights into the practical application of financial concepts.By the end of this course, you will be well-equipped to take on leadership roles in startups and startup ecosystems, armed with the managerial understanding required to drive success in dynamic and competitive markets.

Learning Objectives

Upon completion of this seminar, course participants will be able to

1. Analyze, forecast, and plan the cost structure and revenue streams of the venture project.
2. Reflect on the sustainability of a business based on the Triple Bottom Line theory.
3. Develop the essential financial statements for a startup.
4. Recall and reflect on investment strategies for startups.
5. Discover business stakeholders and prepare a tailored communication strategy.
6. Reflect on the role of information technology.
7. Apply negotiation techniques essential for securing favorable terms and agreements.
8. Have a brief overview of the related topic.

Credentials:

ONLY ONE of the two options - Business Planning for founders OR Business Planning for founders in the field of IT-Security - can be taken and credited under the in CAS mentioned partial credit, as they cover similar content. Registration must take place in the CAS for the respective examination.

Organizational issues
Registration is via the Wiwi-Portal.

In the seminar you will work on a project in teams of max. 5 persons. Team applications are welcome but not a prerequisite for participation. The seminars will be held in English.

T 11.45 Course: CAD-NX Training Course [T-MACH-102187]

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

Part of: M-MACH-102613 - Major Field: Lifecycle Engineering

Type	Credits	Grading scale	Recurrence	Version
Completed coursework (practical)	2	pass/fail	Each term	2

Events					
ST 2024	2123357	CAD-NX training course	2 SWS	Practical course / Blended	Rönnau, Mitarbeiter
WT 24/25	2123357	CAD-NX training course	2 SWS	Practical course / Blended	Rönnau, Mitarbeiter
Exams					
ST 2024	76-T-MACH-102187	CAD-NX Training Course			Rönnau

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 2024, 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
Informationen zum Ablauf des Praktikums werden in einer Auftaktveranstaltung veröffentlicht. Hinweise hierzu siehe ILIAS.

Literature
Praktikumsskript

V CAD-NX training course

2123357, WS 24/25, 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 11.46 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-102405 - Fundamentals and Methods of General Mechanical Engineering
M-MACH-102575 - Fundamentals and Methods of Energy and Environmental Engineering
M-MACH-102597 - Compulsory Elective Module Mechanical Engineering
M-MACH-102598 - Major Field: Advanced Mechatronics
M-MACH-102601 - Major Field: Automation Technology
M-MACH-102605 - Major Field: Engineering Design
M-MACH-102613 - Major Field: Lifecycle Engineering
M-MACH-102614 - Major Field: Mechatronics
M-MACH-102628 - Major Field: Lightweight Construction
M-MACH-102642 - Major Field: Development of Innovative Appliances and Power Tools
M-MACH-102739 - Fundamentals and Methods of Automotive Engineering
M-MACH-102740 - Fundamentals and Methods of Mechatronics and Microsystem Technology
M-MACH-102741 - Fundamentals and Methods of Product Development and Construction
M-MACH-102742 - Fundamentals and Methods of Production Technology
M-MACH-102744 - Fundamentals and Methods of Materials and Structures for High Performance Systems

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

Events					
ST 2024	2147175	CAE-Workshop	3 SWS	Block / 🗣	Düser
WT 24/25	2147175	CAE-Workshop	3 SWS	Block / 🗣	Düser
Exams					
ST 2024	76-T-MACH-105212	CAE-Workshop			Albers, Düser

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
Consistent attendance on the workshop days is required for successful participation in the exam. The number of participants is limited. Selection will be made by drawing lots after the end of the registration period.

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

V **CAE-Workshop**
2147175, SS 2024, 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

Annotation: Number of participants limited. The selection will be made by drawing after the end of the registration period.

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** **Block (B)**
2147175, WS 24/25, 3 SWS, Language: German, Open in study portal **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 and structure optimization with industrial common software.
- evaluate and to question the results of a simulation.
- identify and improve the mistakes of a simulation or optimization.

Regular attendance: 31.5 h

Self-study: 88.5 h

Exam: 1h written

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 11.47 Course: CATIA Advanced [T-MACH-105312]

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

Part of: M-MACH-102613 - Major Field: Lifecycle Engineering

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

Events					
ST 2024	2123380	CATIA advanced	3 SWS	Project (P /	Rönnau, Mitarbeiter
WT 24/25	2123380	Advanced CATIA	3 SWS	Project (P /	Rönnau, Mitarbeiter
Exams					
ST 2024	76-T-MACH-105312	CATIA Advanced			Rönnau

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

Competence Certificate
Assessment of another type. Design project and written documentation in team work and final presentation. Grading: Project work 3/5, documentation 1/5 and presentation 1/5.

Prerequisites
none

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

V CATIA advanced
2123380, SS 2024, 3 SWS, Language: German/English, Open in study portal

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

Content
In this design project, students develop a product in small groups according to an agile approach using the 3DEXPERIENCE platform (CATIA V6) from Dassault Systèmes. The extended functionalities of the platform are addressed and model-based work is carried out.

The development process is traced from the idea to the finished model. The main focus is on independent solution finding, teamwork, function fulfillment, production and design. The project results are presented at the end of the semester.

Organizational issues
Siehe ILIAS-Kurs.

Literature
Keine / None

V Advanced CATIA
2123380, WS 24/25, 3 SWS, Language: German/English, Open in study portal

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

Content
In this design project, students develop a product in small groups according to an agile approach using the 3DEXPERIENCE platform (CATIA V6) from Dassault Systèmes. The extended functionalities of the platform are addressed and model-based work is carried out.

The development process is traced from the idea to the finished model. The main focus is on independent solution finding, teamwork, function fulfillment, production and design. The project results are presented at the end of the semester.

Organizational issues
Siehe ILIAS zur Lehrveranstaltung

Literature
Keine / None

T 11.48 Course: Cell Biology [T-CIWVT-111062]

Responsible: apl. Prof. Dr. Hans-Eric Gottwald
Organisation: KIT Department of Chemical and Process Engineering
Part of: M-MACH-102595 - Compulsory Elective Module Natural Science/Computer Science/Electrical Engineering

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

Events					
WT 24/25	2212113	Biology for Engineers - Cell Biology	2 SWS	Lecture / 🗣	Gottwald
Exams					
ST 2024	7212113-V-ZELL	Cell Biology			Gottwald
WT 24/25	7212113-V-ZELL	BING Cell Biology			Gottwald

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

Competence Certificate
Written examination with a duration of 90 minutes (section 4, subsection 2 Nr. 1 SPO).

Prerequisites
None

11.49 Course: Ceramic Processing Technology [T-MACH-102182]

Responsible: Dr. Joachim Binder
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102597 - Compulsory Elective Module Mechanical Engineering
M-MACH-102619 - Major Field: Technical Ceramics and Powder Materials

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

Competence Certificate
The assessment consists of an oral exam (approx. 20 min) taking place at the agreed date.

Auxiliary means: none

The re-examination is offered upon agreement.

Prerequisites
none

T 11.50 Course: CFD for Power Engineering [T-MACH-105407]

Responsible: Dr. Ivan Otic
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102597 - Compulsory Elective Module Mechanical Engineering
M-MACH-102608 - Major Field: Nuclear Energy
M-MACH-102612 - Major Field: Modeling and Simulation in Energy- and Fluid Engineering
M-MACH-102643 - Major Field: Fusion Technology

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

Events					
ST 2024	2130910	CFD for Power Engineering	2 SWS	Lecture /	Otic
Exams					
ST 2024	76-T-MACH-105407	CFD in Power Engineering			Otic

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 CFD for Power Engineering
2130910, SS 2024, 2 SWS, Language: English, Open in study portal

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

Content
Contents:

The course is aimed of giving the fundamental of Computational Fluid Dynamics (CFD) for energy technologies. Starting from the basic physical phenomena equations an overview on computational methods and turbulence modeling is given.
The course consists of both, a theoretical and a numerical component. The former will deal with the derivations and properties of the methods and models for CFD. The numerical part will make use of open source CFD computer program OpenFOAM to give a "hands on" insight into the simulation of turbulent flows. After completing the course you should be able to establish a connection between theory and CFD modeling and simulation for energy applications.

Tentative Course Outline:
The weekly coverage might change as it depends on the progress of the class.
Content
1 Introduction: What is Computational Fluid Dynamics?
2 Governing Equations
3 Numerical Methods: Introduction
4 Numerical Methods: Finite Volume
5 Numerical Methods: Solution of ordinary differential equations
6 Numerical Methods: Convergence and numerical stability
7 Turbulence and Turbulence Modelling
8 Reynolds Averaged Navier-Stokes Simulation Approach
9 Heat Transfer

CFD Project:

- Part of this class is performing CFD simulations of turbulent heat and mass transfer using open-source CFD software OpenFOAM
- After CFD analysis is completed students have to write a technical report
- Projects are to be performed individually or in teams of two but every student writes his own report
- The CFD analysis technical report is part of the final examination.

Objectives:

After completing the course students:

- are able to understand fundamentals of non-linear partial differential equations
- will get working knowledge of computational techniques that can be used for solving engineering heat and mass transfer problems
- are able to understand fundamentals of statistical fluid mechanics and to derive RANS transport equations
- have learned how to computationally solve turbulent heat and mass transfer problems using OpenFOAM software
- are able to present their results in form of technical report.

Literature
Vorlesungsskript

Projektskript und Unterlagen

An Introduction to Computational Fluid Dynamics: The Finite Volume Method, H. Versteeg and W. Malalasekra, 2007.

Ferziger, J; Peric, M.: Computational Methods for Fluid Dynamics, Springer 2002.

T 11.51 Course: CFD-Lab Using OpenFOAM [T-MACH-105313]

Responsible: Dr.-Ing. Rainer Koch

Organisation: KIT Department of Mechanical Engineering
Institute of Thermal Turbomachinery

Part of: M-MACH-102610 - Major Field: Power Plant Technology
M-MACH-102612 - Major Field: Modeling and Simulation in Energy- and Fluid Engineering
M-MACH-102623 - Major Field: Fundamentals of Energy Technology
M-MACH-102636 - Major Field: Thermal Turbomachines

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

Events					
WT 24/25	2169459	CFD-Lab using OpenFOAM	3 SWS	Practical course / 🗣	Koch
Exams					
WT 24/25	76-T-MACH-105313	CFD-Lab Using Open Foam			Koch

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

Competence Certificate
Successful solution of problems

Prerequisites
none

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

V CFD-Lab using OpenFOAM
2169459, WS 24/25, 3 SWS, Language: German, Open in study portal

Practical course (P)
On-Site

Content

- Successful solution of problems
- Course material is distributed on ILIAS

- Introduction to using Open Foam
- Grid generation
- Boundary conditions
- Numerical errors
- Discretization schemes
- Turbulence models
- Two phase flow - Euler-Lagrange
- Large Eddy Simulation
- Combustion

The students are able to:

- use OpenFOAM
- generate simple grids or import grids into OpenFOAM
- choose and define appropriate boundary conditions
- estimate numerical errors and asses them
- judge turbulence models and select an appropriate model
- simulate 2-phase flows using suitable models

Organizational issues

Literature

- Dokumentation zu OpenFOAM
- https://openfoam.org/

T 11.52 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-102607 - Major Field: Vehicle Technology
M-MACH-102623 - Major Field: Fundamentals of Energy Technology
M-MACH-102627 - Major Field: Energy Converting Engines
M-MACH-102635 - Major Field: Engineering Thermodynamics
M-MACH-102650 - Major Field: Combustion Engines Based Powertrains

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

Events					
WT 24/25	2133113	CO2-neutral combustion engines and their fuels I	4 SWS	Lecture / Practice (/ 🗣	Koch
Exams					
ST 2024	76-T-MACH-102194	CO2-neutral combustion engines and their fuels I			Koch, Kubach

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 24/25, 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 11.53 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-102607 - Major Field: Vehicle Technology
M-MACH-102627 - Major Field: Energy Converting Engines
M-MACH-102635 - Major Field: Engineering Thermodynamics
M-MACH-102650 - Major Field: Combustion Engines Based Powertrains

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

Events					
ST 2024	2134151	CO2-neutral combustion engines and their fuels II	3 SWS	Lecture / Practice (/ 🗣	Koch
Exams					
ST 2024	76-T-MACH-104609	Combustion Engines, Hydrogen Engines and CO2 neutral Fuels II			Koch, Kubach

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 2024, 3 SWS, Language: German, Open in study portal

Lecture / Practice (VÜ)
On-Site

T 11.54 Course: Coal Fired Power Plants [T-MACH-105410]

Responsible: Hon.-Prof. Dr. Thomas Schulenberg
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102597 - Compulsory Elective Module Mechanical Engineering
M-MACH-102610 - Major Field: Power Plant Technology

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

Competence Certificate
Oral examination, Duration approximately 30 Minutes

no tools or reference materials may be used during the exam

Prerequisites
none

T 11.55 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-102598 - Major Field: Advanced Mechatronics
M-MACH-102609 - Major Field: Cognitive Technical Systems
M-MACH-102633 - Major Field: Robotics
M-MACH-102640 - Major Field: Technical Logistics

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

Events					
ST 2024	2138341	Cogitive Automobiles - Laboratory	3 SWS	/ 🗣	Stiller, Lauer, Blumberg
Exams					
ST 2024	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 2024, 3 SWS, Language: German, Open in study portal   **On-Site**

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.

11.56 Course: Combined Cycle Power Plants [T-MACH-105444]

Responsible: Prof. Dr.-Ing. Daniel Banuti
Hon.-Prof. Dr. Thomas Schulenberg

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102597 - Compulsory Elective Module Mechanical Engineering
M-MACH-102610 - Major Field: Power Plant Technology
M-MACH-102636 - Major Field: Thermal Turbomachines

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

Events					
ST 2024	2170490	Combined Cycle Power Plants	2 SWS	Lecture / 🗣	Banuti, Schulenberg
Exams					
ST 2024	76-T-MACH-105444	Combined Cycle Power Plants			Banuti, Schulenberg
WT 24/25	76-T-MACH-105444	Combined Cycle Power Plants			Banuti, Schulenberg

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

Competence Certificate
oral exam ca. 30 min

Prerequisites
none

Recommendation
We recommend to combine the lecture with the Simulator Exercises for Combined Cycle Power Plants (T-MACH-105445).

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

V Combined Cycle Power Plants

2170490, SS 2024, 2 SWS, Language: English, Open in study portal

Lecture (V)
On-Site

Content
The training objective of the course is the qualification for a research-related professional activity in power plant engineering. The participants can name the most important components of the combined cycle power plant and describe their function. They can design or modify combined cycle power plants independently and creatively. They have acquired a broad knowledge of this power plant technology, including specific knowledge of gas turbine design, steam turbine design and boiler design. On this basis, they can describe and analyze the specific behavior of the power plant components as well as the entire power plant in the grid. Participants in the lecture have a trained analytical thinking and judgment in power plant design.

Layout of a combined cycle power plant, design and operation of gas turbines, of the heat recovery steam generator, of the feedwater system and cooling systems. Design and operation of steam turbines, of the generator and its electrical systems. System response to challinging grids, protection systems, water make-up and water chemistry. Design concepts of different power plant manufacturers, innovative power plant concepts.

Literature
Die gezeigten Vorlesungsfolien und weiteres Unterrichtsmaterial werden bereitgestellt.

Ferner empfohlen:

C. Lechner, J. Seume, Stationäre Gasturbinen, Springer Verlag, 2. Auflage 2010

T 11.57 Course: Combustion Diagnositics [T-MACH-105429]

Responsible: Prof. Dr. Ulrich Maas
Dr.-Ing. Robert Schießl
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102597 - Compulsory Elective Module Mechanical Engineering
M-MACH-102635 - Major Field: Engineering Thermodynamics

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

Events					
ST 2024	2167048	Combustion diagnositics	2 SWS	Lecture / 🗣	Schießl
WT 24/25	2167048	Combustion diagnositics	2 SWS	Lecture / 🗣	Schießl
Exams					
WT 24/25	76-T-MACH-105429	Combustion Diagnositics			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 Combustion diagnositics
2167048, SS 2024, 2 SWS, Language: German, Open in study portal

Lecture (V)
On-Site

Content
Diagnostical methods: Laser induced fluorescence, Rayleigh-scattering, Raman-scattering
Chemoluminescence.
Reduced description of combustion processes and measurements.
Discussion of the potential and limits of specific strategies in different combustion systems.

Organizational issues
Termin siehe Aushang im Schaukasten und Internetseite des Instituts.

Literature
Skriptum zur Vorlesung

A.C. Eckbreth, Laser Diagnostics for Combustion Temperature and Species, Abacus Press, 2nd ed. (1996)

W. Demtröder, Laser Spectroscopy: Basic Concepts and Instrumentation, Springer, 3rd ed., 2003

Hollas J.M. Modern Spectroscopy, Wiley, 3rd ed., 1996
K. Kohse-Höinghaus, J. B. Jeffries (ed.), Applied Combustion Diagnostics, Taylor and Francis

Atkins P., Paula, J., Physical Chemistry, 8th ed., Oxford University Press, 2006

V Combustion diagnositics
2167048, WS 24/25, 2 SWS, Language: German, Open in study portal

Lecture (V)
On-Site

Content
Diagnostical methods: Laser induced fluorescence, Rayleigh-scattering, Raman-scattering, chemoluminescence.
Analysis of the potential and limits of specific strategies in different combustion systems.

Organizational issues
Termin nach Vereinbarung

Literature
Skriptum zur Vorlesung

A.C. Eckbreth, Laser Diagnostics for Combustion Temperature and Species, Abacus Press, 2nd ed. (1996)

W. Demtröder, Laser Spectroscopy: Basic Concepts and Instrumentation, Springer, 3rd ed., 2003

Hollas J.M. Modern Spectroscopy, Wiley, 3rd ed., 1996
K. Kohse-Höinghaus, J. B. Jeffries (ed.), Applied Combustion Diagnostics, Taylor and Francis

Atkins P., Paula, J., Physical Chemistry, 8th ed., Oxford University Press, 2006

T 11.58 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-102599 - Major Field: Powertrain Systems
M-MACH-102607 - Major Field: Vehicle Technology
M-MACH-102630 - Major Field: Mobile Machines

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

Events					
WT 24/25	2133113	CO2-neutral combustion engines and their fuels I	4 SWS	Lecture / Practice (/ 🗣	Koch
Exams					
ST 2024	76-T-MACH-102194	CO2-neutral combustion engines and their fuels I			Koch, Kubach

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 24/25, 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 11.59 Course: Combustion Engines II [T-MACH-104609]

Responsible: Dr.-Ing. Rainer Koch
Dr.-Ing. Heiko Kubach

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102650 - Major Field: Combustion Engines Based Powertrains

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

Events					
ST 2024	2134151	CO2-neutral combustion engines and their fuels II	3 SWS	Lecture / Practice (/ 🗣	Koch
Exams					
ST 2024	76-T-MACH-104609	Combustion Engines, Hydrogen Engines and CO2 neutral Fuels II			Koch, Kubach

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 I helpful

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

V CO2-neutral combustion engines and their fuels II
2134151, SS 2024, 3 SWS, Language: German, Open in study portal

Lecture / Practice (VÜ)
On-Site

11.60 Course: Communication Systems and Protocols [T-ETIT-101938]

Responsible: Dr.-Ing. Jens Becker
Prof. Dr.-Ing. Jürgen Becker

Organisation: KIT Department of Electrical Engineering and Information Technology

Part of: M-MACH-102595 - Compulsory Elective Module Natural Science/Computer Science/Electrical Engineering

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

Events					
ST 2024	2311616	Communication Systems and Protocols	2 SWS	Lecture / 🗣	Becker, Becker
ST 2024	2311618	Tutorial for 2311616 Communication Systems and Protocols	1 SWS	Practice / 🗣	Stammler
Exams					
ST 2024	7311616	Communication Systems and Protocols			Becker, Becker
WT 24/25	7311616	Communication Systems and Protocols			Becker, Becker

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

Prerequisites
none

T 11.61 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

Lightweight Design

Part of: M-MACH-102597 - Compulsory Elective Module Mechanical Engineering
M-MACH-102607 - Major Field: Vehicle Technology
M-MACH-102628 - Major Field: Lightweight Construction
M-MACH-102632 - Major Field: Polymer Engineering
M-MACH-102641 - Major Field: Rail System Technology

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

Events					
ST 2024	2114053	Composite Manufacturing – Polymers, Fibers, Semi-Finished Products, Manufacturing Technologies	2 SWS	Lecture / Blended	Henning
Exams					
ST 2024	76-T-MACH-105535	Composite Manufacturing - Polymers, Fibers, Semi-Finished Products, Manufacturing Technologies			Henning
WT 24/25	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

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

2114053, SS 2024, 2 SWS, Language: German, Open in study portal

Content

Physical connections of fiber reinforcement

Use and examples
- Automotive construction
- Transport
- Energy and construction
- Sport and recreation

Resins
- Thermoplastics
- Duromeres

Mechanisms of reinforcements
- Glas fibers
- Carbon fibers
- Aramid fibers
- Natural fibers

Semi-finished products - textiles

Process technologies - prepregs

Recycling of composites

Aim of this lecture:

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 Lehrveranstaltung wird im SS 2024 als Hybridveranstaltung geplant.

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 11.62 Course: Computational Dynamics [T-MACH-105349]

Responsible: Prof. Dr.-Ing. Carsten Proppe
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102604 - Major Field: Computational Mechanics
M-MACH-102646 - Major Field: Applied Mechanics
M-MACH-104434 - Major Field: Modeling and Simulation in Dynamics
M-MACH-104443 - Major Field: Vibration Theory

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

Events					
ST 2024	2162246	Computational Dynamics	2 SWS	Lecture / On-Site	Proppe
WT 24/25	2162246	Computational Dynamics	2 SWS	Lecture / Online	Proppe
Exams					
ST 2024	76-T-MACH-105349	Computational Dynamics			Proppe

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

Competence Certificate
oral exam, duration approx. 20 min.

Prerequisites
none

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

V Computational Dynamics

2162246, SS 2024, 2 SWS, Language: German, Open in study portal

Lecture (V)
On-Site

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

V Computational Dynamics

2162246, WS 24/25, 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 11.63 Course: Computational Intelligence [T-MACH-105314]

Responsible:	Stefan Meisenbacher apl. Prof. Dr. Ralf Mikut apl. Prof. Dr. Markus Reischl
Organisation:	KIT Department of Mechanical Engineering
Part of:	M-MACH-102597 - Compulsory Elective Module Mechanical Engineering M-MACH-102598 - Major Field: Advanced Mechatronics M-MACH-102601 - Major Field: Automation Technology M-MACH-102609 - Major Field: Cognitive Technical Systems M-MACH-102614 - Major Field: Mechatronics M-MACH-102615 - Major Field: Medical Technology M-MACH-102624 - Major Field: Information Technology M-MACH-102633 - Major Field: Robotics

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

Events					
WT 24/25	2105016	Computational Intelligence	2 SWS	Lecture / Blended	Mikut, Reischl, Meisenbacher
Exams					
ST 2024	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 24/25, 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: History, Architectures, Training strategies, Interpretability and Explainable AI, Use Cases

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 11.64 Course: Computational Mechanics I [T-MACH-105351]

Responsible: Prof. Dr.-Ing. Thomas Böhlke
Dr.-Ing. Tom-Alexander Langhoff

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102597 - Compulsory Elective Module Mechanical Engineering
M-MACH-102604 - Major Field: Computational Mechanics
M-MACH-102646 - Major Field: Applied Mechanics

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

Events					
WT 24/25	2161250	Computational Mechanics I	2 SWS	Lecture / 🗣	Langhoff, Böhlke
Exams					
ST 2024	76-T-MACH-105351	Computational Mechanics I			Böhlke, Langhoff

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

Competence Certificate
oral examination, 30 min.

Prerequisites
none

Recommendation
The contents of the lectures "Mathematical Methods in Continuum Mechanics" and "Introduction to the Finite Element Method" are assumed to be known

This course is geared to MSc students of Mechanical Engineering

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

V Computational Mechanics I

2161250, WS 24/25, 2 SWS, Language: German, Open in study portal

Lecture (V)
On-Site

Literature

Simó, J.C.; Hughes, T.J.R.: Computational Inelasticity. Springer 1998.
Haupt, P.: Continuum Mechanics and Theory of Materials. Springer 2002.
Belytschko, T.; Liu,W.K.; Moran, B.: Nonlinear FE for Continua and Structures. JWS 2000.
W. S. Slaughter: The linearized theory of elasticity. Birkhäuser, 2002.
J. Betten: Finite Elemente für Ingenieure 2, Springer, 2004.

T 11.65 Course: Computational Mechanics II [T-MACH-105352]

Responsible: Prof. Dr.-Ing. Thomas Böhlke
Dr.-Ing. Tom-Alexander Langhoff

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102597 - Compulsory Elective Module Mechanical Engineering
M-MACH-102604 - Major Field: Computational Mechanics
M-MACH-102646 - Major Field: Applied Mechanics

Type	Credits	Grading scale	Recurrence	Version
Oral examination	6	Grade to a third	Each summer term	2

Events					
ST 2024	2162296	Computational Mechanics II	2 SWS	Lecture / 🗣	Böhlke, Langhoff
ST 2024	2162297	Tutorial Computational Mechanics II	2 SWS	Practice / 🗣	Krause, Keursten, Böhlke
Exams					
ST 2024	76-T-MACH-105352	Computational Mechanics II			Böhlke, Langhoff

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 Computational Mechanics II

2162296, SS 2024, 2 SWS, Language: German, Open in study portal

Lecture (V)
On-Site

Content
overview quasistatic nonlinear phenomena; numerics of nonlinear systems; balance equations of geometrically nonlinear solid mechanics; infinitesimal plasicity; linear and gemetrically nonlinear thermoelasticity

Literature
Simó, J.C.; Hughes, T.J.R.: Computational Inelasticity. Springer 1998; Haupt, P.: Continuum Mechanics and Theory of Materials. Springer 2002; Belytschko, T.; Liu,W.K.; Moran, B.: Nonlinear FE for Continua and Structures. JWS 2000

V Tutorial Computational Mechanics II

2162297, SS 2024, 2 SWS, Language: German, Open in study portal

Practice (Ü)
On-Site

Content
see lecture "Computational Mechanics II"

Organizational issues
weitere Informationen siehe Homepage bzw in der ersten Vorlesung

Literature
siehe Vorlesung "Rechnerunterstützte Mechanik II"

T 11.66 Course: Computational Vehicle Dynamics [T-MACH-105350]

Responsible: Prof. Dr.-Ing. Carsten Proppe
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102597 - Compulsory Elective Module Mechanical Engineering
M-MACH-102604 - Major Field: Computational Mechanics
M-MACH-102607 - Major Field: Vehicle Technology
M-MACH-102609 - Major Field: Cognitive Technical Systems
M-MACH-102641 - Major Field: Rail System Technology
M-MACH-102646 - Major Field: Applied Mechanics
M-MACH-104434 - 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 2024	2162256	Computational Vehicle Dynamics	2 SWS	Lecture / 🖥	Proppe
WT 24/25	2162256	Computational Vehicle Dynamics	2 SWS	Lecture / 🖥	Proppe
Exams					
ST 2024	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 2024, 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 24/25, 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 11.67 Course: Constitution and Properties of Protective Coatings [T-MACH-105150]

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

Part of: M-MACH-102597 - Compulsory Elective Module Mechanical Engineering
M-MACH-102611 - 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 24/25	2177601	Constitution and Properties of Protective Coatings	2 SWS	Lecture / 🗣	Ulrich
Exams					
ST 2024	76-T-MACH-105150	Constitution and Properties of Protective Coatings			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 Protective Coatings

2177601, WS 24/25, 2 SWS, Language: German, Open in study portal

Lecture (V)
On-Site

Content
oral examination (about 30 min); no tools or reference materials

Teaching Content:

introduction and overview

concepts of surface modification

coating concepts

coating materials

methods of surface modification

coating methods

characterization methods

state of the art of industrial coating of tools and components

new developments of coating technology

regular attendance: 22 hours
self-study: 98 hours

Transfer of the basic knowledge of surface engineering, of the relations between constitution, properties and performance, of the manifold methods of modification, coating and characterization of surfaces.

Recommendations: none

Organizational issues

Falls die Vorlesung online stattfinden muss, bitte um Anmeldung unter sven.ulrich@kit.edu bis zum 22.10.24.

Den entsprechenden MS Teams Link erhalten Sie dann per E-Mail am 23.10.24.

Literature

Bach, F.-W.: Modern Surface Technology, Wiley-VCH, Weinheim, 2006

Abbildungen und Tabellen werden verteilt; Copies with figures and tables will be distributed

T 11.68 Course: Constitution and Properties of Wearresistant Materials [T-MACH-102141]

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

Part of: M-MACH-102597 - Compulsory Elective Module Mechanical Engineering
M-MACH-102611 - Major Field: Materials Science and Engineering
M-MACH-102637 - Major Field: Tribology

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

Events					
ST 2024	2194643	Constitution and Properties of Wear resistant materials	2 SWS	Lecture / 🗣	Ulrich
Exams					
ST 2024	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 — **Lecture (V) On-Site**
2194643, SS 2024, 2 SWS, Language: German, Open in study portal

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
Die Blockveranstaltung findet in folgendem Zeitraum statt:

15.04.-17.04.2024: jeweils von 8:00-16:00 Uhr;

Ort: KIT-CN, Geb. 681, Raum 214

Anmeldung verbindlich bis zum 13.04.2024 unter sven.ulrich@kit.edu.

Nach der Anmeldung wird Ihnen im Falle einer Online-Veranstaltung der Link zur Vorlesung per E-Mail am 14.04.2024 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 11.69 Course: Contact Mechanics [T-MACH-105786]

Responsible: Prof. Dr. Christian Greiner
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102597 - Compulsory Elective Module Mechanical Engineering
M-MACH-102637 - Major Field: Tribology

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

Events					
ST 2024	2181220	Contact Mechanics	2 SWS	Lecture / 🗣	Greiner
Exams					
ST 2024	76-T-MACH-105786	Contact Mechanics			Greiner

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

Competence Certificate
oral exam ca. 30 minutes

Prerequisites
none

Recommendation
preliminary knowledge in mathematics, physics and materials science

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

V Contact Mechanics
2181220, SS 2024, 2 SWS, Language: German, Open in study portal

Lecture (V)
On-Site

Content
The course introduces contact mechanics of smooth and rough surface for non-adhesive and adhesive interfacial conditions. There will a computer lab held in parallel to the lecture that teaches numerical approaches to contact mechanical problems.

1. Introduction: contact area and stiffness
2. Theory of the elastic half-space
3. Contact of nonadhesive spheres: Hertz theory
4. Physics and chemistry of adhesive interactions at interfaces
5. Contact of adhesive spheres: theories of Johnson-Kendall-Roberts, Derjaguin-Muller-Toporov and Maugis-Dugdale
6. Surface roughness: topography, power spectral density, structure of real surfaces, fractal surfaces as a model, metrology
7. Contact of nonadhesive rough surfaces: theories of Greenwood-Williamson, Persson, Hyun-Pei-Robbins-Molinari
8. Contact of adhesive rough surface: theories of Fuller-Tabor, Persson and recent numerical results
9. Contact of rough spheres: theory of Greenwood-Tripp and recent numerical results
10. Lateral and sliding contact: theories of Cattaneo-Mindlin, Savkoor, Persson
11. Applications of contact mechanics

The student

- knows models for smooth and rough surfaces under non-adhesive and adhesive conditions and understands their strengths and limits
- knows fundamental scaling relations for the functional dependency between contact area, stiffness and normal force
- can apply numerical methods to study questions from materials science

preliminary knowledge in mathematics, physics and materials science recommended

regular attendance: 22,5 hours

self-study: 97,5 hours

oral exam ca. 30 minutes

Literature

K. L. Johnson, Contact Mechanics (Cambridge University Press, 1985)

D. Maugis, Contact, Adhesion and Rupture of Elastic Solids (Springer-Verlag, 2000)

J. Israelachvili, Intermolecular and Surface Forces (Academic Press, 1985)

T 11.70 Course: Contact Mechanics for Dynamic Systems [T-MACH-110834]

Responsible: Dr.-Ing. Ulrich Römer
Organisation:
Part of: M-MACH-104434 - Major Field: Modeling and Simulation in Dynamics
M-MACH-104443 - Major Field: Vibration Theory

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

Events					
ST 2024	2162291	Contact Mechanics for Dynamic Systems	2 SWS	Lecture / ✕	Römer

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

Competence Certificate
oral examination (duration 20 min.)

Prerequisites
none

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

V Contact Mechanics for Dynamic Systems

2162291, SS 2024, 2 SWS, Language: German, Open in study portal

Lecture (V)
Cancelled

Content
Geometric description of contacts between two or more objects.
Description of dynamic systems with unilateral contacts and/or friction by means of complementarity problems.
Different solution methods, their advantages and disadvantages and physical interpretation.
Special difficulties (existence & uniqueness of solutions) for non-smooth dynamical systems.
Nonlinearities due to elastic contacts (Hertz contact) and friction (Stribeck curve).
Influence of contact nonlinearities on vibrations of simple mechanical systems.

Learning objectives:

Students can describe dynamic systems with contacts, especially one-sided bonds and static-sliding friction transitions, mathematically. They are able to explain the complementarity problems that arise in this context and explain various methods for solving them as well as their advantages and disadvantages. The students can name difficulties in solving them and explain their causes and effects. They can explain the effects of contact nonlinearities on the vibrations of simple mechanical systems and calculate them.

Organizational issues
Die Vorlesung Kontaktmechanik für dynamische Systeme wird im Sommersemester nicht angeboten.

Literature
Literaturempfehlungen in der Vorlesung/in den Vorlesungsunterlagen.

T 11.71 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-102597 - Compulsory Elective Module Mechanical Engineering
M-MACH-102628 - Major Field: Lightweight Construction
M-MACH-102743 - Fundamentals and Methods of Theoretical Foundations of Mechanical Engineering

Type	Credits	Grading scale	Recurrence	Expansion	Version
Written examination	3	Grade to a third	Each winter term	1 terms	5

Events					
WT 24/25	2161252	Continuum mechanics of solids and fluids	2 SWS	Lecture / 🗣	Böhlke, Frohnapfel
Exams					
ST 2024	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
Coursework in *Tutorial Continuum Mechanics of Solids and Fluids* (T-MACH-110333) must be passed

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 24/25, 2 SWS, Language: German, Open in study portal

Lecture (V)
On-Site

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 11.72 Course: Control of Mobile Machines [T-MACH-111821]

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

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102597 - Compulsory Elective Module Mechanical Engineering
M-MACH-102599 - Major Field: Powertrain Systems
M-MACH-102614 - Major Field: Mechatronics
M-MACH-102624 - Major Field: Information Technology
M-MACH-102630 - Major Field: Mobile Machines

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

Exams			
ST 2024	76-T-MACH-111821	Control of mobile machines	Becker, Geimer

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

Prerequisites
A prerequisite for participation in the examination is the preparation of a semester report. The preexamination with the code T-MACH-111820 must be passed.

Modeled Conditions
The following conditions have to be fulfilled:

1. The course T-MACH-111820 - Control of Mobile Machines – Prerequisites must have been passed.

T 11.73 Course: Control of Mobile Machines – Prerequisites [T-MACH-111820]

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

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102597 - Compulsory Elective Module Mechanical Engineering
M-MACH-102599 - Major Field: Powertrain Systems
M-MACH-102614 - Major Field: Mechatronics
M-MACH-102624 - Major Field: Information Technology
M-MACH-102630 - Major Field: Mobile Machines

Type	Credits	Grading scale	Recurrence	Version
Completed coursework	0	pass/fail	Each summer term	1

Exams			
ST 2024	76-T-MACH-111820	Control of mobile machines - Advance	Becker, Geimer

Competence Certificate
Preparation of a report on the completion of the semester task

Prerequisites
none

T 11.74 Course: Control Technology [T-MACH-105185]

Responsible: Hon.-Prof. Dr. Christoph Gönnheimer
Organisation: KIT Department of Mechanical Engineering

Part of:
M-MACH-102597 - Compulsory Elective Module Mechanical Engineering
M-MACH-102599 - Major Field: Powertrain Systems
M-MACH-102601 - Major Field: Automation Technology
M-MACH-102618 - Major Field: Production Technology
M-MACH-102624 - Major Field: Information Technology
M-MACH-102633 - Major Field: Robotics

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

Events					
ST 2024	2150683	Control Technology	2 SWS	Lecture / 🗣	Gönnheimer
Exams					
ST 2024	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 2024, 2 SWS, Language: German, Open in study portal

Lecture (V)
On-Site

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

Organizational issues
Zur Vertiefung des im Rahmen der Lehrveranstaltung erworbenen Wissens werden die theoretischen Vorlesungseinheiten durch Praxiseinheiten im Umfeld der Karlsruher Forschungsfabrik (https://www.karlsruher-forschungsfabrik.de) unterstützt.

The theoretical lectures are complemented by practical lectures in the Karlsruhe Research Factory (https://www.karlsruher-forschungsfabrik.de/en.html) to deepen the acquired knowledge.

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 11.75 Course: Current Topics on BioMEMS [T-MACH-102176]

Responsible: Prof. Dr. Andreas Guber
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102616 - Major Field: Microsystem Technology

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

Events					
ST 2024	2143873	Actual topics of BioMEMS	2 SWS	Seminar / Blended	Guber, Ahrens
WT 24/25	2143873	Actual topics of BioMEMS	2 SWS	Seminar / Blended	Guber, Ahrens

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

Competence Certificate
active participation and own presentation (30 Min.)

Prerequisites
none

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

V Actual topics of BioMEMS
2143873, SS 2024, 2 SWS, Language: German, Open in study portal

Seminar (S)
Blended (On-Site/Online)

Content

- Short introduction to the basics of BioMEMS
- Selected aspects of biomedical engineering and life sciences
- Possible micro technical manufacturing processes
- Selected application examples from research and industry

The seminar includes (bio)medical engineering as well as biological and biotechnological topics in the context of engineering sciences

- Use of microtechnical components and systems in innovative medical products
- Use of microfluidic chip systems in applied biology and biotechnology

Organizational issues
Aktuell werden im Rahmen dieses Seminars nur Vorträge zu Abschlussarbeiten gehalten. Neue Themen nur auf Anfrage.

V Actual topics of BioMEMS
2143873, WS 24/25, 2 SWS, Language: German, Open in study portal

Seminar (S)
Blended (On-Site/Online)

Organizational issues
Wird bekannt gegeben

T 11.76 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-102597 - Compulsory Elective Module Mechanical Engineering
M-MACH-102598 - Major Field: Advanced Mechatronics
M-MACH-102601 - Major Field: Automation Technology
M-MACH-102609 - Major Field: Cognitive Technical Systems
M-MACH-102614 - Major Field: Mechatronics
M-MACH-102615 - Major Field: Medical Technology
M-MACH-102624 - Major Field: Information Technology
M-MACH-102633 - Major Field: Robotics

Type	Credits	Grading scale	Recurrence	Version
Written examination	5	Grade to a third	Each summer term	2

Events					
ST 2024	2106014	Data Analytics for Engineers	3 SWS	Lecture / Practice (/ 🧩	Mikut, Reischl, Meisenbacher
Exams					
ST 2024	76-T-MACH-105694	Datenanalyse für Ingenieure			Mikut, Reischl

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 2024, 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 and Python): 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 11.77 Course: Data Driven Engineering 1: Machine Learning for Dynamical Systems [T-MACH-111193]

Responsible: Prof. Dr.-Ing. Hans-Jörg Bauer

Organisation: KIT Department of Mechanical Engineering
Institute of Thermal Turbomachinery

Part of:
M-MACH-102597 - Compulsory Elective Module Mechanical Engineering
M-MACH-102598 - Major Field: Advanced Mechatronics
M-MACH-102609 - Major Field: Cognitive Technical Systems
M-MACH-102610 - Major Field: Power Plant Technology
M-MACH-102612 - Major Field: Modeling and Simulation in Energy- and Fluid Engineering
M-MACH-102614 - Major Field: Mechatronics
M-MACH-102623 - Major Field: Fundamentals of Energy Technology
M-MACH-102624 - Major Field: Information Technology
M-MACH-102635 - Major Field: Engineering Thermodynamics
M-MACH-102636 - Major Field: Thermal Turbomachines
M-MACH-102739 - Fundamentals and Methods of Automotive Engineering

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

Competence Certificate
Oral exam, approximately 30 minutes

Prerequisites
None

T 11.78 Course: Data Driven Engineering 2: Advanced Topics [T-MACH-111373]

Responsible: Prof. Dr.-Ing. Hans-Jörg Bauer

Organisation: KIT Department of Mechanical Engineering
Institute of Thermal Turbomachinery

Part of: M-MACH-102598 - Major Field: Advanced Mechatronics
M-MACH-102609 - Major Field: Cognitive Technical Systems
M-MACH-102610 - Major Field: Power Plant Technology
M-MACH-102612 - Major Field: Modeling and Simulation in Energy- and Fluid Engineering
M-MACH-102614 - Major Field: Mechatronics
M-MACH-102623 - Major Field: Fundamentals of Energy Technology
M-MACH-102624 - Major Field: Information Technology
M-MACH-102636 - Major Field: Thermal Turbomachines

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

Competence Certificate
Oral exam, approximately 30 minutes

Prerequisites
none

Recommendation
The course is intended for students with a strong background and interest in ML applications for engineering problems. It is strongly recommended to be taken in combination with the “Data Driven Engineering 1 Machine Learning for Dynamical Systems” course.

T 11.79 Course: Data Science and Scientific Workflows [T-MACH-111588]

Responsible: Prof. Dr. Peter Gumbsch
Dr. Daniel Weygand

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-105904 - Major Field: Advanced Materials Modelling and Data Management

Type	Credits	Grading scale	Recurrence	Version
Written examination	3	Grade to a third	Each summer term	1

Events					
ST 2024	2182741	Data Science and Scientific Workflows	3 SWS	Lecture / Practice (/	Weygand, Gumbsch
Exams					
ST 2024	76-T-MACH-111588	Data Science and Scientific Workflows			Weygand, Gumbsch

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

Competence Certificate
written exam

Prerequisites
T-MACH-111603 must have been passed

Modeled Conditions
The following conditions have to be fulfilled:

1. The course T-MACH-111603 - Data Science and Scientific Workflows (Project) must have been passed.

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

V Data Science and Scientific Workflows
2182741, SS 2024, 3 SWS, Language: German, Open in study portal

Lecture / Practice (VÜ)
On-Site

Content
The amount of data generated in scientific projects is increasing rapidly. The increase is partly due to the fact that new data-based evaluation methods allow a better and more precise analysis of scientific data. In addition, the linking of data provides new insights. This requires a systematic organization of data. The necessary knowledge of data science and computer science is equally required for both computer simulations and experimental investigations. The preparation/classification (e.g. electronic laboratory notebook) and structuring of data is a necessary step for their reuse. The lecture introduces the principles and software tools for the corresponding scientific workflows: Python and libraries, Jupyter notebook, shell scripts and documentation with git-tools. Furthermore, an overview is given of database systems in materials research and the FAIR data principle (findability, accessibility, interoperability and reusability).

Objective:

Students will be able to

- organize and document data electronically
- handle data formats: simple, hierarchical ones
- deal with software management tools (git, gitlab)
- record scientific workflows in detail and ensure traceability
- use python-based libraries for data handling and analyses

Detailed lecture content:

1. Introduction: the need for data science and computer science basics.
2. Programming and programming paradigms using Python
3. Software and data management: local and central management (git, gitlab)
4. Automating tasks: from scripts to workflow (with many examples from simulation and experiment)
5. Data processing
6. Electronic lab book
7. Data management requirements for publicly funded projects

Exercise:

The lecture material will be deepened in the exercises (exercise 1SWS).

Mode of examination:

- Project: Project topics from the areas
    - Material simulation and workflow
    - Data organization and analysis: from experiment or simulation
    - Presentation of the project in a 15 minute lecture + questions

- Preliminary examination performance: successful start to project work

Literature
Literatur:

- Handbuch Data Science, Hanser Verlag
- Effective Computation in Physics, Scopatz & Huff, O’Reilly 2015
- Python Data Science Handbook, J. VanderPlas, O’Reilly 2016.

T 11.80 Course: Data Science and Scientific Workflows (Project) [T-MACH-111603]

Responsible: Prof. Dr. Peter Gumbsch
Dr. Daniel Weygand

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-105904 - Major Field: Advanced Materials Modelling and Data Management

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

Events					
ST 2024	2182741	Data Science and Scientific Workflows	3 SWS	Lecture / Practice (/	Weygand, Gumbsch
Exams					
ST 2024	76-T-MACH-111588	Data Science and Scientific Workflows			Weygand, Gumbsch
ST 2024	76-T-MACH-111603	Data Science and Scientific Workflows (Project)			Weygand, Gumbsch

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

Competence Certificate
Successfully create a functional programme/workflow and documentation.

Prerequisites
none

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

V Data Science and Scientific Workflows

2182741, SS 2024, 3 SWS, Language: German, Open in study portal

Lecture / Practice (VÜ)
On-Site

Content
The amount of data generated in scientific projects is increasing rapidly. The increase is partly due to the fact that new data-based evaluation methods allow a better and more precise analysis of scientific data. In addition, the linking of data provides new insights. This requires a systematic organization of data. The necessary knowledge of data science and computer science is equally required for both computer simulations and experimental investigations. The preparation/classification (e.g. electronic laboratory notebook) and structuring of data is a necessary step for their reuse. The lecture introduces the principles and software tools for the corresponding scientific workflows: Python and libraries, Jupyter notebook, shell scripts and documentation with git-tools. Furthermore, an overview is given of database systems in materials research and the FAIR data principle (findability, accessibility, interoperability and reusability).

Objective:

Students will be able to

- organize and document data electronically
- handle data formats: simple, hierarchical ones
- deal with software management tools (git, gitlab)
- record scientific workflows in detail and ensure traceability
- use python-based libraries for data handling and analyses

Detailed lecture content:

1. Introduction: the need for data science and computer science basics.
2. Programming and programming paradigms using Python
3. Software and data management: local and central management (git, gitlab)
4. Automating tasks: from scripts to workflow (with many examples from simulation and experiment)
5. Data processing
6. Electronic lab book
7. Data management requirements for publicly funded projects

Exercise:

The lecture material will be deepened in the exercises (exercise 1SWS).

Mode of examination:

- Project: Project topics from the areas
    - Material simulation and workflow
    - Data organization and analysis: from experiment or simulation
    - Presentation of the project in a 15 minute lecture + questions
- Preliminary examination performance: successful start to project work

Literature
Literatur:

- Handbuch Data Science, Hanser Verlag
- Effective Computation in Physics, Scopatz & Huff, O'Reilly 2015
- Python Data Science Handbook, J. VanderPlas, O'Reilly 2016.

T 11.81 Course: Data-Driven Algorithms in Vehicle Technology [T-MACH-112126]

Responsible: Dr. Stefan Scheubner
Organisation: KIT Department of Mechanical Engineering
Part of: M-MACH-102607 - 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 24/25	2113840	Data-Driven Algorithms in Vehicle Technology	2 SWS	Lecture / Blended	Scheubner
Exams					
ST 2024	7600001	Data-Driven Algorithms in Vehicle Technology			Scheubner
WT 24/25	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 24/25, 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/

Die erste VL am 22.10.24 um 14:00 Uhr findet in Präsenz am Campus Ost, Geb. 70.04, Raum 219 statt.

Alle weiteren Vorlesungsinhalte werden als Videoaufzeichnungen in ILIAS bereit gestellt. In regelmäßigen Abständen wird es Sprechstunden geben. Die genauen Termine erfahren Sie dann über den entsprechenden ILIAS Kurs

T 11.82 Course: Decision-Making and Motion Planning for Automated Driving [T-MACH-113597]

Responsible: Dr.-Ing. Maximilian Naumann
apl. Prof. Dr. Moritz Werling

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102597 - Compulsory Elective Module Mechanical Engineering
M-MACH-102598 - Major Field: Advanced Mechatronics
M-MACH-102601 - Major Field: Automation Technology
M-MACH-102607 - Major Field: Vehicle Technology
M-MACH-102609 - Major Field: Cognitive Technical Systems
M-MACH-102614 - Major Field: Mechatronics
M-MACH-102624 - Major Field: Information Technology
M-MACH-102630 - Major Field: Mobile Machines
M-MACH-102633 - Major Field: Robotics
M-MACH-102640 - Major Field: Technical Logistics

Type	Credits	Grading scale	Recurrence	Version
Written examination	6	Grade to a third	Each winter term	1

Events					
WT 24/25	2137401	Decision-Making and Motion Planning for Automated Driving	3 SWS	Lecture /	Naumann, Werling

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

Competence Certificate
written examination, duration 60 min.

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

Prerequisites
none

Annotation
Basic knowledge of control engineering and systems theory should be available from "Measurement and Control Systems" or from other lectures.

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

V Decision-Making and Motion Planning for Automated Driving

2137401, WS 24/25, 3 SWS, Language: English, Open in study portal

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

Content
Kurzfassung (EN):
Driver assistance is on its way to evolve from pure driving dynamics control systems, such as ABS or ESP, to full automation. To realize new, customer-value safety and comfort systems, the primary task of active driving interventions in steering, accelerator and braking is shifting from the so-called vehicle stabilization level to the so-called vehicle guidance level, the new subject area of modern assistance systems. The challenge here is to provide optimum support for the driver without patronizing him. The next step is driving automation, in which the driving task is completely taken over, at least in certain situations. For highly and fully automated vehicles, the challenge is to produce pleasant, safe and predictable driving behavior under given uncertainties in the perception of the environment and the behavior of other road users.

Lernziele (EN):

The lecture is aimed at students of mechanical engineering and related courses who wish to acquire interdisciplinary qualifications in a future-oriented subject area. It covers control engineering, information technology and vehicle technology aspects and provides a holistic overview of the field of automated vehicle control. Practical application examples from innovative driver assistance and driving automation systems deepen and illustrate the lecture content.

Contents:

Part 1: Driver Assistance:

1) Introduction to driver assistance
2) System description and modeling
3) Assistance systems of the stabilization level
4) Assistance systems of the command level

Part 2: Driving Automation:

5) Introduction Maneuver Planning
6) Dynamic Programming
7) Linear-quadratic optimization problems
8) Model predictive control
9) Decision making under uncertainty (MDPs, reinforcement learning, imitation learning).

Prerequisites:
Basic knowledge of control engineering and systems theory should be available from "Measurement and Control Systems" or from lectures of other departments.

Nachweis: written exam

Arbeitsaufwand: 180 hours

Organizational issues
Die Vorlesung ist die Nachfolgevorlesung von LV 2138336 Verhaltensgenerierung für Fahrzeuge.

T 11.83 Course: Design and Development of Mobile Machines [T-MACH-105311]

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

Part of: M-MACH-102597 - Compulsory Elective Module Mechanical Engineering
M-MACH-102605 - Major Field: Engineering Design
M-MACH-102630 - Major Field: Mobile Machines

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

Events					
WT 24/25	2113079	Design and Development of Mobile Machines	2 SWS	Lecture / 🗣	Geimer
Exams					
ST 2024	76-T-MACH-105311	Design and Development of Mobile Machines			Geimer
WT 24/25	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 24/25, 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 11.84 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-102597 - Compulsory Elective Module Mechanical Engineering
M-MACH-102605 - Major Field: Engineering Design
M-MACH-102630 - Major Field: Mobile Machines

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

Exams			
WT 24/25	76-T-MACH-108887	Design and Development of Mobile Machines - Advance	Geimer

Competence Certificate
Preparation of semester report

Prerequisites
none

T 11.85 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-102597 - Compulsory Elective Module Mechanical Engineering
M-MACH-102599 - Major Field: Powertrain Systems
M-MACH-102607 - Major Field: Vehicle Technology

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

Events					
ST 2024	2146208	Design and Optimization of Conventional and Electrified Automotive Transmissions	2 SWS	Lecture / 🗣	Faust
Exams					
ST 2024	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 2024, 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 11.86 Course: Design of a Jet Engine Combustion Chamber [T-CIWVT-110571]

Responsible: Dr.-Ing. Stefan Raphael Harth
Organisation: KIT Department of Chemical and Process Engineering
Part of: M-MACH-102627 - Major Field: Energy Converting Engines

Type	Credits	Grading scale	Recurrence	Version
Examination of another type	6	Grade to a third	Each winter term	1

Events					
WT 24/25	2232310	Design of a Jet Engine Combustion Chamber	2 SWS	/ 🗣	Harth
Exams					
ST 2024	7232310	Design of a Gas Turbine Combustor			Harth
WT 24/25	7232310	Design of a Jet Engine Combustion Chamber			Harth

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

Competence Certificate
Success control is an examination of another kind according to § 4 Abs. 2 Nr. 3 SPO.

Project: Participation and presentation as well as a final oral examination amounting to max. 30 minutes.

Prerequisites
None

T 11.87 Course: Design of Fuel Cell Systems [T-MACH-111398]

Responsible: Dr.-Ing. Jan Haußmann
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102599 - Major Field: Powertrain Systems
M-MACH-102605 - Major Field: Engineering Design
M-MACH-102623 - Major Field: Fundamentals of Energy Technology

Type	Credits	Grading scale	Recurrence	Expansion	Version
Oral examination	4	Grade to a third	Each winter term	1 terms	2

Events					
WT 24/25	2145200	Design of fuel cell systems	2 SWS	Lecture / 🗣	Haußmann

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

Competence Certificate
Oral exam (app. 30 min)

Prerequisites
None

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

V Design of fuel cell systems

2145200, WS 24/25, 2 SWS, Language: German, Open in study portal

Lecture (V)
On-Site

Content

Within the interactive lecture “Design of fuel cell systems” knowledge, methods and procedures are taught on how fuel cell systems for various applications have to be designed. Starting from the general principles of electrochemical converters the design of the fuel cell and the system components with respect to dimension, geometry and material are discussed. Especially, the lecture will focus on the PEM fuel cell which is highly relevant for mobile applications such as trucks, ships or airplanes. Due to the industry experience of the lecturer in the automotive sector the design of the different components of the fuel cell system can be explained by present use cases.

The students have the opportunity within the lecture to design a complete fuel cell system for a specific application on their own. Starting from the dimensions of a single cell the fuel cell stack and the complete fuel cell system will be designed with respect to the power demand of the application. The relevant criteria power density, efficiency, lifetime and costs will be considered for the design. In detail, the single subsystems such as the hydrogen path, the air path and the cooling system as well as its single components will be engineered. Additionally, hybrid concepts of fuel cell and battery as well as operating strategies for different drive systems with respect to the application will be discussed.

The presented topics are as follows:

- Layout of a fuel cell drive system, hybridization of battery and fuel cell
- Layout of fuel cell systems (fuel cell and system components)
- Design of fuel cells with respect to medium flow, heat transport and electrical conduction
- Measurement techniques to analyze fuel cells and control of system components
- Layout and design of fuel cell components and related manufacturing techniques
- Design of fuel cell systems with respect to power and efficiency
- Degradation of fuel cell components and their influence on lifetime of the fuel cell system

Learning objectives:

The students…

- can differentiate between various system topologies of drive trains and fuel cell systems as well as assign it to possible applications
- can name the function of the system components and can relate their influence on the overall design of the fuel cell system
- can illustrate the layout of a PEM fuel cell and alternative fuel cell types and can relate and name the function of the different components
- can design the fuel cell size and geometry with respect to electric power, heat dissipation and mass flow qualitatively and quantitatively

Literature

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

Manfred Klell, Helmut Eichlseder, Alexander Trattner, Wasserstoff in der Fahrzeugtechnik : Erzeugung, Speicherung, Anwendung, ISBN: 978-3-658-20447-1 , DOI: 10.1007/978-3-658-20447-1

Johannes Töpler, Jochen Lehmann, Wasserstoff und Brennstoffzelle : Technologien und Marktperspektiven, ISBN: 3-642-37414-X , DOI: 10.1007/978-3-642-37415-9

Peter Kurzweil, Brennstoffzellentechnik : Grundlagen, Materialien, Anwendungen, Gaserzeugung, ISBN: 978-3-658-14935-2 , DOI: 10.1007/978-3-658-14935-2

T 11.88 Course: Design of Highly Stresses Components [T-MACH-105310]

Responsible: apl. Prof. Dr. Jarir Aktaa
Organisation: KIT Department of Mechanical Engineering

Part of:
M-MACH-102597 - Compulsory Elective Module Mechanical Engineering
M-MACH-102602 - Major Field: Reliability in Mechanical Engineering
M-MACH-102608 - Major Field: Nuclear Energy
M-MACH-102610 - Major Field: Power Plant Technology
M-MACH-102636 - Major Field: Thermal Turbomachines
M-MACH-102643 - Major Field: Fusion Technology
M-MACH-102650 - Major Field: Combustion Engines Based Powertrains

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

Events					
WT 24/25	2181745	Design of highly stressed components	2 SWS	Lecture / 🗣	Aktaa
Exams					
ST 2024	76-T-MACH-105310	Design of Highly Stresses Components			Aktaa

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

Competence Certificate
oral exam

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

V Design of highly stressed components
2181745, WS 24/25, 2 SWS, Language: German, Open in study portal

Lecture (V)
On-Site

Content
Contents of the lecture:

rules of common design codes

classical models for elasto-plasticity and creep

lifetime rules for creep, fatigue and creep-fatigue interaction

unified constitutive models for thermo-elasto-viscoplasticity

continuum mechanical models for damage at high temperatures

application of advanced material models in FE-codes

The students know about the rules of established design codes for the assessment of components which under operation are subjected to high thermo-mechanical and/or irradiation loadings. They understnd which constitutive equations are used according to state-of-the-art of technology and research to estimate deformation and damage appearing under these loadings and to predict expected lifetime. They gained insight into the application of these generally non-linear constitutive equations in finite element codes and can judge the major issues which shall be thereby taken into account.

Qualification: Materials Sciense, solid mechanics II

regular attendance: 22,5 hours
self-study: 97,5 hours

oral exam ca. 30 minutes

Organizational issues
Die Vorlesung findet ab dem 29.10.2024 statt

Literature
Viswanathan, Damage Mechanisms and Life Assessment of High-Temperature Components, ASM International, 1989.

Lemaitre, J.; Chaboche J.L.: Mechanics of Solid Materials, Cambridge University Press, Cambridge, 1990.

T 11.89 Course: Design Thinking [T-WIWI-102866]

Responsible: Prof. Dr. Orestis Terzidis
Organisation: KIT Department of Economics and Management
Part of: M-MACH-104323 - Major Field: Innovation and Entrepreneurship

Type	Credits	Grading scale	Recurrence	Version
Examination of another type	3	Grade to a third	Irregular	1

Events					
ST 2024	2545008	Design Thinking (Track 1)	2 SWS	Seminar / 🗣	Bhargava, Jochem, Terzidis
WT 24/25	2545008	Design Thinking (Track 1)	2 SWS	Seminar / 🧩	Terzidis
Exams					
ST 2024	7900053	Design Thinking (Track 1)			Terzidis

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

Competence Certificate
Alternative exam assessments (§4(2), 3 SPO).

Prerequisites
None

Recommendation
None

Annotation
The seminar content will be published on the website of the institute.

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

V Design Thinking (Track 1)
2545008, SS 2024, 2 SWS, Language: English, Open in study portal

Seminar (S)
On-Site

Content
Content

Design Thinking is a user-centric innovation management method. The iterative process first analyzes the problem space and builds a sound understanding of the future users. Subsequently, ideas for the solution are generated, prototypes are created and tested by the user group. The result is a proven and validated product.

Learning Objectives

During the seminar, the students learn basic procedures for achieving user-centric innovations. These are concrete methods that start with the potential user of certain products and services. The method is problem-oriented and emphasizes the specific customer situation. After attending the seminar, the students have a clear understanding of the need to explore end-user needs and are able to independently apply the methods of Design Thinking for developing market-driven innovations at a basic level.

Credentials:

ATTENTION: Creditability in the seminar module: The seminar is NOT credited in the seminar module! Crediting is only possible in the EXPERT MODULE ENTREPRENEURSHIP.

Organizational issues
Registration is via the Wiwi-Portal.

V Design Thinking (Track 1)
2545008, WS 24/25, 2 SWS, Language: English, Open in study portal

Seminar (S)
Blended (On-Site/Online)

Content
Course Content:

Design Thinking is a user-centric innovation management method. The iterative process first analyzes the problem space and builds a sound understanding of the future users. Subsequently, ideas for the solution are generated, prototypes are created and tested by the user group. The result is a proven and validated product.

Learning Objectives
During the seminar, the students learn basic procedures for achieving user-centric innovations. These are concrete methods that start with the potential user of certain products and services. The method is problem-oriented and emphasizes the specific customer situation. After attending the seminar, the students have a clear understanding of the need to explore end-user needs and are able to independently apply the methods of Design Thinking for developing market-driven innovations at a basic level.

Credentials:

Registration is via the Wiwi portal.

ATTENTION: Creditability in the seminar module: The seminar is NOT credited in the seminar module! Crediting is only possible in the EXPERT MODULE ENTREPRENEURSHIP.

Organizational issues
Registration is via the Wiwi portal.

In the seminar you will work on a project in teams of 4-5 persons. The groups are formed in the seminar

T 11.90 Course: Design with Plastics [T-MACH-105330]

Responsible: Dipl.-Ing. Markus Liedel
Organisation: KIT Department of Mechanical Engineering

Part of:
M-MACH-102597 - Compulsory Elective Module Mechanical Engineering
M-MACH-102605 - Major Field: Engineering Design
M-MACH-102611 - Major Field: Materials Science and Engineering
M-MACH-102628 - Major Field: Lightweight Construction
M-MACH-102632 - Major Field: Polymer Engineering
M-MACH-102642 - Major Field: Development of Innovative Appliances and Power Tools

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

Competence Certificate
Oral exam, about 20 minutes

Prerequisites
none

Recommendation
Poly I

T 11.91 Course: Designing with Composites [T-MACH-108721]

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

Part of: M-MACH-102597 - Compulsory Elective Module Mechanical Engineering
M-MACH-102607 - Major Field: Vehicle Technology
M-MACH-102628 - Major Field: Lightweight Construction

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

Exams			
ST 2024	76-T-MACH-108721	Designing with Composites	

Competence Certificate
Oral exam, 20 minutes

Prerequisites
None

Annotation
The lecture notes are made available via ILIAS.

T 11.92 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-102597 - Compulsory Elective Module Mechanical Engineering
M-MACH-102605 - Major Field: Engineering Design
M-MACH-102607 - Major Field: Vehicle Technology

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

Events					
WT 24/25	2161229	Designing with numerical methods in product development	2 SWS	Lecture / 🗣	Schnack
Exams					
ST 2024	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 24/25, 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.

Literature
Vorlesungsskript

T 11.93 Course: Development of Hybrid Drivetrains [T-MACH-110817]

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

Part of: M-MACH-102597 - Compulsory Elective Module Mechanical Engineering
M-MACH-102607 - Major Field: Vehicle Technology
M-MACH-102627 - Major Field: Energy Converting Engines
M-MACH-102650 - Major Field: Combustion Engines Based Powertrains

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

Events					
ST 2024	2134155	Development of Hybrid Powertrains	2 SWS	Lecture / 🗣	Koch, Doppelbauer
Exams					
ST 2024	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 2024, 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 11.94 Course: Development of Oil-Hydraulic Powertrain Systems [T-MACH-105441]

Responsible: Dr.-Ing. Gerhard Geerling
Organisation: KIT Department of Mechanical Engineering

Part of:
M-MACH-102597 - Compulsory Elective Module Mechanical Engineering
M-MACH-102599 - Major Field: Powertrain Systems
M-MACH-102605 - Major Field: Engineering Design
M-MACH-102607 - Major Field: Vehicle Technology
M-MACH-102618 - Major Field: Production Technology
M-MACH-102627 - Major Field: Energy Converting Engines
M-MACH-102630 - Major Field: Mobile Machines
M-MACH-102642 - Major Field: Development of Innovative Appliances and Power Tools

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

Events					
WT 24/25	2113072	Development of Oil-Hydraulic Powertrain Systems	2 SWS	Block / 🗣	Geerling

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 24/25, 2 SWS, Language: German, Open in study portal

Block (B)
On-Site

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 11.95 Course: Digital Control [T-MACH-105317]

Responsible: Prof. Dr.-Ing. Michael Knoop
Organisation: KIT Department of Mechanical Engineering

Part of:
M-MACH-102597 - Compulsory Elective Module Mechanical Engineering
M-MACH-102598 - Major Field: Advanced Mechatronics
M-MACH-102601 - Major Field: Automation Technology
M-MACH-102609 - Major Field: Cognitive Technical Systems
M-MACH-102614 - Major Field: Mechatronics
M-MACH-102624 - Major Field: Information Technology
M-MACH-102629 - Major Field: Logistics and Material Flow Theory
M-MACH-102633 - Major Field: Robotics

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

Events					
WT 24/25	2137309	Digital Control	2 SWS	Lecture / 🗣	Knoop, Rack
Exams					
ST 2024	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 24/25, 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: oral examination; duration: 30 minutes

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 11.96 Course: Digital Transformation of Industrial Companies [T-MACH-111298]

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

Part of: M-MACH-102600 - Major Field: Man - Technology - Organisation
M-MACH-102613 - Major Field: Lifecycle Engineering

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

Events					
WT 24/25	2109050	Digital Transformation of Industrial Companies	3 SWS	Block / 🗣	Dommermuth

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

Competence Certificate
oral exam (approx. 30 min)

The exam is offered in German only!

Recommendation
- Previous knowledge of work and production systems as well as industrial engineering recommended
- Knowledge of labor and economics advantageous

Annotation
The course is capacity-limited, therefore the allocation of places is based on § 5 para. 4 in the module handbook: **Registration and admission to module examinations and courses** . This results in the following selection criteria:

- Students of the degree program have priority over students from outside the degree program

- Among students within the degree program, a decision may be made based on academic progress (not just with subject semesters)
- In the case of equal academic progress according to waiting time
- In the case of equal waiting time by lot

The exact procedure is explained on **ILIAS**.

"Successful participation requires active and continuous participation in the course."

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

V Digital Transformation of Industrial Companies

2109050, WS 24/25, 3 SWS, Language: German, Open in study portal

Block (B)
On-Site

Content

Learning objectives:

The ongoing digital Transformation fundamentally changes the conditions and the environment of the industry worldwide. Industrial companies are facing massive socio-technical challenges with the target shaping and implementing the digital Transformation considering individual, holistic, practical and economic aspects. In this course the students especially learn:

Basic knowledge regarding Industrial Engineering, economic design of modern work- and production-systems, applicable Industry 4.0 technologies and their corresponding chances and challenges in a modern work environment (brown- & greenfield)

Keen knowledge regarding industrial companies and their elementary business & process types as a base for a benefit orientated derivation of measures

Ability of maturity estimation for an industrial company, requirements derivation and identification of corresponding potentials for the digital Transformation

Ability of a holistic, individual and economic planning & implementation of the digital Transformation for industrial companies including necessary steps,, corresponding methods and guidelines, as well target measurement to ensure value contribution of implemented solutions (e.g. information technology)

Content:

Theoretical background and basics regarding Industrial Engineering, industrial history and existing structures of globally operating industrial companies

Digital Transformation of industrial companies and effects on the work environment

Analysis status quo of corresponding work- and production-systems of industrial companies

Planning of the digital Transformation

Implementation of the digital Transformation incl. Industry 4.0

Target measurement and conclusions in practice

Organizational:

Compulsory attendance in one week course

Limited number of participants. Registration in ILIAS

The slides and corresponding literature (e.g. ISBN 978-3-662-62822-5) can be downloaded in ILIAS

The corresponding workload of the course is 120 hours (= 4 ECTS)

Type of examination: oral test (about 30 minutes)

Organizational issues

Prüfung am 20.01.2025

T 11.97 Course: Digitalization from Product Concept to Production [T-MACH-113647]

Responsible: Dr.-Ing. Marc Wawerla
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102618 - Major Field: Production Technology

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

Events					
WT 24/25	2149702	Digitalization from Product Concept to Production	2 SWS	Lecture / 🗣	Wawerla

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

Competence Certificate
Alternative test achievement (graded):
- Written processing of a case study (weighting 50%) and
- Presentation of the results (ca. 10 min.) followed by a colloquium (ca. 30 min.), (weighting 50%)

Prerequisites
none

Annotation
For organisational reasons, the number of participants for the course is limited. As a result, a selection process will take place. Further information for application can be found via: https://www.wbk.kit.edu/english/education.php.

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

V Digitalization from Product Concept to Production
2149702, WS 24/25, 2 SWS, Language: English, Open in study portal

Lecture (V)
On-Site

Content
The lecture deals with Digitalization along the entire value chain end-to-end, with a focus on production and supply chain. Within this context, concepts, tools, methods, technologies and concrete applications in the industry are presented. Furthermore, the students get the opportunity to get first-hand insights into the digitalization journey of a German technology company.

Main topics of the lecture:

- Concepts and methods such as disruptive innovation and agile project management
- Overview on technologies at disposal
- Practical approaches in innovation
- Applications in industry
- Field trip to ZEISS

Learning Outcomes:

The students …

- are capable to comment on the content covered by the lecture.
- are able to analyze and evaluate the suitability of digitalization technologies in the optical industry.
- are able to assess the applicability of methods such as disruptive innovation and agile project management.
- are able to appreciate the practical challenges to digitalization in industry.

Workload:

regular attendance: 21 hours
self-study: 99 hours

Organizational issues
Aus organisatorischen Gründen ist die Teilnehmeranzahl für die Lehrveranstaltung begrenzt. Infolgedessen wird ein Auswahlprozess stattfinden. Weitere Informationen zur Bewerbung sind unter https://www.wbk.kit.edu/studium-und-lehre.php zu finden.

For organisational reasons, the number of participants for the course is limited. As a result, a selection process will take place. Further information for application can be found via:
https://www.wbk.kit.edu/english/education.php.

T 11.98 Course: Digitization in the Railway System [T-MACH-113016]

Responsible: Prof. Dr.-Ing. Martin Cichon
Organisation: KIT Department of Mechanical Engineering
Part of: M-MACH-102597 - Compulsory Elective Module Mechanical Engineering
M-MACH-102641 - Major Field: Rail System Technology

Type	Credits	Grading scale	Recurrence	Expansion	Version
Oral examination	4	Grade to a third	Each winter term	1 terms	2

Events					
WT 24/25	2115920	Railway System Digitalisation	2 SWS	Lecture / 🗣	Jost, Cichon
Exams					
WT 24/25	76-T-MACH-106426	Railway System Digitalisation			Jost

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

Competence Certificate
Oral examination
Duration: approx. 20 minutes
No tools or reference material may be used during the exam.

T 11.99 Course: Drive System Engineering A: Automotive Systems [T-MACH-113405]

Responsible: Prof. Dr.-Ing. Tobias Düser
Sascha Ott

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102599 - Major Field: Powertrain Systems
M-MACH-102605 - Major Field: Engineering Design
M-MACH-102607 - Major Field: Vehicle Technology
M-MACH-102637 - Major Field: Tribology

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

Competence Certificate
written examination: 90 min duration

Prerequisites
None

T 11.100 Course: Drive Train of Mobile Machines [T-MACH-105307]

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

Part of: M-MACH-102597 - Compulsory Elective Module Mechanical Engineering
M-MACH-102599 - Major Field: Powertrain Systems
M-MACH-102630 - Major Field: Mobile Machines

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

Events					
WT 24/25	2113077	Drive Train of Mobile Machines	2 SWS	Lecture / 🗣	Geimer
WT 24/25	2113078	Übung zu 'Antriebsstrang mobiler Arbeitsmaschinen'	1 SWS	Practice / 🗣	Geimer, Bargen-Herzog
Exams					
ST 2024	76-T-MACH-105307	Drive Train of Mobile Machines			Geimer
WT 24/25	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 24/25, 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 11.101 Course: Dynamic Systems of Technical Logistics [T-MACH-112113]

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

Part of: M-MACH-102640 - Major Field: Technical Logistics

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

Events					
ST 2024	2148605	Dynamic Systems of Technical Logistics	4 SWS	Lecture / Practice (/ 🗣	Mittwollen
Exams					
ST 2024	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 2024, 4 SWS, Language: German, Open in study portal

Lecture / Practice (VÜ)
On-Site

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 Vorlesungs- und Übungsteil bis ca. Ende Juni gehalten wird. Der anschließende Zeitraum ist ausschließlich für die (optionale) Projektarbeit vorgesehen.

T 11.102 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-102640 - 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 2024	2148606	Dynamic Systems of Technical Logistics - Project	2 SWS	Project (P / 🗣	Mittwollen

Legend: 🖥 Online, ⚄ Blended (On-Site/Online), 🗣 On-Site, x 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 2024, 2 SWS, Language: German, Open in study portal

Project (PRO)
On-Site

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 Mittwochs-Zeitslots für die Vorlesung ausschließlich der Vorlesungs- und Übungsteil bis ca. Ende Juni gehalten wird. Der anschließende Zeitraum ist ausschließlich für die (optionale) Projektarbeit vorgesehen.

T 11.103 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-102598 - Major Field: Advanced Mechatronics
M-MACH-102614 - Major Field: Mechatronics
M-MACH-102647 - Major Field: Microactuators and Microsensors
M-MACH-104434 - Major Field: Modeling and Simulation in Dynamics
M-MACH-104443 - Major Field: Vibration Theory

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

Events					
ST 2024	2162210	Dynamics of electro-mechanical systems	2 SWS	Lecture / ✕	Fidlin
ST 2024	2162211	Dynamics of electro-mechanical systems (Tutorial)	2 SWS	Practice / ✕	Fidlin, Altoé

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 2024, 2 SWS, Language: German, Open in study portal

Lecture (V)
Cancelled

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

Organizational issues
Die Vorlesung Dynamik elektromechanischer Systeme wird im Sommersemester 2024 nicht angeboten.

T 11.104 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-102597 - Compulsory Elective Module Mechanical Engineering
M-MACH-102599 - Major Field: Powertrain Systems
M-MACH-102607 - Major Field: Vehicle Technology
M-MACH-104434 - Major Field: Modeling and Simulation in Dynamics
M-MACH-104443 - Major Field: Vibration Theory

Type	Credits	Grading scale	Recurrence	Version
Oral examination	5	Grade to a third	Each winter term	2

Exams			
ST 2024	76-T-MACH-105226	Dynamics of the Automotive Drive Train	Fidlin

Competence Certificate
Oral examination, 30 min.

Prerequisites
none

Recommendation
Powertrain Systems Technology A: Automotive SystemsMachine DynamicsVibration Theory

T 11.105 Course: Dynamics of Unsteady Flows - Modelling and Control of Industrial Processes [T-MACH-112719]

Responsible: Prof. Dr.-Ing. Bettina Frohnapfel
Prof. Frank Ohle

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102634 - Major Field: Fluid Mechanic

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

Events					
ST 2024	2154444	Dynamics of unsteady flows - modelling and control of industrial processes	2 SWS	Block / Blended	Ohle
Exams					
ST 2024	76-T-MACH-112719	Dynamics of unsteady flows - modelling and control of industrial processes			Ohle

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

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

V Dynamics of unsteady flows - modelling and control of industrial processes

2154444, SS 2024, 2 SWS, Language: German, Open in study portal

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

Content
Fluid mechanical systems are of particular interest in nonlinear dynamics. Such unsteady or complex systems generally have an infinite number of degrees of freedom. In the lecture different methods for the description and control of stationary and unsteady flows are discussed. In addition to the classic methods, methods of nonlinear dynamics are presented, with which the number of degrees of freedom of a complex system can be greatly reduced and only a small number of order parameters are required for modeling. The great advantage of this type of modeling is that specific linear or non-linear time-dependent driving forces can be calculated from these models, with which a dynamical system can be controlled particularly efficiently. The approaches are explained using simple practical examples such as flows behind blunt bodies and other oscillatory systems.

Organizational issues
Die Anmeldung muss bis zum 25.07.24 an sekretariat@istm.kit.edu erfolgen.

T 11.106 Course: Edge-AI in Software and Sensor Applications [T-INFO-110819]

Responsible: Dr. Victor Pankratius
Organisation: KIT Department of Informatics
Part of: M-MACH-102642 - Major Field: Development of Innovative Appliances and Power Tools

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

Events					
ST 2024	2400006	EdgeAI in Software and Sensor Applications	2 SWS	Lecture / 🖥	Pankratius
WT 24/25	2400124	EdgeAI in Software and Sensor Applications	2 SWS	Lecture / 🖥	Pankratius
Exams					
ST 2024	7500196	Edge-AI in Software and Sensor Applications			Pankratius
WT 24/25	7500303	Edge-AI in Software and Sensor Applications			Pankratius

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

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

V EdgeAI in Software and Sensor Applications

2400006, SS 2024, 2 SWS, Language: English, Open in study portal

Lecture (V)
Online

Content

Just imagine a world, where every thing you touch is intelligent and ready to assist you. Where everyday devices learn with you autonomously all the time, augmenting your senses and providing immediate feedback for your decisions. EdgeAI is the next frontier in artificial intelligence that enables such capabilities in the smallest imaginable devices and sensors even when there is no cloud connectivity.

Edge Computing includes applications, data, services at the periphery of networks that are close to real-world sensors. Edge systems are typically constrained in their available energy budget, CPUs, memory, and connectivity. Fog computing further combines these aspects with cloud architectures in order to add enhanced local pre-processing and intelligence that extends the capabilities of classical clouds.

Modern sensor applications - for instance in industrial monitoring and logistics, Internet-of-Things, Ubiquitous Computing, mobile devices, wearables & hearables, health & fitness, drones, or augmented reality - increasingly rely on Edge and Fog Computing to better handle Big Data, always-on applications, continuous fusion of data streams, and new kinds of use cases that were unimaginable before.

In this context, Edge Artificial Intelligence methods (Edge-AI) become key to the realization of continuously learning systems that provide more autonomy and instant feedback. In contrast to mainstream AI, EdgeAI techniques have to cope with significant resource constraints and be fault-tolerant. This course therefore picks up on this exciting topic to provide an overview of state-of-the-art, further dive into current research works, show demonstrations, and discuss open problems.

[Note: Online Video-Streaming and e-Learning will be offered to all registered participants. Details will be communicated to students via the email address provided at the course registration]

Organizational issues

Freitags 8:00-9:30, Beginn 21.4.2023, online. Die Teilnehmerzahl für diese Lehrveranstaltung ist auf 18 begrenzt. Online Streaming / E-Learning der Vorlesung wird für alle angemeldeten Teilnehmer angeboten. Details per Email nach Anmeldung.

Literature

Fog and Edge Computing: Principles and Paradigms, R. Buyya & S. N.Srirama, Wiley 2019, ISBN 978-1119524984

TinyML: Machine Learning with TensorFlow Lite on Arduino and Ultra-Low-Power Microcontrollers, P. Warden & D. Situnayake, O'Reilly 2019, ISBN 978-1492052043

Edge-Oriented Computing Paradigms: A Survey on Architecture Design and System Management, Li et.al., ACM Computing Surveys 51(2), 4/2018, https://doi.org/10.1145/3154815

Practical Deep Learning for Cloud, Mobile & Edge, A. Koul et.al., O'Reilly, 10/2019, ISBN 978-1-492-03486-5

Machine Learning for Data Streams, A. Bifet et.al., The MIT Press, 2017, ISBN 978-0-262-03779-2

V

EdgeAI in Software and Sensor Applications

2400124, WS 24/25, 2 SWS, Language: English, Open in study portal

Lecture (V)
Online

Content

Just imagine a world, where every thing you touch is intelligent and ready to assist you. Where everyday devices learn with you autonomously all the time, augmenting your senses and providing immediate feedback for your decisions. EdgeAI is the next frontier in artificial intelligence that enables such capabilities in the smallest imaginable devices and sensors even when there is no cloud connectivity.

Edge Computing includes applications, data, services at the periphery of networks that are close to real-world sensors. Edge systems are typically constrained in their available energy budget, CPUs, memory, and connectivity. Fog computing further combines these aspects with cloud architectures in order to add enhanced local pre-processing and intelligence that extends the capabilities of classical clouds.

Modern sensor applications - for instance in industrial monitoring and logistics, Internet-of-Things, Ubiquitous Computing, mobile devices, wearables & hearables, health & fitness, drones, or augmented reality - increasingly rely on Edge and Fog Computing to better handle Big Data, always-on applications, continuous fusion of data streams, and new kinds of use cases that were unimaginable before.

In this context, Edge Artificial Intelligence methods (Edge-AI) become key to the realization of continuously learning systems that provide more autonomy and instant feedback. In contrast to mainstream AI, EdgeAI techniques have to cope with significant resource constraints and be fault-tolerant. This course therefore picks up on this exciting topic to provide an overview of state-of-the-art, further dive into current research works, show demonstrations, and discuss open problems.

[Note: Online Video-Streaming and e-Learning will be offered to all registered participants. Details will be communicated to students via the email address provided at the course registration]

Organizational issues

Die Teilnehmerzahl für diese Lehrveranstaltung ist aufgrund der Raumgröße begrenzt. Aufgrund der Covid19-Entwicklung wird Online Streaming / E-Learning der Vorlesung für alle angemeldeten Teilnehmer angeboten, Details per Email nach Anmeldung.

Literature

Fog and Edge Computing: Principles and Paradigms, R. Buyya & S. N.Srirama, Wiley 2019, ISBN 978-1119524984

TinyML: Machine Learning with TensorFlow Lite on Arduino and Ultra-Low-Power Microcontrollers, P. Warden & D. Situnayake, O'Reilly 2019, ISBN 978-1492052043

Edge-Oriented Computing Paradigms: A Survey on Architecture Design and System Management, Li et.al., ACM Computing Surveys 51(2), 4/2018, https://doi.org/10.1145/3154815

Practical Deep Learning for Cloud, Mobile & Edge, A. Koul et.al., O'Reilly, 10/2019, ISBN 978-1-492-03486-5

Machine Learning for Data Streams, A. Bifet et.al., The MIT Press, 2017, ISBN 978-0-262-03779-2

T 11.107 Course: Elective Specialization Supplementary Studies on Science, Technology and Society / About Knowledge and Science - Self-Registration [T-FORUM-113580]

Responsible: Dr. Christine Mielke
Christine Myglas

Organisation:

Part of: M-FORUM-106753 - Supplementary Studies on Science, Technology and Society

Type	Credits	Grading scale	Recurrence	Version
Examination of another type	3	Grade to a third	Each term	1

Competence Certificate
Another type of examination assessment under § 5, section 3 involves a presentation, term paper, or project work within the chosen course.

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:

- Studium Generale. Forum Wissenschaft und Gesellschaft (FORUM) (ehem. ZAK)
- FORUM (ehem. ZAK) Begleitstudium

Recommendation
The contents of the basic module are helpful. The basic module should be completed or attended in parallel, but not after the advanced module.
The reading recommendations for primary and specialist literature are determined individually by the respective lecturers according to the subject area and course.

Annotation
This placeholder can be used for any achievement in the Advanced Unit of the Supplementary Studies.

T 11.108 Course: Elective Specialization Supplementary Studies on Science, Technology and Society / Science in Public Debates - Self Registration [T-FORUM-113582]

Responsible: Dr. Christine Mielke
Christine Myglas

Organisation:

Part of: M-FORUM-106753 - Supplementary Studies on Science, Technology and Society

Type	Credits	Grading scale	Recurrence	Version
Examination of another type	3	Grade to a third	Each term	1

Competence Certificate
Another type of examination assessment under § 5, section 3 involves a presentation, term paper, or project work within the chosen course.

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:

- Studium Generale. Forum Wissenschaft und Gesellschaft (FORUM) (ehem. ZAK)
- FORUM (ehem. ZAK) Begleitstudium

Recommendation
The contents of the basic module are helpful. The basic module should be completed or attended in parallel, but not after the advanced module.
The reading recommendations for primary and specialist literature are determined individually by the respective lecturers according to the subject area and course.

Annotation
This placeholder can be used for any achievement in the Advanced Unit of the Supplementary Studies.

T 11.109 Course: Elective Specialization Supplementary Studies on Science, Technology and Society / Science in Society - Self-Registration [T-FORUM-113581]

Responsible: Dr. Christine Mielke
Christine Myglas

Organisation:

Part of: M-FORUM-106753 - Supplementary Studies on Science, Technology and Society

Type	Credits	Grading scale	Recurrence	Version
Examination of another type	3	Grade to a third	Each term	1

Competence Certificate
Another type of examination assessment under § 5, section 3 involves a presentation, term paper, or project work within the chosen course.

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:

- Studium Generale. Forum Wissenschaft und Gesellschaft (FORUM) (ehem. ZAK)
- FORUM (ehem. ZAK) Begleitstudium

Recommendation
The contents of the basic module are helpful. The basic module should be completed or attended in parallel, but not after the advanced module.
The reading recommendations for primary and specialist literature are determined individually by the respective lecturers according to the subject area and course.

Annotation
This placeholder can be used for any achievement in the Advanced Unit of the Supplementary Studies.

T 11.110 Course: Electric Drives, Power Electronics and Electrical Grids [T-ETIT-112895]

Responsible: Prof. Dr.-Ing. Marc Hiller
Organisation: KIT Department of Electrical Engineering and Information Technology
Part of: M-MACH-102595 - Compulsory Elective Module Natural Science/Computer Science/Electrical Engineering

Type	Credits	Grading scale	Recurrence	Version
Written examination	6	Grade to a third	Each winter term	1

Prerequisites
none

T 11.111 Course: Electrical Engineering for Business Engineers, Part II [T-ETIT-100534]

Responsible: Dr. Wolfgang Menesklou
Organisation: KIT Department of Electrical Engineering and Information Technology
Part of: M-MACH-102739 - Fundamentals and Methods of Automotive Engineering

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

Events					
ST 2024	2304224	Elektrotechnik II für Wirtschaftsingenieure	3 SWS	Lecture / 🗣	Menesklou
Exams					
ST 2024	7304224	Electrical Engineering for Business Engineers, Part II			Menesklou
WT 24/25	7304224	Electrical Engineering for Business Engineers, Part II			Menesklou

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

T 11.112 Course: Elements and Systems of Technical Logistics [T-MACH-102159]

Responsible: Georg Fischer
Dr.-Ing. Martin Mittwollen

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102597 - Compulsory Elective Module Mechanical Engineering
M-MACH-102618 - Major Field: Production Technology

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

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

Prerequisites
none

Recommendation
Knowledge out of "Basics of Technical Logistics I" (T-MACH-109919) preconditioned.

T 11.113 Course: Elements and Systems of Technical Logistics - Project [T-MACH-108946]

Responsible: Georg Fischer
Dr.-Ing. Martin Mittwollen

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102618 - Major Field: Production Technology

Type	Credits	Grading scale	Recurrence	Version
Examination of another type	2	Grade to a third	Each winter term	1

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

Prerequisites
T-MACH-102159 (Elements and Systems of Technical Logistics) must have been started

Modeled Conditions
The following conditions have to be fulfilled:

1. The course T-MACH-102159 - Elements and Systems of Technical Logistics must have been started.

Recommendation
Knowledge out of "Basics of Technical Logistics I" (T-MACH-109919) preconditioned.

T 11.114 Course: Energy and Indoor Climate Concepts [T-ARCH-107406]

Responsible: Prof. Andreas Wagner
Organisation: KIT Department of Architecture
Part of: M-MACH-102648 - Major Field: Energy Technology for Buildings

Type	Credits	Grading scale	Recurrence	Version
Examination of another type	4	Grade to a third	Each summer term	2

Events					
ST 2024	1720970	Energy and Indoor Climate Concepts	2 SWS	Lecture / 🗣	Wagner
Exams					
ST 2024	7000764	Energy and Indoor Climate Concepts			Wagner

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

Competence Certificate
Completed coursework consisting of working on a project (building analysis) and an oral exam (30 minutes).

Prerequisites
none

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

V Energy and Indoor Climate Concepts

1720970, SS 2024, 2 SWS, Language: German, Open in study portal

Lecture (V)
On-Site

Content
The students will become familiar with concepts and technologies of energy-efficient building. Topics like heat protection, passive solar energy use, ventilation systems and passive cooling are addressed. New ways of renewable energy supply show the path towards climate-neutral buildings. On the basis of examples from practice, energy and indoor climate concepts for different buildings types are investigated in detail and analyzed with regard to presented performance criteria. For qualification targets see module handbook.

Appointment: Tues. 09:45 AM - 11:15 AM R240 Bauko

First meeting: Tues. 16.04.2024, 09:45 AM

Submission/Exam: 06.08.2024/07.08.2024

Number of Participants: 10

T 11.115 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-102597 - Compulsory Elective Module Mechanical Engineering
M-MACH-102599 - Major Field: Powertrain Systems
M-MACH-102618 - Major Field: Production Technology
M-MACH-102623 - Major Field: Fundamentals of Energy Technology
M-MACH-102628 - Major Field: Lightweight Construction
M-MACH-102629 - Major Field: Logistics and Material Flow Theory
M-MACH-102630 - Major Field: Mobile Machines
M-MACH-102640 - Major Field: Technical Logistics

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

Events					
WT 24/25	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 24/25, 2 SWS, Language: German, Open in study portal

Lecture (V)
On-Site

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

Organizational issues
Blockveranstaltung 2022/2023. Die Veranstaltung findet in Präsenz statt

Literature
Keine.

T 11.116 Course: Energy Market Engineering [T-WIWI-107501]

Responsible: Prof. Dr. Christof Weinhardt
Organisation: KIT Department of Economics and Management
Part of: M-MACH-104323 - Major Field: Innovation and Entrepreneurship

Type	Credits	Grading scale	Recurrence	Version
Written examination	4,5	Grade to a third	Each summer term	1

Events					
ST 2024	2540464	Energy Market Engineering	2 SWS	Lecture /	Weinhardt, Miskiw
ST 2024	2540465	Übung zu Energy Market Engineering	1 SWS	Practice /	Semmelmann
Exams					
ST 2024	79852	Energy Market Engineering			Weinhardt

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

Competence Certificate
The assessment consists of a written exam (60 min) (according to §4(2), 1 of the examination regulations). By successful completion of the exercises (§4 (2), 3 SPO 2007 respectively §4 (3) SPO 2015) a bonus can be obtained. If the grade of the written exam is at least 4.0 and at most 1.3, the bonus will improve it by one grade level (i.e. by 0.3 or 0.4).

Prerequisites
None

Recommendation
None

Annotation
Former course title until summer term 2017: T-WIWI-102794 "eEnergy: Markets, Services, Systems".

The lecture has also been added in the IIP Module *Basics of Liberalised Energy Markets*.

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

V Energy Market Engineering
2540464, SS 2024, 2 SWS, Language: German, Open in study portal

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

Content
The lecture "Energy Market Engineering" addresses the design and analysis of energy markets considering current developments and challenges. A particular focus is on the integration of renewable energies and the associated market mechanisms and regulations.

Specifically, the following topics are covered:

- **Introduction to Market Engineering**: What design elements do markets and specifically auctions have in general, and what influence does this have on participant behavior.
- **Introduction to Energy Markets**: Fundamentals and current trends in the energy system, including climate change and the expansion of renewable energies.
- **Market Design and Products**: Various pricing models such as nodal pricing, zonal pricing, and the structure of capacity markets.
- **Grid Expansion, Distribution Networks, and Flexibility Markets**: Analysis of distribution network markets and the role of flexibility options like demand response and storage technologies.
- **Intermittent Generation and Grid Stability**: Challenges posed by fluctuating renewable energies and strategies to ensure grid stability.
- **Digitalization and Market Transparency**: The role of digitalization in improving market transparency and efficiency, including the use of smart metering systems and data-driven approaches.
- **Current Research Projects and Developments**: Presentation of ongoing research projects and their significance for the future design of energy markets.

Literature

- Erdmann G, Zweifel P. *Energieökonomik, Theorie und Anwendungen*. Berlin Heidelberg: Springer; 2007.
- Grimm V, Ockenfels A, Zoettl G. Strommarktdesign: Zur Ausgestaltung der Auktionsregeln an der EEX *. *Zeitschrift für Energiewirtschaft*. 2008:147-161.
- Stoft S. *Power System Economics: Designing Markets for Electricity*. IEEE; 2002.,
- Ströbele W, Pfaffenberger W, Heuterkes M. *Energiewirtschaft: Einführung in Theorie und Politik*. 2nd ed. München: Oldenbourg Verlag; 2010:349.

T 11.117 Course: Energy Storage and Network Integration [T-MACH-105952]

Responsible: Dr. Ferdinand Schmidt
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102597 - Compulsory Elective Module Mechanical Engineering

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

Events					
WT 24/25	2189487	Energy Storage and Grid Integration	2 SWS	Lecture / 🗣	Schmidt
Exams					
ST 2024	76-T-MACH-105952	Energy Storage and Grid Integration			Schmidt
WT 24/25	76-T-MACH-105952	Energy Storage and Grid Integration			Schmidt

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

Competence Certificate
oral exam, about 30 minutes

Prerequisites
The courses T-MACH-105952 Energiespeicher und Netzintegration and T-ETIT-104644 - Energy Storage and Network Integration can not be combined.

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

V Energy Storage and Grid Integration
2189487, WS 24/25, 2 SWS, Language: German, Open in study portal

Lecture (V)
On-Site

Content
The lecture provides an overview of the different storage types and their fundamental integration into the power supply grid.

Thereby, within the scope of this lecture, the necessity and the motivation for converting and storing energy will be given. Starting from the definition of fundamental terms different physical and chemical storage types along with their theoretical and practical basis are described. In particular, the decoupling of energy production and energy consumption, and the provision of different energy scales (time, power, density) will be discussed. Furthermore, the challenge of energy transport and re-integration into the different grid types is considered.

Students understand the different types of energy storage and apply their knowledge for the selection and principal dimensioning of relevant energy storage tasks.

Furthermore, students can reflect the state-of-the-art of most important energy storage types, their fundamental characterisitics and viability at given boundary conditions and they are enabled to elaborate and apply basic integration issues dependent on the grid structure for the different network types.

Oral exam, duration approximately 30 min, tools: none

Literature
M. Sterner, I. Stadler: Energiespeicher - Bedarf, Technologien, Integration. Springer 2017, https://link.springer.com/book/10.1007/978-3-662-48893-5

T 11.118 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-102597 - Compulsory Elective Module Mechanical Engineering
M-MACH-102623 - Major Field: Fundamentals of Energy Technology
M-MACH-102643 - Major Field: Fusion Technology
M-MACH-102648 - Major Field: Energy Technology for Buildings

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

Events					
WT 24/25	2129901	Energy Systems I - Renewable Energy	2 SWS	Lecture / 🗣	Dagan
Exams					
ST 2024	76-T-MACH-105408	Energy Systems I: Renewable Energy			Dagan
WT 24/25	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 24/25, 2 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

11.119 Course: Energy Systems II: Reactor Physics [T-MACH-105550]

Responsible: Dr. Aurelian Florin Badea
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102608 - Major Field: Nuclear Energy

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

Events					
ST 2024	2130929	Energy systems II: Reactor Physics	2 SWS	Lecture / 🗣	Badea
Exams					
ST 2024	76-T-MACH-105550	Energy Systems II: Reactor Physics			Badea
WT 24/25	76-T-MACH-105550	Energy Systems II: Reactor Physics			Badea

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 Energy systems II: Reactor Physics

2130929, SS 2024, 2 SWS, Language: German, Open in study portal

Lecture (V)
On-Site

Content
The goal of the course is to train the students for the field of nuclear energy using fission reactors. The students acquire comprehensive knowledge on the physics of nuclear fission reactors: neutron flux, cross sections, fission, breeding processes, chain reaction, critical size of a nuclear system, moderation, reactor dynamics, transport- and diffusion-equation for the neutron flux distribution, power density distributions in reactor, one-group, two-group and multi-group theories for the neutron spectrum. Students are able to analyze and understand the obtained results. Based on the reactor physics knowledge, the students are able to understand, compare and evaluate the capabilities of different types of reactors - LWR, heavy water reactors, nuclear power systems of generation IV – as well as their fundamental nuclear safety concepts. The students are qualified for further training in nuclear energy and safety field and for (also research-related) professional activity in the nuclear industry.

- nuclear fission & fusion,
- radioactive decay, neutron excess, fission, fast and thermal neutrons, fissile and fertile nuclei,
- neutron flux, cross section, reaction rate, mean free path, chain reaction, critical size, moderation,
- reactor dynamics,
- transport- and diffusion-equation for the neutron flux distribution, power distributions in reactor,
- one-group and two-group theories,
- light-water reactors,
- reactor safety,
- design of nuclear reactors,
- breeding processes,
- nuclear power systems of generation IV

Organizational issues
Di (30.07.2024), 09:00 bis 17:00
Do (01.08.2024), 09:00 bis 17:00
Fr (02.08.2024), 09:00 bis 17:00

Literature

Dieter Schmidt, Reaktortechnik, Band 1: Grundlagen, ISBN 3 7650 2003 6

Dieter Schmidt, Reaktortechnik, Band 2: Anwendungen, ISBN 3 7650 2004 4

T 11.120 Course: Energy Topology and Resilience [T-MACH-112755]

Responsible: Dr. Sadeeb Simon Ottenburger
Organisation: KIT Department of Mechanical Engineering
Part of: M-MACH-102623 - 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 2024	2153446	Energy Topology and Resilience	2 SWS	Lecture / 🗣	Ottenburger
Exams					
ST 2024	76-T-MACH-112755	Energy Topology and Resilience			Ottenburger

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

Competence Certificate
oral

Duration: approx. 30 minutes

No auxiliary meand

Prerequisites
none

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

V Energy Topology and Resilience

2153446, SS 2024, 2 SWS, Language: English, Open in study portal

Lecture (V)
On-Site

Content
The topic of energy security is becoming increasingly relevant in the context of the energy transition, especially against the backdrop of primary energy shortages, new vulnerabilities of smart and complex networked energy systems (cyber attacks), new threats (e.g., consequences of climate change).

Against the background of new risks and uncertainties, the question arises to what extent the design of cyber-physical systems such as smart grids can minimize systemic risks despite large uncertainties and which topological degrees of freedom play a special role for this.

After an introduction to resilience research, this lecture addresses current questions on the impact of utility grid design on supply security from a mathematical-physical perspective in the context of the energy transition and smart grids. With the addition of socio-economic constraints, solution approaches lead to hard optimization problems, since there are, e.g., many degrees of freedom in spatial-topological planning in addition to questions about the grid-intrinsic design. Resilience metrics are derived from an analytical understanding on systemic vulnerability and on systemic risks related to utility networks, which are then used in the formulation of optimization problems to identify resilient and techno-economically feasible utility networks.
Key topics:

- Resilient utility networks
- Topology: Degrees of Freedom
- Systemic risks: sys. Vulnerability
- Resilience metrics for networks and microgrid-based power systems
- Topological Optimization and Simulation: Optimization Problems and Solvers

Literature
References:

1. Resilience engineering: theory and practice in interdependent infrastructure systems, A. J. Hickford et al., 2018, Environment Systems and Decisions,
2. Resilience of Critical Infrastructures: A Risk Assessment Methodology for Energy Corridors, A. Carpignano et al., 2020, Issues on Risk Analysis for
3. Power System Resilience: Current Practices, Challenges, and Future Directions, N. Bhusal et al., 2020, IEEE Power & Energy Society Section, https://ieeexplore.ieee.org/document/8966351
4. Globally networked risks and how to respond, D. Helbing, 2013, Nature, https://www.nature.com/articles/nature12047
5. Catastrophic cascade of failures in interdependent networks, S. Buldyrev, 2010, Nature letters, https://www.nature.com/articles/nature08932
6. Component Criticality in Failure Cascade Processes of Network Systems, E. Zio et al., 2011, Risk Analysis, https://doi.org/10.1111/j.1539-6924.2011.01584.
7. Network topology optimization by turning non-scale-free networks into scale-free networks using nonlinear preferential rewiring method, F. Su et al.,
8. Reliable Overlay Topology Design for the Smart Microgrid Network, M. Erol-Kantarci, 2011, IEEE Network, https://ieeexplore.ieee.org/document/6033034
9. Structured Energy: Microgrids and Autonomous Transactive Operation, W. Cox et al., 2013, IEEE PES Innovative Smart Grid Technologies Conference,
10. Importance Measures in Reliability, Risk and Optimization, W. Kuo et al., 2012, Wiley, ISBN: 978-1-119-99344-5
11. Non-linear Multiobjective Optimization, K. Miettinen, 1999, International series in operations research & management science 12; Kluwer Academic

T 11.121 Course: Engine Laboratory [T-MACH-105337]

Responsible: Dr.-Ing. Uwe Wagner
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102591 - Laboratory Course
M-MACH-102627 - Major Field: Energy Converting Engines
M-MACH-102650 - Major Field: Combustion Engines Based Powertrains
M-MACH-102650 - Major Field: Combustion Engines Based Powertrains

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

Events					
ST 2024	2134001	Engine Laboratory	2 SWS	Practical course / 🗣	Wagner
Exams					
ST 2024	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 2024, 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 11.122 Course: Engine Measurement Techniques [T-MACH-105169]

Responsible: Dr.-Ing. Sören Bernhardt
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102597 - Compulsory Elective Module Mechanical Engineering
M-MACH-102607 - Major Field: Vehicle Technology
M-MACH-102624 - Major Field: Information Technology
M-MACH-102650 - Major Field: Combustion Engines Based Powertrains
M-MACH-102650 - Major Field: Combustion Engines Based Powertrains

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

Events					
ST 2024	2134137	Engine measurement techniques	2 SWS	Lecture / 🗣	Bernhardt
Exams					
ST 2024	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 2024, 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 11.123 Course: Engineer's Field of Work [T-MACH-105721]

Responsible: Prof. Dr. Martin Doppelbauer
Prof. Dr.-Ing. Marcus Geimer

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102824 - Key Competencies

Type	Credits	Grading scale	Recurrence	Version
Completed coursework (written)	2	pass/fail	Each summer term	2

Events					
ST 2024	2114917	Engineer's Field of Work	2 SWS	Lecture / 🗣	Doppelbauer, Geimer
Exams					
ST 2024	76-T-MACH-105721	Engineer's Field of Work			Doppelbauer, Geimer
WT 24/25	76-T-MACH-105721	Engineer's Field of Work			Geimer, Doppelbauer

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

Competence Certificate
written test

Duration: 60 minutes

result: passed / not passed

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 Engineer's Field of Work

2114917, SS 2024, 2 SWS, Language: German, Open in study portal

Lecture (V)
On-Site

Content
AFI1: Organization of Companies (Marcus Geimer)
organizational structure, organizational units, managerial structure, organization charts, project organization, relation between superior and staff, board of managing directors, management of the company, supervisory board, advisory board

AFI 2: Project Management (Marcus Geimer)
definition of project, project manager, project team, primary processes, supporting processes

AFI3: Personnel Development (Martin Doppelbauer)
applications, trainee programs, management career, professional career, career paths in companies, individual career planning, tasks of HR, manpower requirements planning, training, training-on-the-job, tools for human resource management, annual personnel talk, objective agreement

AFI4: Scheduling (Marcus Geimer)
Methods for detailed scheduling, network plans, critical path, Gantt-diagram, milestones

AFI5a/b: Development Processes (Martin Doppelbauer)
research, advance development, series development, product marketing, V-model, SPALTEN-model, technical specifications, requirement specifications, clarification, concept, draft, elaboration, validation, verification, documentation, FMEA

AFI6: Standards and Laws (Martin Doppelbauer)
importance of standards, German and international standardization systems, committees, certification

AFI7: Commercial Law (Martin Doppelbauer)
health protection, safety at work, environment protection, product liability, patents

AFI8: Calculation, Financial Statement (Marcus Geimer)
contract award estimate, project costing, unit cost, target costs, cost center accounting, cost recording, hourly rates, asset accounting, profit and loss statement

AFI9: Governance (Marcus Geimer)
principles of governance (accountability, responsibility, transparency, fairness), leadership (technical, commercial), reviews, boards, audits, codetermination, compliance

T 11.124 Course: Entrepreneurship [T-WIWI-102864]

Responsible: Prof. Dr. Orestis Terzidis
Organisation: KIT Department of Economics and Management
Part of: M-MACH-104323 - Major Field: Innovation and Entrepreneurship

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

Events					
ST 2024	2545001	Entrepreneurship	2 SWS	Lecture / 🧩	Terzidis, Dang
WT 24/25	2545001	Entrepreneurship	2 SWS	Lecture / 🧩	Terzidis, Dang
Exams					
ST 2024	7900002	Entrepreneurship			Terzidis
ST 2024	7900192	Entrepreneurship			Terzidis
WT 24/25	7900045	Entrepreneurship			Terzidis

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

Competence Certificate
The assessment consists of a written exam (60 minutes) (following §4(2), 1 of the examination regulation).

Students are offered the opportunity to earn a grade bonus through separate assignments. If the grade of the written exam is between 4.0 and 1.3, the bonus improves the grade by a maximum of one grade level (0.3 or 0.4). The exact criteria for awarding a bonus will be announced at the beginning of the lecture.

Prerequisites
None

Recommendation
None

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

V Entrepreneurship
2545001, SS 2024, 2 SWS, Language: English, Open in study portal

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

Content
The lecture as a compulsory part of the module "Entrepreneurship" introduces the basic concepts of entrepreneurship. Important concepts and empirical facts are introduced, which relate to the conception and implementation of newly founded companies.

The focus here is on introducing methods for generating innovative business ideas, translating patents into business concepts, and general principles of business modeling and business planning. In particular, approaches such as Lean-Startup and Effectuation as well as concepts for financing young companies are covered.

A "KIT Entrepreneurship Talk" is part of each session, in which experienced founder and entrepreneur personalities report on their experiences in the practice of the establishment of an enterprise. Dates and speakers will be announced on the EnTechnon homepage.

Learning objectives:

The students will be introduced to the topic of entrepreneurship. After successful attendance of the course they should have an overview of the sub-areas of entrepreneurship and be able to understand basic concepts of entrepreneurship and apply key concepts.

Workload:

The total effort with 3 credit points: approx. 90 hours
Presence time: 30 hours
Pre- and postprocessing of the LV: 45.0 hours
Exam and exam preparation: 15.0 hours

Examination:

The assessment consists of a written exam (60 minutes) (following §4(2), 1 of the examination regulation)

A grade bonus can be earned by successfully participating in a case study as part of the Entrepreneurship lecture. If the grade of the written exam is between 4.0 and 1.3, the bonus improves the grade by up to 0.3 or 0.4. The bonus only applies if you have passed the exam with at least a 4.0. More details will be provided in the lecture. Participation in the case study is voluntary.

Exam dates: tbd

Organizational issues
VL findet jeweils Di, 15:45 - 19:00 an folgenden Terminen statt:

16.04.2024
23.04.2024
30.04.2024
07.05.2024
14.05.2024
28.05.2024
04.06.2024
11.06.2024 (Prep Session)

17.06.2024 (Klausur)

Literature
Füglistaller, Urs, Müller, Christoph und Volery, Thierry (2008): Entrepreneurship

Ries, Eric (2011): The Lean Startup

Osterwalder, Alexander (2010): Business Model Generation

Aulet, Bill (2013): Disciplined Entrepreneurship. 24 Steps to a Successful Startup. Hoboken: Wiley.

R.C. Dorf, T.H. Byers: Technology Ventures – From Idea to Enterprise., (McGraw Hill 2008)

Hisrich, Robert D.; Ramadani, Veland (2017): Effective entrepreneurial management. Strategy, planning, risk management, and organization. Cham, Switzerland: Springer.

V **Entrepreneurship**
2545001, WS 24/25, 2 SWS, Language: English, Open in study portal

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

Content
The lecture as an obligatory part of the module "Entrepreneurship" introduces the basic concepts of entrepreneurship. Important concepts and empirical facts are presented that relate to the conception and implementation of newly founded companies.

The focus here is on the introduction to methods for generating innovative business ideas, for transferring patents into business concepts and general principles of business modelling and business planning. In particular approaches such as Lean Startup and Effectuation as well as concepts for the financing of young enterprises are treated.

A "KIT Entrepreneurship Talk" is part of each session, in which experienced founder and entrepreneur personalities report on their experiences in practice of the establishment of an enterprise. Dates and speakers will be announced on the EnTechnon homepage.

Learning objectives:

The studentsare introduced to the topic Entrepreneurship. After successful attendance of the meeting they are to have an overview of the subranges of the Entrepreneurships and be able to understand basic concepts of the Entrepreneurships and apply key concepts.

Workload:

Total effort with 3 credit points: approx. 90 hours
Presence time: 30 hours
Pre- and postprocessing of the LV: 45.0 hours
Exam and exam preparation: 15.0 hours

Examination:

The assessment of success takes place in the form of a written examination (60 min.) (according to §4(2), 1 SPO). The grade is the grade of the written exam.

A grade bonus can be earned through successful participation in a case study in the Entrepreneurship lecture. If the grade of the written exam is between 4.0 and 1.3, the bonus improves the grade by up to 0.3 or 0.4.The bonus only applies if you have passed the exam with at least a 4.0. More details will be provided in the lecture. Participation in the case study is voluntary.

Exam date: tba

Organizational issues
VL findet jeweils Mo, 15:45 - 19:00 an folgenden Terminen statt:
21.10.2024
28.10.2024
04.11.2024
11.11.2024
18.11.2024
25.11.2024
02.12.2024
09.12.2024 (Prep Session 13:30 - 14:30)

Literature
Aulet, Bill (2013): Disciplined Entrepreneurship. 24 Steps to a Successful Startup. Hoboken: Wiley.

R.C. Dorf, T.H. Byers: Technology Ventures – From Idea to Enterprise., (McGraw Hill 2008)

Füglistaller, Urs, Müller, Christoph and Volery, Thierry (2008): Entrepreneurship

Hisrich, Robert D.; Ramadani, Veland (2017): Effective entrepreneurial management. Strategy, planning, risk management, and organization. Cham, Switzerland: Springer.

Ries, Eric (2011): The Lean Startup.

Osterwalder, Alexander (2010): Business Model Generation.

T 11.125 Course: Excercises - Fatigue of Welded Components and Structures [T-MACH-109304]

Responsible: Dr. Majid Farajian
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102597 - Compulsory Elective Module Mechanical Engineering

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

Competence Certificate
successful solving of all exercises

Prerequisites
none

11.126 Course: Exercices - Tribology [T-MACH-109303]

Responsible: Prof. Dr. Martin Dienwiebel
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102599 - Major Field: Powertrain Systems
M-MACH-102637 - Major Field: Tribology
M-MACH-102650 - Major Field: Combustion Engines Based Powertrains

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

Events					
WT 24/25	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 24/25, 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 11.127 Course: Exercises for Applied Materials Simulation [T-MACH-110928]

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

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102597 - Compulsory Elective Module Mechanical Engineering

Type	Credits	Grading scale	Recurrence	Version
Completed coursework	2	pass/fail	Each summer term	1

Events					
ST 2024	2182616	Applied Materials Simulation	4 SWS	Lecture / Practice (/ 🗣	Gumbsch
Exams					
ST 2024	76-T-MACH-110928	Exercises for Applied Materials Simulation			Gumbsch

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

Competence Certificate
successful solving of all exercises

Prerequisites
T-MACH-107671 – Übungen zu Angewandte Werkstoffsimulation has not been started

Modeled Conditions
The following conditions have to be fulfilled:

1. The course T-MACH-107671 - Exercises for Applied Materials Simulation must not have been started.

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

V Applied Materials Simulation

2182616, SS 2024, 4 SWS, Language: English, Open in study portal

Lecture / Practice (VÜ)
On-Site

Content
This lecture should give the students an overview of different simulation methods in the field of materials science and engineering. Numerical methods are presented and their use in different fields of application and size scales shown and discussed. On the basis of theoretical as well as practical aspects, a critical examination of the opportunities and challenges of numerical material simulation shall be carried out.

The student can

- define different numerical methods and distinguish their range of application
- approach issues by applying the finite element method and discuss the processes and results
- understand complex processes of metal forming and crash simulation and discuss the structural and material behavior
- define and apply the physical fundamentals of particle-based simulation techniques to applications of materials science
- illustrate the range of application of atomistic simulation methods and distinguish between different models

preliminary knowlegde in mathematics, physics and materials science recommended

regular attendance: 34 hours

exercise: 11 hours

self-study: 165 hours

oral exam ca. 35 minutes

no tools or reference materials

admission to the exam only with successful completion of the exercises

Literature

1. D. Frenkel, B. Smit: Understanding Molecular Simulation: From Algorithms to Applications, Academic Press, 2001
2. W. Kurz, D.J. Fisher: Fundamentals of Solidification, Trans Tech Publications, 1998
3. P. Haupt: Continuum Mechanics and Theory of Materials, Springer, 1999
4. M. P. Allen, D. J. Tildesley: Computer simulation of liquids, Clarendon Press, 1996

T 11.128 Course: Exercises for Applied Materials Simulation [T-MACH-107671]

Responsible: Prof. Dr. Peter Gumbsch
Dr.-Ing. Johannes Schneider
Organisation: KIT Department of Mechanical Engineering
Part of: M-MACH-102597 - Compulsory Elective Module Mechanical Engineering

Type	Credits	Grading scale	Recurrence	Version
Completed coursework	2	pass/fail	Each summer term	3

Events					
ST 2024	2182614	Applied Materials Simulation	4 SWS	Lecture / Practice (/ 🖥	Gumbsch
Exams					
ST 2024	76-T-MACH-107671	Exercises for Applied Materials Simulation			Gumbsch, Schulz

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

Competence Certificate
successful solving of all exercises

Prerequisites
T-MACH-110928 – Exercises for Applied Materials Simulation has not been started

Modeled Conditions
The following conditions have to be fulfilled:

1. The course T-MACH-110928 - Exercises for Applied Materials Simulation must not have been started.

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

V Applied Materials Simulation

2182614, SS 2024, 4 SWS, Language: German, Open in study portal

Lecture / Practice (VÜ)
Online

Content
This lecture should give the students an overview of different simulation methods in the field of materials science and engineering. Numerical methods are presented and their use in different fields of application and size scales shown and discussed. On the basis of theoretical as well as practical aspects, a critical examination of the opportunities and challenges of numerical material simulation shall be carried out.

The student can

- define different numerical methods and distinguish their range of application
- approach issues by applying the finite element method and discuss the processes and results
- understand complex processes of metal forming and crash simulation and discuss the structural and material behavior
- define and apply the physical fundamentals of particle-based simulation techniques to applications of materials science
- illustrate the range of application of atomistic simulation methods and distinguish between different models

preliminary knowlegde in mathematics, physics and materials science recommended

regular attendance: 34 hours

exercise: 11 hours

self-study: 165 hours

oral exam ca. 35 minutes

no tools or reference materials

admission to the exam only with successful completion of the exercises

Organizational issues

Die Vorlesung wir nur als Aufzeichnung angeboten!

Bitte besuchen Sie die englischsprachige Veranstaltung "Applied Materials Simulation" (2182616)!

Weitere Informationen finden Sie in ILIAS.

Kontakt: johannes.schneider@kit.edu

Literature

1. D. Frenkel, B. Smit: Understanding Molecular Simulation: From Algorithms to Applications, Academic Press, 2001
2. W. Kurz, D.J. Fisher: Fundamentals of Solidification, Trans Tech Publications, 1998
3. P. Haupt: Continuum Mechanics and Theory of Materials, Springer, 1999
4. M. P. Allen, D. J. Tildesley: Computer simulation of liquids, Clarendon Press, 1996

T 11.129 Course: Exercises for Fundamentals in Materials Thermodynamics and Heterogeneous Equilibria [T-MACH-107669]

Responsible: Prof. Dr. Hans Jürgen Seifert

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102597 - Compulsory Elective Module Mechanical Engineering

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

Events					
WT 24/25	2193005	Exercises for Fundamentals in Materials Thermodynamics and Heterogeneous Equilibria	1 SWS	Practice / 🗣	Seifert, Ziebert, Dürrschnabel

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

Competence Certificate
successful solving of all exercises

Prerequisites
T-MACH-110924 – Exercises for Fundamentals in Materials Thermodynamics and Heterogeneous Equilibria has not been started

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

V Exercises for Fundamentals in Materials Thermodynamics and Heterogeneous Equilibria

Practice (Ü)
On-Site

2193005, WS 24/25, 1 SWS, Language: German, Open in study portal

Content
1. Ternary phase diagrams

- Complete solubility

- Eutectic systems

2. Thermodynamics of solution phases

3. Materials reactions involving pure condensed phases and a gaseous phase

4. Reaction equilibria in systems containing components in condensed solutions

This exercise deals with the construction of isothermal sections and isopleths in ternary materials systems. The thermodynamic properties of multiphase engineering materials are calculated.

Recommendations:

- Lecture in Fundamentals in Materials Thermodynamics and Heterogeneous Equilibria
- Basic course in materials science and engineering
- physical chemistry

regular attendance: 14 hours

self-study: 46 hours

Organizational issues
Die genauen Termine werden in der ersten Vorlesung (23.10.24) bekannt gegeben.

Die Übungen finden ab der zweiten Vorlesungswoche montags, 09:45-11:15 Uhr in Geb. 10.50, HS 102 statt.

Literature
1. Phase Equilibria, Phase Diagrams and Phase Transformations, Their Thermodynamic Basis; M. Hillert, University Press, Cambridge (2007)

2. Introduction to the Thermodynamics of Materials; D.R. Gaskell, Taylor & Francis (2008)

T 11.130 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-102611 - Major Field: Materials Science and Engineering

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

Events					
ST 2024	2174586	Materials Characterization	2 SWS	Lecture / 🗣	Gibmeier, Peterlechner
ST 2024	2174988	Tutorials and lab courses for "materials characterization"	1 SWS	Practice / 🗣	Gibmeier, Peterlechner
Exams					
ST 2024	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 2024, 2 SWS, Language: German, Open in study portal

Lecture (V)
On-Site

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**.**

Literature
Vorlesungsskript (wird zu Beginn der Veranstaltung ausgegeben).

Literatur wird zu Beginn der Veranstaltung bekanntgegeben.

V Tutorials and lab courses for "materials characterization"

2174988, SS 2024, 1 SWS, Language: German, Open in study portal

Practice (Ü)
On-Site

Content
s. lecture "materials characterization" (V-No. 2174586)

Organizational issues
Die Termine und der Ort zu den Übungen und Laborbesuche zur Vorlesung Werkstoffanalytik (V-Nr. 2174586) werden in der Vorlesung bekanntgegeben.

The dates and locations of the tutorials and lab courses for the lecture materials characterization (V-No. 2174586) will be announced in one of the first lectures.

Literature
Vorlesungsskript (wird zu Beginn der Veranstaltung ausgegeben).

Literatur wird zu Beginn der Veranstaltung bekanntgegeben.

T 11.131 Course: Exercises for Solid State Reactions and Kinetics of Phase Transformations [T-MACH-107632]

Responsible: Dr. Peter Franke
Prof. Dr. Hans Jürgen Seifert

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102597 - Compulsory Elective Module Mechanical Engineering
M-MACH-102611 - Major Field: Materials Science and Engineering

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

Events					
WT 24/25	2193004	Exercises for Solid State Reactions and Kinetics of Phase Transformations	1 SWS	Practice / 🗣	Franke, Ziebert

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

Competence Certificate
successful processing of exercises

Prerequisites
T-MACH-110926 – Exercises for Solid State Reactions and Kinetics of Phase Transformations has not been started

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

V Exercises for Solid State Reactions and Kinetics of Phase Transformations

Practice (Ü)
On-Site

2193004, WS 24/25, 1 SWS, Language: German, Open in study portal

Content
1. Fick's laws of diffusion

2. Calculation of diffusion coefficients

3. Diffusion and solidification

Recommendations: Lecture in Solid State Reactions and Kinetics of Phase Transformations; Basic course in materials science and engineering; physical chemistry

Reinforcement of the lecture by the solution of practical and lecture-relevant exercises

regular attendance: 14 hours

self-study: 46 hours

Literature
Vorlesungsskript;

Lecture notes

T 11.132 Course: experimental Characterisation of thermo-visco-elastic materials [T-MACH-112758]

Responsible: Prof. Dr.-Ing. Thomas Böhlke
Dr.-Ing. Maria Loredana Kehrer

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102646 - Major Field: Applied Mechanics
M-MACH-102743 - Fundamentals and Methods of Theoretical Foundations of Mechanical Engineering

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

Exams			
ST 2024	76-T-MACH-112758	experimental Characterisation of thermo-visco-elastic materials	Böhlke, Kehrer

Competence Certificate
oral examination

Prerequisites
none

T 11.133 Course: Experimental Dynamics [T-MACH-105514]

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

Part of: M-MACH-102598 - Major Field: Advanced Mechatronics
M-MACH-102614 - Major Field: Mechatronics
M-MACH-104434 - Major Field: Modeling and Simulation in Dynamics
M-MACH-104443 - Major Field: Vibration Theory

Type	Credits	Grading scale	Recurrence	Version
Oral examination	5	Grade to a third	Each summer term	2

Events					
ST 2024	2162225	Experimental Dynamics	3 SWS	Lecture / ✕	Fidlin
ST 2024	2162228	Übungen zu Experimentelle Dynamik	2 SWS	Practice / ✕	Fidlin, Genda
Exams					
ST 2024	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 2024, 3 SWS, Language: German, Open in study portal

Lecture (V)
Cancelled

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

Organizational issues
Die Vorlesung Experimentelle Dynamik wird im Sommersemester 2024 nicht angeboten.

T 11.134 Course: Experimental Fluid Mechanics [T-MACH-105512]

Responsible: Dr. Jochen Kriegseis
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102597 - Compulsory Elective Module Mechanical Engineering
M-MACH-102627 - Major Field: Energy Converting Engines
M-MACH-102634 - Major Field: Fluid Mechanic
M-MACH-102636 - Major Field: Thermal Turbomachines

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

Events					
ST 2024	2154446	Experimental Fluid Mechanics	2 SWS	Lecture / Blended	Kriegseis
WT 24/25	2153530	Experimental Fluid Mechanics	2 SWS	Lecture / Blended	Kriegseis
Exams					
ST 2024	76-T-MACH-105512	Experimental Fluid Mechanics			Kriegseis

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 Experimental Fluid Mechanics
2154446, SS 2024, 2 SWS, Language: German, Open in study portal

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

Content
This lecture focuses on experimental methods of fluid mechanics and their application to solve flow problems of practical relevance. In addition, measurement signals and data, obtained with the discussed measuring techniques, are evaluated, presented and discussed.

The lecture covers a selection of the following topics:

- measuring techniques and measureable quantities
- measurements in turbulent flows
- pressure measurements
- hot wire measurements
- optical measuring techniques
- error analysis
- scaling laws
- signal and data evaluation

Organizational issues
Die Vergabe von Leistungspunkten zu den Veranstaltungen mit LVNr 2154446 und 2153530 schließt sich gegenseitig aus.

Literature
Tropea, C., Yarin, A.L., Foss, J.F.: Springer Handbook of Experimental Fluid Mechanics, Springer 2007

Nitsche, W., Brunn, A.: Strömungsmesstechnik, Springer, 2006

Spurk, J.H.: Strömungslehre, Springer, 1996

V Experimental Fluid Mechanics
2153530, WS 24/25, 2 SWS, Language: English, Open in study portal

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

Content

The students can describe the relevant physical principles of experimental fluid mechanics. They are qualified to comparatively discuss the introduced measurement techniques. Furthermore, they are able to distinguish (dis-)advantages of the respective approaches. The students can evaluate and discuss measurment signal and data obtained with the common fluid mechanical measuring techniques.

This lecture focuses on experimental methods of fluid mechanics and their application to solve flow problems of practical relevance. In addition, measurement signals and data, obtained with the discussed measuring techniques, are evaluated, presented and discussed.

The lecture covers a selection of the following topics:

- measuring techniques and measureable quantities
- measurements in turbulent flows
- pressure measurements
- hot wire measurements
- optical measuring techniques
- error analysis
- scaling laws
- signal and data evaluation

Literature

Tropea, C., Yarin, A.L., Foss, J.F.: Springer Handbook of Experimental Fluid Mechanics, Springer 2007

Nitsche, W., Brunn, A.: Strömungsmesstechnik, Springer, 2006

Spurk, J.H.: Strömungslehre, Springer, 1996

Tropea, C., Yarin, A.L., Foss, J.F.: Springer Handbook of Experimental Fluid Mechanics, Springer 2007

Spurk, J.H.:Fluid Mechanics, Springer, 1997

11.135 Course: Experimental Lab Class in Welding Technology, in Groups [T-MACH-102099]

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

Part of: M-MACH-102618 - Major Field: Production Technology

Type	Credits	Grading scale	Recurrence	Version
Completed coursework	4	pass/fail	Each winter term	3

Events					
WT 24/25	2173560	Welding Lab Course, in groupes	3 SWS	Practical course / 🗣	Dietrich, Schulze

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

Competence Certificate
Lab Course Report

Annotation
The lab takes place at the beginning of the winter semester break once a year. The registration is possible during the lecture period via iam-wk-lehre@iam.kit.edu at the IAM – WK. The lab is carried out in the Handwerkskammer Karlsruhe.

You need sturdy shoes and long clothes!

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

Welding Lab Course, in groupes
2173560, WS 24/25, 3 SWS, Language: German, Open in study portal

Practical course (P)
On-Site

Content
The lab takes place at the beginning of the winter semester break once a year. The registration is possible during the lecture period in the secretariat of the Institute of Applied Materials (IAM – WK). The lab is carried out in the Handwerkskammer Karlsruhe.

learning objectives: The students are capable to name a survey of current welding processes and their suitability for joining different metals. The students can evaluate the advantages and disadvantages of the individual procedures. The students have weld with different welding processes.

requirements:

You need sturdy shoes and long clothes!

workload:

regular attendance: 31,5 hours
preparation: 8,5 hours
lab report: 80 hours

Organizational issues
Die Lehrveranstaltung "Experimentelles schweißtechnisches Praktikum" findet dieses Jahr wieder in der Woche vom [Datum wird noch bekannt gegeben] statt. Der Veranstaltungsort ist die

Bildungsakademie Handwerkskammer Karlsruhe
Hertzstr. 177
76187 Karlsruhe

Die Gruppeneinteilung in die beiden Gruppen findet Anfang Februar statt!

- Gruppe 1. Montag 7.30 Uhr bis Mittwoch 12.00 Uhr
- Gruppe 2. Mittwoch 13.00 Uhr bis Freitag 15.00 Uhr

Sollte aufgrund anderer LV oder Prüfungen für Sie nur eine der beiden Gruppen in Frage kommen, melden Sie sich bitte rechtzeitig unter iam-wk-lehre@iam.kit.edu

Bitte bringen Sie festes und geschlossenes Schuhwerk (optimalerweise Arbeitsschuhe) und lange und entbehrliche Hosen sowie Oberteile mit, da wir uns die Hände schmutzig machen und mit flüssigem, umherfliegendem Metall konfrontiert sein werden. Für die Mittagspause können Sie sich selbst versorgen oder auch in der Mensa der Bildungsakademie essen.

Literature
wird im Praktikum ausgegeben

T 11.136 Course: Experimental techniques in thermo- and fluid-dynamics [T-MACH-106373]

Responsible: Prof. Dr.-Ing. Xu Cheng
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102597 - Compulsory Elective Module Mechanical Engineering
M-MACH-102635 - Major Field: Engineering Thermodynamics

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

Events					
ST 2024	2190920	Experimental Techniques in thermo- and fluid-dynamics	2 SWS	Block / 🗣	Cheng
Exams					
ST 2024	76-T-MACH-106373	Experimental techniques in thermo- and fluid-dynamics			Cheng

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

Competence Certificate
oral exam, duration 20 min

Prerequisites
none

T 11.137 Course: Fabrication Processes in Microsystem Technology [T-MACH-102166]

Responsible: Dr. Klaus Bade
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102597 - Compulsory Elective Module Mechanical Engineering
M-MACH-102616 - Major Field: Microsystem Technology
M-MACH-102647 - Major Field: Microactuators and Microsensors

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

Events					
ST 2024	2143882	Fabrication Processes in Microsystem Technology	2 SWS	Lecture / 🗣	Bade
WT 24/25	2143882	Fabrication Processes in Microsystem Technology	2 SWS	Lecture / 🧩	Bade
Exams					
ST 2024	76-T-MACH-102166	Fabrication Processes in Microsystem Technology			Bade

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

Competence Certificate
Oral examination, 20 minutes

Prerequisites
none

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

V Fabrication Processes in Microsystem Technology
2143882, SS 2024, 2 SWS, Language: German, Open in study portal

Lecture (V)
On-Site

Content
The lecture offers an advanced understanding of manufacturing processes in microsystem technology. Basic aspects of microtechnological processing will be introduced. With examples from semiconductor microfabrication and microsystem technology the base processing steps for conditioning and finishing, patterning, removal are imparted. Nano-patterning is covered is also included and the micro-nano interface is discussed. By the help of typical processing steps elementary mechanisms, process execution, and equipment are explained. Additionally quality control, process control and environmental topics are included

Literature
M. Madou
Fundamentals of Microfabrication

CRC Press, Boca Raton, 1997

W. Menz, J. Mohr, O. Paul

Mikrosystemtechnik für Ingenieure

Dritte Auflage, Wiley-VCH, Weinheim 2005

L.F. Thompson, C.G. Willson, A.J. Bowden
Introduction to Microlithography
2nd Edition, ACS, Washington DC, 1994

V Fabrication Processes in Microsystem Technology
2143882, WS 24/25, 2 SWS, Language: German, Open in study portal

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

Literature

M. Madou
Fundamentals of Microfabrication

CRC Press, Boca Raton, 1997

W. Menz, J. Mohr, O. Paul

Mikrosystemtechnik für Ingenieure

Dritte Auflage, Wiley-VCH, Weinheim 2005

L.F. Thompson, C.G. Willson, A.J. Bowden
Introduction to Microlithography
2nd Edition, ACS, Washington DC, 1994

T 11.138 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-102597 - Compulsory Elective Module Mechanical Engineering
M-MACH-102602 - Major Field: Reliability in Mechanical Engineering
M-MACH-102611 - Major Field: Materials Science and Engineering
M-MACH-102637 - Major Field: Tribology

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

Events					
WT 24/25	2182572	Failure Analysis	2 SWS	Lecture / 🗣	Greiner, Schneider
Exams					
ST 2024	76-T-MACH-105724	Failure Analysis			Schneider
WT 24/25	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 24/25, 2 SWS, Language: German, 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 11.139 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-102597 - Compulsory Elective Module Mechanical Engineering
M-MACH-102599 - Major Field: Powertrain Systems
M-MACH-102602 - Major Field: Reliability in Mechanical Engineering
M-MACH-102611 - Major Field: Materials Science and Engineering
M-MACH-102619 - Major Field: Technical Ceramics and Powder Materials
M-MACH-102628 - Major Field: Lightweight Construction
M-MACH-102636 - Major Field: Thermal Turbomachines

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

Events					
WT 24/25	2181711	Failure of structural materials: deformation and fracture	3 SWS	Lecture / Practice (/ 🗣	Gumbsch, Weygand
Exams					
ST 2024	76-T-MACH-102140	Failure of Structural Materials: Deformation and Fracture			Weygand, Gumbsch
WT 24/25	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 24/25, 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!

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 11.140 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-102597 - Compulsory Elective Module Mechanical Engineering
M-MACH-102602 - Major Field: Reliability in Mechanical Engineering
M-MACH-102611 - Major Field: Materials Science and Engineering
M-MACH-102628 - Major Field: Lightweight Construction
M-MACH-102636 - Major Field: Thermal Turbomachines

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

Events					
WT 24/25	2181715	Failure of Structural Materials: Fatigue and Creep	2 SWS	Lecture / 🗣	Gruber, Gumbsch
Exams					
ST 2024	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 24/25, 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 11.141 Course: Fatigue of Materials [T-MACH-112106]

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

Part of: M-MACH-102597 - Compulsory Elective Module Mechanical Engineering
M-MACH-102602 - Major Field: Reliability in Mechanical Engineering
M-MACH-102610 - Major Field: Power Plant Technology
M-MACH-102611 - Major Field: Materials Science and Engineering
M-MACH-102636 - Major Field: Thermal Turbomachines

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

Events					
ST 2024	2173586	Fatigue of Materials	2 SWS	Lecture / 🗣	Guth
Exams					
ST 2024	76-T-MACH-112106	Fatigue of Materials			Guth
WT 24/25	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, SS 2024, 2 SWS, Language: German, Open in study portal

Lecture (V)
On-Site

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.

11.142 Course: Fatigue of Welded Components and Structures [T-MACH-105984]

Responsible: Dr. Majid Farajian
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102597 - Compulsory Elective Module Mechanical Engineering
M-MACH-102611 - Major Field: Materials Science and Engineering

Type	Credits	Grading scale	Recurrence	Version
Oral examination	3	Grade to a third	Each winter term	1

Competence Certificate
oral examination (ca. 30 min)

no tools or reference materials

Prerequisites
admission to the exam only with successful completion of the exercises [T-MACH-109304]

Modeled Conditions
The following conditions have to be fulfilled:

1. The course T-MACH-109304 - Excercises - Fatigue of Welded Components and Structures must have been passed.

Recommendation
preliminary knowlegde materials science and mechanics

T 11.143 Course: FEM Workshop - Constitutive Laws [T-MACH-105392]

Responsible: PD Dr.-Ing. Katrin Schulz
Dr. Daniel Weygand

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102602 - Major Field: Reliability in Mechanical Engineering
M-MACH-102604 - Major Field: Computational Mechanics

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

Events					
ST 2024	2183716	FEM Workshop -- Constitutive Laws	2 SWS	Block / 🧩	Schulz, Weygand
WT 24/25	2183716	FEM Workshop -- constitutive laws	2 SWS	Block / 🗣	Schulz, Weygand

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

Competence Certificate
solving of a FEM problem

preparation of a report

preparation of a short presentation

Prerequisites
none

Recommendation
Engineering Mechanics; Advanced Mathematics; Introduction to Theory of Materials

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

V FEM Workshop -- Constitutive Laws

2183716, SS 2024, 2 SWS, Language: German, Open in study portal

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

Content
The course repeats the fundamentals of the theory of materials. It leads to the characterization and classification of material behavior as well as the specification by adequate material models. Here we focus on elastic, viscoelastic, plastic, and viscoplastic deformation behavior. Introducing the finite element program ABAQUS, the students learn how to analyze the material models numerically. Therefore ABAQUS-own and continuative constitutive equations are chosen.

The student

- has the basic understanding of the materials theory and the classification of materials
- is able to independently generate numerical models using ABAQUS and can choose and apply adequate constitutive equations

Engineering Mechanics; Advanced Mathematics; Introduction to Theory of Materials recommended

regular attendance: 28 hours
self-study: 92 hours

Oral examination (ca. 20 min) in the elective module MSc, otherwise no grading

solving of a FEM problem

preparation of a report

preparation of a short presentation

Organizational issues
Blockveranstaltung, Termine werden noch bekannt gegeben!

Anmeldung per Email bis zum 26.04.2024 an katrin.schulz@kit.edu

V **FEM Workshop -- constitutive laws**
2183716, WS 24/25, 2 SWS, Language: German, Open in study portal

Block (B)
On-Site

Content
The course repeats the fundamentals of the theory of materials. It leads to the characterization and classification of material behavior as well as the specification by adequate material models. Here we focus on elastic, viscoelastic, plastic, and viscoplastic deformation behavior. Introducing the finite element program ABAQUS, the students learn how to analyze the material models numerically. Therefore ABAQUS-own and continuative constitutive equations are chosen.

The student

- has the basic understanding of the materials theory and the classification of materials
- is able to independently generate numerical models using ABAQUS and can choose and apply adequate constitutive equations

Engineering Mechanics; Advanced Mathematics; Introduction to Theory of Materials recommended

regular attendance: 28 hours
self-study: 92 hours

Oral examination (ca. 20 min) in the elective module MSc, otherwise no grading

solving of a FEM problem

preparation of a report

preparation of a short presentation

Organizational issues
Blockveranstaltung: Anmeldung bei der Dozentin (katrin.schulz@kit.edu) bis zum 10.10.2024, Termine siehe Aushang!

Literature
Peter Haupt: Continuum Mechanics and Theory of Materials, Springer; ABAQUS Manual; Skript

T 11.144 Course: Finite Difference Methods for Numerial Solution of Thermal and Fluid Dynamical Problems [T-MACH-105391]

Responsible: Prof. Dr. Claus Günther

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102597 - Compulsory Elective Module Mechanical Engineering
M-MACH-102604 - Major Field: Computational Mechanics

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

Competence Certificate
oral exam, Duration: 30 minutes

no auxiliary means

Prerequisites
none

T 11.145 Course: Finite Element Workshop [T-MACH-105417]

Responsible: Prof. Dr. Claus Mattheck
Dr. Daniel Weygand

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102602 - Major Field: Reliability in Mechanical Engineering

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

Events					
ST 2024	2182731	Finite Element Workshop	2 SWS	Block / 🗣	Tesari, Weygand, Mattheck
Exams					
ST 2024	76-T-MACH-105417	Finite Element Workshop			Mattheck, Gruber, Weygand

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

Competence Certificate
attendance certificate for participation in all course dates

Prerequisites
none

Recommendation
Continuum Mechanics

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

V Finite Element Workshop

2182731, SS 2024, 2 SWS, Language: German, Open in study portal

Block (B)
On-Site

Content
The students will learn the foundations of the FEM stress analysis and the optimization methode 'Zugdreiecke'.

The student can

- perform stress analysis for simple components using the commercial software package ANSYS
- utilise the method of the tensile triangle to optimize the shape of components with respect to stress distribution

Fundamentals of Continuum Mechanics are required.

regular attendance: 22,5 hours

certificate in case of regular attendance

Organizational issues

Weitere Veranstaltung im Sommersemester 2024:

Der Finite-Elemente Workshop findet vom 02. bis 05. April 2024 am CN, Bau 421, Raum 413 statt.

Bei Interesse wenden Sie sich bitte an: iwiza.tesari@kit.edu

T 11.146 Course: Finite Volume Methods for Fluid Flow [T-MACH-105394]

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

Part of: M-MACH-102597 - Compulsory Elective Module Mechanical Engineering
M-MACH-102604 - Major Field: Computational Mechanics

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

Competence Certificate
oral exam, Duration: 30 minutes

no auxiliary means

Prerequisites
none

T 11.147 Course: Flow Measurement Techniques [T-MACH-108796]

Responsible: Dr. Jochen Kriegseis
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102591 - Laboratory Course

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

Events					
ST 2024	2155425	Flow Measurement Techniques	3 SWS	Practical course / 🗣	Kriegseis, Leister
WT 24/25	2155425	Flow Measurement Techniques	3 SWS	Practical course / 🗣	Kriegseis
Exams					
ST 2024	76-T-MACH-108796	Flow Measurement Techniques			Kriegseis

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

Competence Certificate
Participation in at least 7 out of 9 events, successful initial colloquium prior to the respective measurements and submission of a significant report after every experiment

Prerequisites
none

Recommendation
The content of lecture "Experimental Fluid Mechanics" (T-MACH-105512)

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

V Flow Measurement Techniques

2155425, SS 2024, 3 SWS, Language: German/English, Open in study portal

Practical course (P)
On-Site

Content
The following flow measurement techniques are considered:

- wind tunnel techniques and estimation of turbulence intensity
- hot wire calibration an measzrement
- pressure measurements in air (around bodies)
- pressure measurements in water (Nikuradse diagram)
- Schlieren techniques
- Mach-Zehnder interferometry
- laser Doppler anemometry
- particle image velocimetry
- uncertainty estimation

The students can apply various flow measurements. They are capable to obtain, (post-)process and analyze flow data. Furthermore, the students can contrast advantages and disadvantages of the respective experimental approaches.

regular attendance: 30 hours
self-study: 90 hours

Organizational issues
Erfolgskontrolle:

Teilnahme an mindestens 7 der 9 Termine, erfolgreiche Eingangskolloquien vor jedem Versuch und Abgabe eines aussagekräfigen Versuchsprotokolls nach jedem Experiment

Participation in at least 7 out of 9 events, successful initial colloquium prior to the respective measurements and submission of a significant report after every experiment

Empfehlungen:

Kenntnisse der Vorlesung "Experimentelle Strömungsmechanik" (LVNr. 2154446)

The content of lecture "Experimental Fluid Mechanics" (LVNr. 2154446)

V	**Flow Measurement Techniques** 2155425, WS 24/25, 3 SWS, Language: English, Open in study portal	**Practical course (P)** **On-Site**

Content
The following flow measurement techniques are considered:

- wind tunnel techniques and estimation of turbulence intensity
- hot wire calibration an measzrement
- pressure measurements in air (around bodies)
- pressure measurements in water (Nikuradse diagram)
- Schlieren techniques
- Mach-Zehnder interferometry
- laser Doppler anemometry
- particle image velocimetry
- uncertainty estimation

The students can apply various flow measurements. They are capable to obtain, (post-)process and analyze flow data. Furthermore, the students can contrast advantages and disadvantages of the respective experimental approaches.

regular attendance: 30 hours
self-study: 90 hours

Organizational issues
Im Wintersemester findet die Veranstaltung auf Englisch statt, im Sommersemester auf Deutsch.

The course will be held in English in the winter semester and in German in the summer semester

Erfolgskontrolle:

Die Teilnahme an allen Plenumsveranstaltungen und Versuchsterminen sowie die Abgabe aller erfolgreich bearbeiteten Aufgaben.

Participation in all plenary events and experiment sessions as well as submission of all assignments.

Empfehlungen:

Kenntnisse der Vorlesung "Experimentelle Strömungsmechanik" (LVNr. 2154446)

The content of lecture "Experimental Fluid Mechanics" (LVNr. 2154446)

Grundkenntnisse in Matlab

Basic knowledge of Matlab

Literature
Literatur:

Tropea, C., Yarin, A.L., Foss, J.F.: Springer Handbook of Experimental Fluid Mechanics, Springer 2007
Nitsche, W., Brunn, A.: Strömungsmesstechnik, Springer, 2006
Spurk, J.H., Aksel, N: Strömungslehre, Springer, 2010

Tropea, C., Yarin, A.L., Foss, J.F.: Springer Handbook of Experimental Fluid Mechanics, Springer 2007
Nitsche, W., Brunn, A.: Strömungsmesstechnik, Springer, 2006
Spurk, J.H., Aksel, N: Fluid Mechanics, Springer, 2008

T 11.148 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-102597 - Compulsory Elective Module Mechanical Engineering
M-MACH-102608 - Major Field: Nuclear Energy
M-MACH-102612 - Major Field: Modeling and Simulation in Energy- and Fluid Engineering
M-MACH-102623 - Major Field: Fundamentals of Energy Technology
M-MACH-102635 - Major Field: Engineering Thermodynamics

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

Events					
WT 24/25	2189910	Flows and Heat Transfer in Energy Technology	2 SWS	Lecture / 🗣	Cheng
WT 24/25	2189911	Tutorial 'Flows and Heat Transfer in Energy Technology '	1 SWS	Practice / 🗣	Cheng, Mitarbeiter

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 Flows and Heat Transfer in Energy Technology

2189910, WS 24/25, 2 SWS, Language: German, Open in study portal

Lecture (V)
On-Site

Content
This lecture is dedicated to students of mechanical engineering and other engineering Bachelor or Master degree courses. Goal of the lecture is the understanding of major processes in fluid dynamics and heat transfer in energy engineering. Through this lecture the students are capable of understanding the important physical processes and the selection of suitable methods for the analysis of the processes. With the discussion of some practical examples, the students can analyze the pressure drop and heat transfer in energy engineering systems.

1. collection of sample applications
2. heat transfer and its application
3. convective fluid dynamics and heat transfer
4. thermal radiation and its application
5. special cases

Literature

- Bahr, H.D., Stephan, K., Wärme- und Stoffübertragung, 3. Auflage Springer Verlag, 1998

T 11.149 Course: Flows with Chemical Reactions [T-MACH-105422]

Responsible: apl. Prof. Dr. Andreas Class
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102597 - Compulsory Elective Module Mechanical Engineering
M-MACH-102612 - Major Field: Modeling and Simulation in Energy- and Fluid Engineering
M-MACH-102634 - Major Field: Fluid Mechanic
M-MACH-102635 - Major Field: Engineering Thermodynamics

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

Events					
WT 24/25	2153406	Flows with chemical reactions	2 SWS	Lecture /	Class
Exams					
ST 2024	76-T-MACH-105422	Flows with Chemical Reactions			Class

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

Competence Certificate
oral exam, duration 30 minutes

Auxiliary none

Prerequisites
none

Recommendation
Fluid Mechanics (T-MACH-105207)

Mathematical Methods in Fluid Mechanics (T-MACH-105295)

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

V Flows with chemical reactions
2153406, WS 24/25, 2 SWS, Language: German/English, Open in study portal

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

Content
The students can describe flow scenarios, where a chemical reaktion is confined to a thin layer. They can choose simplifying approaches for the underlying chemistry and discuss the problems with focus on the fluid mechanic aspects. The students are able to solve simple problems analytically. Furthermore, they are qualified to discuss simplifications as relevant for an efficent numerical solution of complex problems.

In the lecture we mainly consider problems, where chemical reaktion is confined to a thin layer.
The problems are solved analytically or they are at least simplified allowing for efficent numerical
sollution procedures. We apply simplified chemistry and focus on the fluid mechanic aspects of the problems.

Literature
Vorlesungsskript

Buckmaster, J.D.; Ludford, G.S.S.: Lectures on Mathematical Combustion, SIAM 1983

T 11.150 Course: Fluid Mechanics of Turbulent Flows [T-BGU-110841]

Responsible: Prof. Dr.-Ing. Markus Uhlmann
Organisation: KIT Department of Civil Engineering, Geo and Environmental Sciences
Part of: M-MACH-102634 - Major Field: Fluid Mechanic

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

Events					
ST 2024	6221806	Fluid Mechanics of Turbulent Flows	4 SWS	Lecture / Practice (/ 🗣	Uhlmann
Exams					
ST 2024	8244110841	Fluid Mechanics of Turbulent Flows			Uhlmann

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

Competence Certificate
oral exam, appr. 45 min.

Prerequisites
none

Recommendation
none

Annotation
none

T 11.151 Course: Fluid Power Systems [T-MACH-102093]

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

Part of:
M-MACH-102405 - Fundamentals and Methods of General Mechanical Engineering
M-MACH-102575 - Fundamentals and Methods of Energy and Environmental Engineering
M-MACH-102597 - Compulsory Elective Module Mechanical Engineering
M-MACH-102627 - Major Field: Energy Converting Engines
M-MACH-102630 - Major Field: Mobile Machines
M-MACH-102739 - Fundamentals and Methods of Automotive Engineering
M-MACH-102741 - Fundamentals and Methods of Product Development and Construction
M-MACH-102742 - Fundamentals and Methods of Production Technology
M-MACH-102743 - Fundamentals and Methods of Theoretical Foundations of Mechanical Engineering

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

Events					
WT 24/25	2114093	Fluid Technology	2 SWS	Lecture / 🗣	Geimer
Exams					
ST 2024	76-T-MACH-102093	Fluid Power Systems			Geimer
WT 24/25	76-T-MACH-102093	Fluid Power Systems			Geimer

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

Competence Certificate
The assessment consists of a oral exam 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 24/25, 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 11.152 Course: Fluid-Structure-Interaction [T-MACH-105474]

Responsible: Prof. Dr.-Ing. Bettina Frohnapfel
Dr.-Ing. Mark-Patrick Mühlhausen

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102597 - Compulsory Elective Module Mechanical Engineering

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

Events					
ST 2024	2154453	Fluid-Structure-Interaction with Python	2 SWS	/ 🖥	Mühlhausen
Exams					
ST 2024	76-T-MACH-111507	Fluid-Structure-Interaction with Python			Mühlhausen

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 Fluid-Structure-Interaction with Python

2154453, SS 2024, 2 SWS, Language: German, Open in study portal **Online**

Content
„The lecture provides the basics for the description and modeling of flows, structures and their interaction. In the practical part, the covered methods and procedures are deepened with various exercises and examples with Python and Ansys Fluent.

- Brief introduction to Python and Ansys Fluent
- Basic equations of continuum mechanics
- Smoothing and remeshing algorithms for mesh deformation
- Finite volume and finite element method
- Methods of fluid-structure interaction
- coupling conditions
- Monolithic and partitioned coupling methods
- Coupling algorithms for partitioned methods
- Stability and convergence of coupled systems"

Organizational issues
Die Anmeldung bitte bis zum 18.07.24 an sekretariat@istm.kit.edu schicken.

Literature
wird in der Vorlesung vorgestellt

T 11.153 Course: Fluid-Structure-Interaction with Python [T-MACH-111507]

Responsible: Dr.-Ing. Mark-Patrick Mühlhausen
Organisation: KIT Department of Mechanical Engineering
Part of: M-MACH-102634 - Major Field: Fluid Mechanic

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

Events					
ST 2024	2154453	Fluid-Structure-Interaction with Python	2 SWS	/ 🖥	Mühlhausen
Exams					
ST 2024	76-T-MACH-111507	Fluid-Structure-Interaction with Python			Mühlhausen

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

Competence Certificate
oral exam (appr. 30 minutes)

Prerequisites
none

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

V Fluid-Structure-Interaction with Python
2154453, SS 2024, 2 SWS, Language: German, Open in study portal **Online**

Content
„The lecture provides the basics for the description and modeling of flows, structures and their interaction. In the practical part, the covered methods and procedures are deepened with various exercises and examples with Python and Ansys Fluent.

- Brief introduction to Python and Ansys Fluent
- Basic equations of continuum mechanics
- Smoothing and remeshing algorithms for mesh deformation
- Finite volume and finite element method
- Methods of fluid-structure interaction
- coupling conditions
- Monolithic and partitioned coupling methods
- Coupling algorithms for partitioned methods
- Stability and convergence of coupled systems"

Organizational issues
Die Anmeldung bitte bis zum 18.07.24 an sekretariat@istm.kit.edu schicken.

Literature
wird in der Vorlesung vorgestellt

T 11.154 Course: Foundations of Nonlinear Continuum Mechanics [T-MACH-105324]

Responsible: apl. Prof. Marc Kamlah
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102597 - Compulsory Elective Module Mechanical Engineering
M-MACH-102646 - Major Field: Applied Mechanics

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

Events					
WT 24/25	2181720	Foundations of nonlinear continuum mechanics	2 SWS	Lecture / 🗣	Kamlah
Exams					
ST 2024	76-T-MACH-105324	Foundations of Nonlinear Continuum Mechanics			Kamlah

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

Competence Certificate
oral exam

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

V Foundations of nonlinear continuum mechanics

2181720, WS 24/25, 2 SWS, Language: German, Open in study portal

Lecture (V)
On-Site

Content
The lecture is organized in three parts. In the first part, the mathematical foundations of tensor algebra and tensor analysis are introduced, usually in cartesian representation. In the second part of the lecture, the kinematics, i.e. the geometry of deformation is presented. Besides finite deformation, geometric linearization is discussed. The thrid part of the lecture deals with the physical balance laws of thermomechanics. It is shown, how a special classical theory of continuum mechanics can be derived by adding a corresponding constitutive model. For the illustration of the theory, elementary examples are discussed repeatedly.

The students understand the fundamental structure of a continuum theory consisting of kinematics, balance laws and constitutive model. In particular, they recognize non-linear continuum mechanics as a common structure including all continuum theories of thermomechanics, which are obtained by adding a corresponding constitutive model. The students understand in detail the kinematics of finite deformation and know the transition to the geometrically linear theory they are familiar with. The students know the spatial and material representation of the theory and the different related tensors. The students take the balance laws as physical postulates and understand their respective physical motivation.

Qualification: Engineering Mechanics - Advanced Mathematics

regular attendance: 22,5 hours
self-study: 97,5 hours

oral exam ca. 30 minutes

Literature
Vorlesungsskript

T 11.155 Course: Foundry Technology [T-MACH-105157]

Responsible: Dr.-Ing. Daniel Günther
Dr.-Ing. Steffen Klan

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102597 - Compulsory Elective Module Mechanical Engineering
M-MACH-102611 - Major Field: Materials Science and Engineering
M-MACH-102618 - Major Field: Production Technology
M-MACH-102628 - Major Field: Lightweight Construction

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

Events					
ST 2024	2174575	Foundry Technology	2 SWS	Lecture / ✕	Klan, Günther

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

Competence Certificate
The assessment is carried out as a written exam of about 1 h.

Prerequisites
none

Recommendation
The lectures Materials Science I and Materials Science II should have been attended in advance.

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

V Foundry Technology

2174575, SS 2024, 2 SWS, Language: German, Open in study portal

Lecture (V)
Cancelled

Organizational issues
Die Vorlesung ist abgesagt!

Literature
Literaturhinweise werden in der Vorlesung gegeben

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

T 11.156 Course: Fuels and Lubricants for Combustion Engines [T-MACH-105184]

Responsible: Hon.-Prof. Dr. Bernhard Ulrich Kehrwald
Dr.-Ing. Heiko Kubach

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102597 - Compulsory Elective Module Mechanical Engineering

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

Events					
WT 24/25	2133108	Fuels and Lubricants for Combustion Engines	2 SWS	Lecture / 🗣	Kehrwald
Exams					
ST 2024	76-T-MACH-105184	Fuels and Lubricants for Combustion Engines			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 24/25, 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 11.157 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-102597 - Compulsory Elective Module Mechanical Engineering
M-MACH-102623 - Major Field: Fundamentals of Energy Technology
M-MACH-102627 - Major Field: Energy Converting Engines
M-MACH-102650 - Major Field: Combustion Engines Based Powertrains

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

Events					
WT 24/25	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 24/25, 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 11.158 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-102605 - Major Field: Engineering Design
M-MACH-102607 - Major Field: Vehicle Technology

Type	Credits	Grading scale	Recurrence	Version
Oral examination	2	Grade to a third	Each winter term	1

Events					
WT 24/25	2113814	Fundamentals for Design of Motor-Vehicles Bodies I	1 SWS	Lecture / 🗣	Bardehle
Exams					
ST 2024	76-T-MACH-102116	Fundamentals for Design of Motor-Vehicle Bodies I			Bardehle, Unrau
WT 24/25	76-T-MACH-102116	Fundamentals for Design of Motor-Vehicle Bodies I			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 24/25, 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/

Termine und nähere Informationen: siehe ILIAS oder 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 11.159 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-102605 - Major Field: Engineering Design
M-MACH-102607 - Major Field: Vehicle Technology

Type	Credits	Grading scale	Recurrence	Version
Oral examination	2	Grade to a third	Each summer term	1

Events					
ST 2024	2114840	Fundamentals for Design of Motor-Vehicles Bodies II	1 SWS	Lecture / 🗣	Bardehle
Exams					
ST 2024	76-T-MACH-102119	Fundamentals for Design of Motor-Vehicle Bodies II			Bardehle, Gauterin
WT 24/25	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 2024, 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
Voraussichtliche Termine, nähere Informationen und evtl. Änderungen:

siehe Institutshomepage.

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 11.160 Course: Fundamentals in Materials Thermodynamics and Heterogeneous Equilibria [T-MACH-107670]

Responsible: Dr. Peter Franke
Prof. Dr. Hans Jürgen Seifert

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102597 - Compulsory Elective Module Mechanical Engineering
M-MACH-102611 - Major Field: Materials Science and Engineering

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

Events					
WT 24/25	2193002	Fundamentals in Materials Thermodynamics and Heterogeneous Equilibria	2 SWS	Lecture / 🗣	Seifert, Dürrschnabel
Exams					
ST 2024	76-T-MACH-107670	Fundamentals in Materials Thermodynamics and Heterogeneous Equilibria			Seifert
WT 24/25	76-T-MACH-107670	Fundamentals in Materials Thermodynamics and Heterogeneous Equilibria			Seifert

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

Competence Certificate
Oral examination (about 30 min)

Prerequisites
The successful participation in Übungen zu Thermodynamische Grundlagen / Heterogene Gleichgewichte is the condition for the admittance to the oral exam in Thermodynamische Grundlagen / Heterogene Gleichgewicht.

T-MACH-110924 – Exercises for Fundamentals in Materials Thermodynamics and Heterogeneous Equilibria has not been started.

T-MACH-110925 – Fundamentals in Materials Thermodynamics and Heterogeneous Equilibria has not been started.

Modeled Conditions
The following conditions have to be fulfilled:

1. The course T-MACH-107669 - Exercises for Fundamentals in Materials Thermodynamics and Heterogeneous Equilibria must have been passed.

Recommendation
Bacic course in materials science and engineering

Basic course in mathematics

physics or physical chemistry

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

V Fundamentals in Materials Thermodynamics and Heterogeneous Equilibria — **Lecture (V) On-Site**
2193002, WS 24/25, 2 SWS, Language: German, Open in study portal

Content
Oral examination (about 30 min)

Teaching Content:

1. Binary phase diagrams

2. Ternary phase diagrams

- Complete solubility
- Eutectic systems
- Peritectic systems
- Systems with transition reactions
- Systems with intermetallic phases

3. Thermodynamics of solution phases

4. Materials reactions involving pure condensed phases and a gaseous phase

5. Reaction equilibria in systems containing components in condensed solutions

6. Thermodynamics of multicomponent multiphase materials systems

7. Calculation of Phase Diagrams (CALPHAD)

Recommendations:

Knowledge of the course "Solid State Reactions and Kinetics of Phase Transformations" (Franke); basic course in materials science and Engineering; basic course in mathematics; physics or physical chemistry

regular attendance: 22 hours

self-study: 98 hours

The students know the heterogeneous phase equilibria of binary, ternary and multicomponent materials systems. They can analyze the thermodynamic properties of multiphase engineering materials and their reactions with gas and liquid phases.

Literature

1. Phase Equilibria, Phase Diagrams and Phase Transformations, Their Thermodynamic Basis; M. Hillert, University Press, Cambridge (2007)

2. Introduction to the Thermodynamics of Materials; D.R. Gaskell, Taylor & Francis (2008)

T 11.161 Course: Fundamentals in the Development of Commercial Vehicles [T-MACH-111389]

Responsible: Christof Weber
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102605 - Major Field: Engineering Design
M-MACH-102607 - Major Field: Vehicle Technology
M-MACH-102630 - Major Field: Mobile Machines

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

Events					
ST 2024	2114844	Fundamentals in the Development of Commercial Vehicles II	1 SWS	Lecture / 🗣	Weber
WT 24/25	2113812	Fundamentals in the Development of Commercial Vehicles I	1 SWS	Lecture / 🗣	Weber
Exams					
ST 2024	76T-MACH-111389	Fundamentals in the Development of Commercial Vehicles			Weber
WT 24/25	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 2024, 1 SWS, Language: German, Open in study portal

Lecture (V)
On-Site

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
Genaue Termine sowie 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 24/25, 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/

Termine und Nähere Informationen: siehe ILIAS oder 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 11.162 Course: Fundamentals of Automobile Development I [T-MACH-105162]

Responsible: Dr. Manfred Harrer
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102605 - Major Field: Engineering Design
M-MACH-102607 - Major Field: Vehicle Technology

Type	Credits	Grading scale	Recurrence	Version
Written examination	2	Grade to a third	Each winter term	1

Events					
WT 24/25	2113810	Fundamentals of Automobile Development I	1 SWS	Lecture / 🗣	Harrer
WT 24/25	2113851	Principles of Whole Vehicle Engineering I	1 SWS	Lecture / 🗣	Harrer
Exams					
ST 2024	76-T-MACH-105162	Fundamentals of Automobile Development I			Frech, Gießler

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 24/25, 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/

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 24/25, 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/

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

Responsible: Dr. Manfred Harrer
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102605 - Major Field: Engineering Design
M-MACH-102607 - Major Field: Vehicle Technology

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

Events					
ST 2024	2114842	Principles of Whole Vehicle Engineering II	1 SWS	Block / 🗣	Frech
ST 2024	2114860	Principles of Whole Vehicle Engineering II	1 SWS	/ 🗣	Frech
Exams					
ST 2024	76-T-MACH-105163	Fundamentals of Automobile Development II			Frech, Gießler

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 Principles of Whole Vehicle Engineering II

2114842, SS 2024, 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
Vorlesung findet als Blockvorlesung an folgenden Terminen statt: 02.05., 16.05., 06.06. 2024, jeweils von 08:00 bis 11:00 Uhr.

Die Vorlesung findet im Sommersemester 2024 zum letzten Mal statt.

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 2024, 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
Veranstaltung findet als Blockvorlesung an folgenden Terminen statt: 02.05., 16.05,, 06.06.2024 von 11:15 bis 14:00 Uhr.

Scheduled dates:

see homepage of the institute.

The lecture will be offered for the last time in summer semester 2024!

Kann nicht mit der Veranstaltung [2114842] kombiniert werden.

Cannot be combined with lecture [2114842].

Literature
Das Skript zur Vorlesung ist über ILIAS verfügbar.

T 11.164 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-102597 - Compulsory Elective Module Mechanical Engineering
M-MACH-102607 - Major Field: Vehicle Technology
M-MACH-102627 - Major Field: Energy Converting Engines
M-MACH-102650 - Major Field: Combustion Engines Based Powertrains

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

Events					
ST 2024	2134138	Fundamentals of catalytic exhaust gas aftertreatment	2 SWS	Lecture / 🗣	Lox, Grunwaldt, Deutschmann

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

2134138, SS 2024, 2 SWS, Language: German, Open in study portal

Lecture (V)
On-Site

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

T 11.165 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-102405 - Fundamentals and Methods of General Mechanical Engineering
M-MACH-102575 - Fundamentals and Methods of Energy and Environmental Engineering
M-MACH-102597 - Compulsory Elective Module Mechanical Engineering
M-MACH-102607 - Major Field: Vehicle Technology
M-MACH-102623 - Major Field: Fundamentals of Energy Technology
M-MACH-102627 - Major Field: Energy Converting Engines
M-MACH-102650 - Major Field: Combustion Engines Based Powertrains
M-MACH-102739 - Fundamentals and Methods of Automotive Engineering
M-MACH-102740 - Fundamentals and Methods of Mechatronics and Microsystem Technology
M-MACH-102741 - Fundamentals and Methods of Product Development and Construction

Type	Credits	Grading scale	Recurrence	Version
Written examination	5	Grade to a third	Each winter term	2

Events					
WT 24/25	2133123	Fundamentals of Combustion Engine Technology	2 SWS	Lecture / 🗣	Kubach, Wagner, Toedter, Pfeil, Bernhardt, Velji
Exams					
ST 2024	76-T-MACH-105652	Fundamentals of Combustion Engine Technology			Kubach

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 Fundamentals of Combustion Engine Technology

2133123, WS 24/25, 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 11.166 Course: Fundamentals of Combustion I [T-MACH-105213]

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

Part of:
M-MACH-102405 - Fundamentals and Methods of General Mechanical Engineering
M-MACH-102575 - Fundamentals and Methods of Energy and Environmental Engineering
M-MACH-102597 - Compulsory Elective Module Mechanical Engineering
M-MACH-102610 - Major Field: Power Plant Technology
M-MACH-102627 - Major Field: Energy Converting Engines
M-MACH-102635 - Major Field: Engineering Thermodynamics
M-MACH-102739 - Fundamentals and Methods of Automotive Engineering
M-MACH-102740 - Fundamentals and Methods of Mechatronics and Microsystem Technology
M-MACH-102743 - Fundamentals and Methods of Theoretical Foundations of Mechanical Engineering

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

Events					
WT 24/25	2165515	Fundamentals of Combustion I	2 SWS	Lecture / 🗣	Maas, Shrotriya
WT 24/25	2165517	Fundamentals of Combustion I (Tutorial)	1 SWS	Practice / 🗣	Bykov
WT 24/25	3165016	Fundamentals of Combustion I	2 SWS	Lecture / 🗣	Maas
WT 24/25	3165017	Fundamentals of Combustion I (Tutorial)	1 SWS	Practice / 🗣	Bykov
Exams					
ST 2024	76-T-MACH-105213	Fundamentals of Combustion I			Maas
ST 2024	76-T-MACH-105464	Fundamentals of Combustion I			Maas
WT 24/25	76-T-MACH-105213	Fundamentals of Combustion I - german exam			Maas
WT 24/25	76-T-MACH-105464	Fundamentals of Combustion I - english exam			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 24/25, 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

Organizational issues
Bei zu wenigen Hörern wird die Lehrveranstaltung mit der englischen Lehrveranstaltung zusammengelegt.

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 24/25, 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 24/25, 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 11.167 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-102597 - Compulsory Elective Module Mechanical Engineering
M-MACH-102623 - Major Field: Fundamentals of Energy Technology
M-MACH-102627 - Major Field: Energy Converting Engines
M-MACH-102635 - Major Field: Engineering Thermodynamics
M-MACH-102650 - Major Field: Combustion Engines Based Powertrains

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

Events					
ST 2024	2166538	Fundamentals of combustion II	2 SWS	Lecture / 🗣	Maas
ST 2024	2166539	Übung zu Grundlagen der technischen Verbrennung II	1 SWS	Practice / 🗣	Maas
ST 2024	3166550	Fundamentals of Combustion II	2 SWS	Lecture / 🗣	Maas, Shrotriya, Bykov
Exams					
ST 2024	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
Lecture (V)
On-Site

2166538, SS 2024, 2 SWS, Language: German, Open in study portal

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
Practice (Ü)
On-Site

2166539, SS 2024, 1 SWS, Language: German, Open in study portal

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 2024, 2 SWS, Language: English, Open in study portal

Lecture (V)
On-Site

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 11.168 Course: Fundamentals of Data Transmission [T-ETIT-112851]

Responsible: Prof. Dr.-Ing. Laurent Schmalen
Prof. Dr.-Ing. Thomas Zwick

Organisation: KIT Department of Electrical Engineering and Information Technology

Part of: M-MACH-102595 - Compulsory Elective Module Natural Science/Computer Science/Electrical Engineering

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

Competence Certificate
The assessment of success takes place in the form of a written examination lasting 120 minutes. The module grade is the grade of the written examination.

Prerequisites
none

T 11.169 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-102623 - 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 2024	2130927	Fundamentals of Energy Technology	3 SWS	Lecture / 🗣	Cheng, Badea
ST 2024	3190923	Fundamentals of Energy Technology	3 SWS	Lecture / 🗣	Badea
Exams					
ST 2024	76-T-MACH-105220	Fundamentals of Energy Technology			Cheng, Badea
ST 2024	76-T-MACH-105220 Fundamentals of Energy Technology	Fundamentals of Energy Technology			Badea
WT 24/25	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 2024, 3 SWS, Language: German, Open in study portal

Lecture (V)
On-Site

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 2024, 3 SWS, Language: English, Open in study portal

Lecture (V)
On-Site

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 11.170 Course: Fundamentals of Reactor Safety for the Operation and Dismantling of Nuclear Power Pants [T-MACH-105530]

Responsible: Dr. Victor Hugo Sanchez-Espinoza
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102608 - Major Field: Nuclear Energy

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

Competence Certificate
oral exam about 30 minutes

Prerequisites
none

T 11.171 Course: Fusion Technology A [T-MACH-105411]

Responsible: Dr. Sara Perez Martin
Dr. Klaus-Peter Weiss

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102597 - Compulsory Elective Module Mechanical Engineering
M-MACH-102610 - Major Field: Power Plant Technology
M-MACH-102643 - Major Field: Fusion Technology

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

Events					
WT 24/25	2169483	Fusion Technology A	2 SWS	Lecture / Practice (/	Weiss, Perez Martin
WT 24/25	2169484	Exercise Fusion Technology A	2 SWS	Practice	Weiss, Perez Martin
Exams					
WT 24/25	76-T-MACH-105411	Fusion Technology A			Weiss, Größle, Perez Martin

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

Competence Certificate
oral exam of about 30 minutes

Prerequisites
none

Recommendation
appreciated is knowldege in heat ans mass transfer as well as in electrical engineering,
basic knowledge in fluid mechanics, material sciences and physics

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

V Fusion Technology A

2169483, WS 24/25, 2 SWS, Language: German, Open in study portal

Lecture / Practice (VÜ)
On-Site

Content

To transfer the basic physical concepts of particle physics, fusion and nuclear fission; this includes fundamental questions such as how: What is a plasma? How can it be ignited? What is the difference between magnetic and inertial fusion? Based on this, aspects of the stability of plasmas, their control and particle transport are discussed. After characterizing the plasma, the "fire" of fusion, the confinement in magnetic fields is sketched, which are built up with the help of magnetic technology. Here, knowledge of superconductivity, production and design of magnets is imparted. A reactor operation with a plasma as energy source requires a continuous operation of a tritium and fuel cycle, which is generated by the fusion reactor itself. Since fusion plasmas require small material densities, vacuum technology plays a central role. Finally, the heat generated in the fusion power plant must be converted into a power plant process and the reaction products removed. The functional basics and the structure of these fusion-typical in-vessel components are presented and the current challenges and the state of the art are demonstrated.

The course describes the essential functional principles of a fusion reactor, beginning with plasma, magnet technology, the tritium and fuel cycle, vacuum technology and the associated material sciences. The physical basics will be taught and the engineering laws of scaling will be demonstrated. Special importance is attached to the understanding of the interfaces between the different subject areas, which essentially determine the engineering technical interpretations. Methods for identifying and evaluating the central parameters will be demonstrated. Based on the acquired perception skills, methods for the design of solution strategies will be taught and technical solutions will be identified, their weak points discussed and evaluated.

Recommendations/Pre-knowledge:

Basic knowledge of fluid mechanics, materials engineering and physics. Knowledge of heat and mass transfer and electrical engineering is helpful.

Presence time: 21 h
Self-study: 90 h

Oral examination:
Duration: approx. 30 minutes, aids: none

Literature

Innerhalb jedes Teilblockes wird eine Literaturliste der jeweiligen Fachliteratur angegeben. Zusätzlich erhalten die Studenten/-innen das Studienmaterial in gedruckter und elektronischer Version.

T 11.172 Course: Fusion Technology B [T-MACH-105433]

Responsible: N.N.
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102597 - Compulsory Elective Module Mechanical Engineering
M-MACH-102643 - Major Field: Fusion Technology

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

Exams			
ST 2024	76-T-MACH-105433	Fusion Technology B	Jelonnek
WT 24/25	76-T-MACH-105433	Fusion Technology B	Jelonnek, Rieth

Competence Certificate
oral exam of about 30 minutes

Prerequisites
none

Recommendation
attendance of fusion technology A lecture

reliable capability to use fundamental knowledge communicated in the bachelor study in physics, material sciences , electrical engineering and engineering design

Annotation
none

T 11.173 Course: Gear Cutting Technology [T-MACH-102148]

Responsible: Hon.-Prof. Dr. Markus Klaiber
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102597 - Compulsory Elective Module Mechanical Engineering
M-MACH-102599 - Major Field: Powertrain Systems
M-MACH-102605 - Major Field: Engineering Design
M-MACH-102607 - Major Field: Vehicle Technology
M-MACH-102618 - Major Field: Production Technology
M-MACH-102627 - Major Field: Energy Converting Engines
M-MACH-102650 - Major Field: Combustion Engines Based Powertrains

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

Events					
WT 24/25	2149655	Gear Technology	2 SWS	Lecture / 🗣	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 24/25, 2 SWS, Language: German, Open in study portal

Lecture (V)
On-Site

Content
Based on the gearing theory, manufacturing processes and machine technologies for producing gearings, the needs of modern gear manufacturing will be discussed in the lecture. For this purpose, various processes for various gear types are taught which represent the state of the art in practice today. A classification in soft and hard machining and furthermore in cutting and non-cutting technologies will be made. For comprehensive understanding the processes, machine technologies, tools and applications of the manufacturing of gearings will be introduced and the current developments presented. For assessment and classification of the applications and the performance of the technologies, the methods of mass production and manufacturing defects will be discussed. Sample parts, reports from current developments in the field of research and an excursion to a gear manufacturing company round out the lecture.

Learning Outcomes:

The students …

- can describe the basic terms of gearings and are able to explain the imparted basics of the gearwheel and gearing theory.
- are able to specify the different manufacturing processes and machine technologies for producing gearings. Furthermore they are able to explain the functional principles and the dis-/advantages of these manufacturing processes.
- can apply the basics of the gearing theory and manufacturing processes on new problems.
- are able to read and interpret measuring records for gearings. are able to make an appropriate selection of a process based on a given application
- can describe the entire process chain for the production of toothed components and their respective influence on the resulting workpiece properties.

Workload:

regular attendance: 21 hours
self-study: 99 hours

Literature

Medien:

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

Media:

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

T 11.174 Course: Genetics [T-CIWVT-111063]

Responsible: Dr. Anke Neumann
Organisation: KIT Department of Chemical and Process Engineering
Part of: M-MACH-102595 - Compulsory Elective Module Natural Science/Computer Science/Electrical Engineering

Type	Credits	Grading scale	Recurrence	Version
Written examination	2	Grade to a third	Each winter term	1

Events					
WT 24/25	2212111	Biology for Engineers - Genetics	2 SWS	Lecture / 🗣	Neumann
Exams					
ST 2024	7212114-V-GEN	Genetics			Neumann
WT 24/25	7212114-V-GEN	Genetics			Neumann

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

Competence Certificate
Written examination with a duration of 90 minutes (section 4 subsection 2 No. 1 SPO).

Prerequisites
None

11.175 Course: Global Logistics [T-MACH-111003]

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

Part of: M-MACH-102597 - Compulsory Elective Module Mechanical Engineering
M-MACH-102618 - Major Field: Production Technology
M-MACH-102629 - Major Field: Logistics and Material Flow Theory
M-MACH-102640 - Major Field: Technical Logistics

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

Events					
ST 2024	2149600	Global Logistics	2 SWS	Lecture / 🗣	Furmans
Exams					
ST 2024	76-T-MACH-105159	Global Production and Logistics - Part 2: Global Logistics / New: Global Logistics			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 Global Logistics

2149600, SS 2024, 2 SWS, Language: German, Open in study portal

Lecture (V)
On-Site

Content
Content:

Characteristics of global trade

- Incoterms
- Customs clearance, documents and export control

Global transport and shipping

- Maritime transport, esp. container handling
- Air transport

Modeling of supply chains

- SCOR model
- Value stream analysis

Location planning in cross-border-networks

- Application of the Warehouse Location Problem
- Transport Planning

Inventory Management in global supply chains

- Stock keeping policies
- Inventory management considering lead time and shipping costs

Media:

presentations, black board

Workload:

regular attendance: 21 hours
self-study: 99 hours

Students are able to:

- assign basic problems of planning and operation of global supply chains and plan them with apropriate methods,
- describe requirements and characteristics of global trade and transport, and
- evaluate characteristics of the design from logistic chains regarding their suitability.

Exam:

The exam consists of a 60 minutes written examination (according to §4(2), 1 of the examination regulation).

The main exam is offered every summer semester. A second date for the exam is offered in winter semester only for students that did not pass the main exam.

Literature
Weiterführende Literatur:

- Arnold/Isermann/Kuhn/Tempelmeier. HandbuchLogistik, Springer Verlag, 2002 (Neuauflage in Arbeit)
- Domschke. Logistik, Rundreisen und Touren,Oldenbourg Verlag, 1982
- Domschke/Drexl. Logistik, Standorte, OldenbourgVerlag, 1996
- Gudehus. Logistik, Springer Verlag, 2007
- Neumann-Morlock. Operations-Research,Hanser-Verlag, 1993
- Tempelmeier. Bestandsmanagement in SupplyChains, Books on Demand 2006
- Schönsleben. IntegralesLogistikmanagement, Springer, 1998

T 11.176 Course: Global Production [T-MACH-110991]

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

Part of: M-MACH-102597 - Compulsory Elective Module Mechanical Engineering
M-MACH-102618 - Major Field: Production Technology
M-MACH-102629 - Major Field: Logistics and Material Flow Theory

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

Events					
WT 24/25	2149613	Global Production	2 SWS	Lecture / 🗣💻	Lanza, Benfer
Exams					
ST 2024	76-T-MACH-110991	Global Production			Lanza

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

Competence Certificate
Written Exam (60 min)

Prerequisites
T-MACH-108848 - Globale Produktion und Logistik - Teil 1: Globale Produktion must not be commenced.
T-MACH-105158 - Globale Produktion und Logistik - Teil 1: Globale Produktion must not be commenced.
T-MACH-110337 - Globale Produktion und Logistik must not be commenced.

Modeled Conditions
The following conditions have to be fulfilled:

1. The course T-MACH-110337 - Global Production and Logistics must not have been started.

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

V Global Production

2149613, WS 24/25, 2 SWS, Language: German, Open in study portal

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

Content
The lecture examines the management of global production networks of manufacturing companies. It gives an overview of the influencing factors and challenges of global production. In-depth knowledge of common methods and procedures for planning, designing and managing global production networks is imparted.

Therefore, the lecture first of all discusses the connections and interdependencies between the business strategy and the production strategy and illustrates necessary tasks for the definition of a production strategy. Methods for site selection, for the site-specific adaptation of product design and production technology as well as for the establishment of new production sites and for the adaptation of existing production networks to changing framework conditions are subsequently taught within the context of the design of the network footprint. With regard to the management of global production networks, the lecture addresses challenges associated with coordination, procurement and order management in global networks. The lecture is complemented by a discussion on the use of industry 4.0 applications in global production and current trends in planning, designing and managing global production networks.

The topics include:

- Basic conditions and influencing factors of global production (historical development, targets, chances and threats)
- Framework for planning, designing and managing global production networks
- Production strategies for global production networks
    - From business strategy to production strategy
    - Tasks of the production strategy (product portfolio management, circular economy, planning of production depth, production-related research and development)
- Design of global production networks
    - Basic types of network structures
    - Planning process for the design of the network footprint
    - Adaptation of the network footprint
    - Site selection
    - Location-specific adaptation of production technology and product design
- Management of global production networks
    - Network coordination
    - Procurement process
    - Order management

- Trends in planning, designing and managing global production networks

Learning Outcomes:

The students …

- can explain the general conditions and influencing factors of global production
- are capable to apply defined procedures for site selection and to evaluate site decisions with the help of different methods
- are able to select the adequate scope of design for siteappropriate production and product construction casespecifically
- can state the central elements in the planning process of establishing a new production site.
- are capable to make use of the methods to design and scale global production networks for company-individual problems

- are able to show up the challenges and potentials of the departments sales, procurement as well as research and development on global basis.

Workload:

regular attendance: 21 hours
self-study: 99 hours

Recommendations:
Combination with Global Production and Logistics – Part 2

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

empfohlene Sekundärliteratur:
Abele, E. et al: Handbuch Globale Produktion, Hanser Fachbuchverlag, 2006 (deutsch)

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

recommended secondary literature:
Abele, E. et al: Global Production – A Handbook for Strategy and Implementation, Springer 2008 (english)

T 11.177 Course: Global Production and Logistics [T-MACH-110337]

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

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102618 - Major Field: Production Technology

Type	Credits	Grading scale	Version
Oral examination	8	Grade to a third	1

Events					
ST 2024	2149600	Global Logistics	2 SWS	Lecture / 🗣	Furmans
WT 24/25	2149613	Global Production	2 SWS	Lecture / 🧩	Lanza, Benfer
Exams					
ST 2024	76-T-MACH-110337	Global Production and Logistics			Furmans, Lanza

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

Competence Certificate
oral exam (40 min)

Prerequisites
The following courses must not be started :

- Globale Production and Logistics - Part 1: Global Production [T-MACH-105158 oder T-MACH-108848]
- Globale Production and Logistics - Part 2: Global Logistics [T-MACH-105159]

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

V Global Logistics
2149600, SS 2024, 2 SWS, Language: German, Open in study portal

Lecture (V)
On-Site

Content
Content:

Characteristics of global trade

- Incoterms
- Customs clearance, documents and export control

Global transport and shipping

- Maritime transport, esp. container handling
- Air transport

Modeling of supply chains

- SCOR model
- Value stream analysis

Location planning in cross-border-networks

- Application of the Warehouse Location Problem
- Transport Planning

Inventory Management in global supply chains

- Stock keeping policies
- Inventory management considering lead time and shipping costs

Media:

presentations, black board

Workload:

regular attendance: 21 hours
self-study: 99 hours

Students are able to:

- assign basic problems of planning and operation of global supply chains and plan them with apropriate methods,
- describe requirements and characteristics of global trade and transport, and
- evaluate characteristics of the design from logistic chains regarding their suitability.

Exam:

The exam consists of a 60 minutes written examination (according to §4(2), 1 of the examination regulation).

The main exam is offered every summer semester. A second date for the exam is offered in winter semester only for students that did not pass the main exam.

Literature
Weiterführende Literatur:

- Arnold/Isermann/Kuhn/Tempelmeier. HandbuchLogistik, Springer Verlag, 2002 (Neuauflage in Arbeit)
- Domschke. Logistik, Rundreisen und Touren,Oldenbourg Verlag, 1982
- Domschke/Drexl. Logistik, Standorte, OldenbourgVerlag, 1996
- Gudehus. Logistik, Springer Verlag, 2007
- Neumann-Morlock. Operations-Research,Hanser-Verlag, 1993
- Tempelmeier. Bestandsmanagement in SupplyChains, Books on Demand 2006
- Schönsleben. IntegralesLogistikmanagement, Springer, 1998

V **Global Production**
2149613, WS 24/25, 2 SWS, Language: German, Open in study portal

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

Content

The lecture examines the management of global production networks of manufacturing companies. It gives an overview of the influencing factors and challenges of global production. In-depth knowledge of common methods and procedures for planning, designing and managing global production networks is imparted.

Therefore, the lecture first of all discusses the connections and interdependencies between the business strategy and the production strategy and illustrates necessary tasks for the definition of a production strategy. Methods for site selection, for the site-specific adaptation of product design and production technology as well as for the establishment of new production sites and for the adaptation of existing production networks to changing framework conditions are subsequently taught within the context of the design of the network footprint. With regard to the management of global production networks, the lecture addresses challenges associated with coordination, procurement and order management in global networks. The lecture is complemented by a discussion on the use of industry 4.0 applications in global production and current trends in planning, designing and managing global production networks.

The topics include:

- Basic conditions and influencing factors of global production (historical development, targets, chances and threats)
- Framework for planning, designing and managing global production networks
- Production strategies for global production networks
  - From business strategy to production strategy
  - Tasks of the production strategy (product portfolio management, circular economy, planning of production depth, production-related research and development)
- Design of global production networks
  - Basic types of network structures
  - Planning process for the design of the network footprint
  - Adaptation of the network footprint
  - Site selection
  - Location-specific adaptation of production technology and product design
- Management of global production networks
  - Network coordination
  - Procurement process
  - Order management

- Trends in planning, designing and managing global production networks

Learning Outcomes:

The students …

- can explain the general conditions and influencing factors of global production
- are capable to apply defined procedures for site selection and to evaluate site decisions with the help of different methods
- are able to select the adequate scope of design for siteappropriate production and product construction casespecifically
- can state the central elements in the planning process of establishing a new production site.
- are capable to make use of the methods to design and scale global production networks for company-individual problems

- are able to show up the challenges and potentials of the departments sales, procurement as well as research and development on global basis.

Workload:

regular attendance: 21 hours
self-study: 99 hours

Recommendations:

Combination with Global Production and Logistics – Part 2

Literature

Medien

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

empfohlene Sekundärliteratur:
Abele, E. et al: Handbuch Globale Produktion, Hanser Fachbuchverlag, 2006 (deutsch)

Media

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

recommended secondary literature:
Abele, E. et al: Global Production – A Handbook for Strategy and Implementation, Springer 2008 (english)

T 11.178 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-102597 - Compulsory Elective Module Mechanical Engineering
M-MACH-102607 - Major Field: Vehicle Technology

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

Events					
WT 24/25	2113807	Handling Characteristics of Motor Vehicles I	2 SWS	Lecture / 🖥	Unrau
Exams					
ST 2024	76-T-MACH-105152	Handling Characteristics of Motor Vehicles I			Unrau
WT 24/25	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 24/25, 2 SWS, Language: German, Open in study portal

Lecture (V)
Online

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
Die Vorlesung wird als Videostream zur Verfügung gestellt. Sie finden den Videostream und das Vorlesungsmaterial auf ILIAS. 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 11.179 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-102597 - Compulsory Elective Module Mechanical Engineering
M-MACH-102607 - Major Field: Vehicle Technology

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

Events					
ST 2024	2114838	Handling Characteristics of Motor Vehicles II	2 SWS	Lecture / 🖥	Unrau
Exams					
ST 2024	76-T-MACH-105153	Handling Characteristics of Motor Vehicles II			Unrau
WT 24/25	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 2024, 2 SWS, Language: German, Open in study portal

Lecture (V)
Online

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
Die Vorlesung wird als Videostream zur Verfügung gestellt. Sie finden den Videostream und das Vorlesungsmaterial auf ILIAS. 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 11.180 Course: Hands-on BioMEMS [T-MACH-106746]

Responsible: Prof. Dr. Andreas Guber
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102597 - Compulsory Elective Module Mechanical Engineering

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

Competence Certificate
Oral presentation and discussion (30 Min.)

Prerequisites
none

T 11.181 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-102405 - Fundamentals and Methods of General Mechanical Engineering
M-MACH-102575 - Fundamentals and Methods of Energy and Environmental Engineering
M-MACH-102739 - Fundamentals and Methods of Automotive Engineering
M-MACH-102740 - Fundamentals and Methods of Mechatronics and Microsystem Technology
M-MACH-102741 - Fundamentals and Methods of Product Development and Construction
M-MACH-102743 - Fundamentals and Methods of Theoretical Foundations of Mechanical Engineering

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

Events					
ST 2024	3122512	Heat and Mass Transfer	2 SWS	Lecture / 🗣	Maas
WT 24/25	2165512	Heat and mass transfer	2 SWS	Lecture / 🗣	Yu, Maas
WT 24/25	2165513	Heat and Mass Transfer (Tutorial)	2 SWS	Practice / 🗣	Yu, Maas, Bykov
Exams					
ST 2024	76-T-MACH-105292	Heat and Mass Transfer			Maas
WT 24/25	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 2024, 2 SWS, Language: English, 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

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 24/25, 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

V **Heat and Mass Transfer (Tutorial)**
2165513, WS 24/25, 2 SWS, Language: German, Open in study portal

Practice (Ü)
On-Site

T 11.182 Course: Heat Transfer and Cooling at Thermally Highly Loaded Components [T-MACH-113362]

Responsible: Prof. Dr.-Ing. Hans-Jörg Bauer
Dr.-Ing. Achmed Schulz

Organisation: KIT Department of Mechanical Engineering
Institute of Thermal Turbomachinery

Part of: M-MACH-102597 - Compulsory Elective Module Mechanical Engineering
M-MACH-102610 - Major Field: Power Plant Technology
M-MACH-102636 - Major Field: Thermal Turbomachines

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

Events					
ST 2024	2170466	Heat Transfer and Cooling at Thermally Highly Loaded Components	2 SWS	Lecture / 🗣	Bauer, Schmid
Exams					
ST 2024	76-T-MACH-113362	Heat Transfer and Cooling at Thermally Highly Loaded Components			Schmid
WT 24/25	76-T-MACH-113362	Heat Transfer and Cooling at Thermally Highly Loaded Components			Schmid

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

Competence Certificate
oral exam, approx. 30 min.

Annotation
Workload:
regular attendance: 30 h
self-study: 90 h

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

V Heat Transfer and Cooling at Thermally Highly Loaded Components

Lecture (V)
On-Site

2170466, SS 2024, 2 SWS, Language: German, Open in study portal

Content

Teaching Content:

Thermally highly loaded components can be found in several fields of application: The hot gas temperatures of **modern gas turbines** and **jet engines** exceed the maximum tolerable temperatures by several hundreds of Kelvin. By increasing the power density of electric motors and the related power electronics in the field of **e-mobility**, the surface, available for lost heat rejection, is reduced. Furthermore, the temperature of the **battery** must be kept within a tight range to achieve an efficient operation. To ensure reliability of lifetime and operational safety, complex cooling technology must be applied.

First, the basics of forced convection and thermal radiation will be introduced in this lesson. Based on that various cooling methods will be presented. Specific pros and cons will be identified and new concepts for further improvement of cooling will be discussed. Subsequently, the capability of the introduced cooling methods is supported by practical applications. Finally, experimental and numerical methods for the characterization of heat transfer will be presented.

Workload:
regular attendance: 30 h
self-study: 90 h

Learning Objectives:
The students are able to:

- outline the basics of forced convection, thermal radiation and film cooling
- name, analyse and differentiate between different cooling methods
- judge the advantages and disadvantages of cooling methods and discuss approaches for the improvement of complex cooling methods
- design cooling concepts for thermally highly loaded components in a simplified manner
- name and rate the experimental and numerical methods for the characterisation of heat transfer

Exam:
oral exam, approximately 30 minutes, no tools or reference materials may be used during the exam

Language: German

T 11.183 Course: Heat Transfer in Nuclear Reactors [T-MACH-105529]

Responsible: Prof. Dr.-Ing. Xu Cheng
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102597 - Compulsory Elective Module Mechanical Engineering

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

Events					
WT 24/25	2189907	Flow and heat transfer in nuclear reactors	2 SWS	Lecture / 🗣	Cheng

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 Flow and heat transfer in nuclear reactors

2189907, WS 24/25, 2 SWS, Language: English, Open in study portal

Lecture (V)
On-Site

Content
This lecture is designed for students of mechanical engineering and other engineering disciplines in their Bachelor or Master studies. The students will understand the most important heat transfer processes and learn the methods for the analysis of flow and heat transfer in nuclear reactors. Students are capable of explaining the thermal-hydraulic processes occurring in nuclear reactors and of selecting suitable models or simulation codes for thermal-hydraulic design and analysis.

1. Reactor types and thermal-hydraulic design criteria
2. Heat transfer processes and modeling
3. Pressure drop calculation
4. Temperature distribution in nuclear reactor
5. Numerical analysis methods for nuclear reactor thermal-hydraulics

Organizational issues
This compact English lecture will be given on February 10 - 12, 2025, 09:00-17:00.

in seminar room of the Institute IATF, Building 07.08, Room 331

Literature

1. L.S. Tong, J. Weisman, Thermal-hydraulics of pressurized water reactors, American Nuclear Society, La Grande Park, Illinois, USA
2. R.T. Lahey, F.J. Moody, The Thermal-Hydraulics of a Boiling Water Nuclear Reactor, 2nd edition, ANS, La Grande Park, Illinois, USA, 1993

T 11.184 Course: Heatpumps [T-MACH-105430]

Responsible: Prof. Dr. Ulrich Maas
Dr.-Ing. Heinrich Wirbser

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102597 - Compulsory Elective Module Mechanical Engineering
M-MACH-102635 - Major Field: Engineering Thermodynamics
M-MACH-102648 - Major Field: Energy Technology for Buildings

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

Events					
ST 2024	2166534	Heatpumps	2 SWS	Lecture / 🗣	Wirbser
WT 24/25	2166534	Heatpumps	2 SWS	Lecture / 🗣	Wirbser
Exams					
ST 2024	76-T-MACH-105430	Heatpumps			Maas, Wirbser
WT 24/25	76-T-MACH-105430	Heatpumps			Maas, Wirbser

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 Heatpumps

2166534, SS 2024, 2 SWS, Language: German, Open in study portal

Lecture (V)
On-Site

Content
The aim of this lecture is to promote heat pumps as heating systems for small an medium scale facilities and to discuss their advantages as well as their drawbacks. After considering the actual energy situation and the political requirements the different aspects of heat pumps are elucidated. The requirements concerning heat sources, the different components and the various types of heat pumps are discussed. In addition ecological and economical aspects are taken into consideration. The coupling of heat pumps with heat accumulators in heating systems will also be part of the lecture.

Literature
Vorlesungsunterlagen

Bach, K.: Wärmepumpen, Bd. 26 Kontakt und Studium, Lexika Verlag, 1979

Kirn, H., Hadenfeldt, H.: Wärmepumpen, Bd. 1: Einführung und Grundlagen, Verlag C. F. Müller, 1987

von Cube, H.L.: Lehrbuch der Kältetechnik, Verlag C.F. Müller, Karlsruhe, 1975.

von Cube, H.L., Steimle,F.: Wärmepumpen, Grunglagen und Praxis VDI-Verlag, Düsseldorf, 1978.

V Heatpumps

2166534, WS 24/25, 2 SWS, Language: German, Open in study portal

Lecture (V)
On-Site

Content
The aim of this lecture is to promote heat pumps as heating systems for small an medium scale facilities and to discuss their advantages as well as their drawbacks. After considering the actual energy situation and the political requirements the different aspects of heat pumps are elucidated. The requirements concerning heat sources, the different components and the various types of heat pumps are discussed. In addition ecological and economical aspects are taken into consideration. The coupling of heat pumps with heat accumulators in heating systems will also be part of the lecture.

Literature

Vorlesungsunterlagen

Bach, K.: Wärmepumpen, Bd. 26 Kontakt und Studium, Lexika Verlag, 1979

Kirn, H., Hadenfeldt, H.: Wärmepumpen, Bd. 1: Einführung und Grundlagen, Verlag C. F. Müller, 1987

von Cube, H.L.: Lehrbuch der Kältetechnik, Verlag C.F. Müller, Karlsruhe, 1975.

von Cube, H.L., Steimle,F.: Wärmepumpen, Grunglagen und Praxis VDI-Verlag, Düsseldorf, 1978.

T 11.185 Course: High Performance Computing [T-MACH-105398]

Responsible: Prof. Dr. Britta Nestler
Dr.-Ing. Michael Selzer

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102597 - Compulsory Elective Module Mechanical Engineering

Type	Credits	Grading scale	Recurrence	Version
Written examination	5	Grade to a third	Each winter term	3

Events					
WT 24/25	2183721	High Performance Computing	2 SWS	Lecture / Practice (/ 🗣	Nestler, Selzer

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

Competence Certificate
At the end of the semester, there will be a written exam (90 min).

Prerequisites
none

Recommendation
preliminary knowlegde in mathematics, physics and materials science

regular participation in the additionally offered computer exercises

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

V High Performance Computing

2183721, WS 24/25, 2 SWS, Language: German, Open in study portal

Lecture / Practice (VÜ)
On-Site

Content
PLEASE NOTE: This lecture is only offered in the winter semester!

Topics of the high performance computing courde are:

- achitectures of parallel platforms
- parallel programming models
- performance analysis of concurrent programs
- parallelization models
- MPI and OpenMP
- onte-Carlo method
- 1D & 2D heat diffusion
- raycasting
- n-body problem
- simple phase-field models

The student

- can explain the foundations and strategies of parallel programming
- can efficiently apply high performance computers for simulations by elaborating respective parallelisation techniques.
- has an overview of typical applications and the specific requirements for parallelization.
- knows the concepts of parallelisation and is capable to apply these to efficiently use high performance computing resources and the growing performance of multi core processors in science and industry.
- has experiences in programming of parallel algorithms through integrated computer exercises.

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 discuss excercises at the computer.

At the end of the semester, there will be a written exam.

Literature

1. Vorlesungsskript; Übungsaufgabenblätter; Programmgerüste
2. Parallele Programmierung, Thomas Rauber, Gudula Rügner; Springer 2007

T 11.186 Course: High Performance Powder Metallurgy Materials [T-MACH-102157]

Responsible: apl. Prof. Dr. Günter Schell
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102597 - Compulsory Elective Module Mechanical Engineering
M-MACH-102611 - Major Field: Materials Science and Engineering
M-MACH-102619 - Major Field: Technical Ceramics and Powder Materials

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

Events					
ST 2024	2126749	Advanced powder metals	2 SWS	Lecture /	Schell
Exams					
ST 2024	76-T-MACH-102157	High Performance Powder Metallurgy Materials			Schell
WT 24/25	76-T-MACH-102157	High Performance Powder Metallurgy Materials			Schell, Wagner

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

Competence Certificate
oral exam, 20- 30 min

Prerequisites
none

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

V Advanced powder metals
2126749, SS 2024, 2 SWS, Language: German, Open in study portal

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

Literature

- W. Schatt ; K.-P. Wieters ; B. Kieback. ".Pulvermetallurgie: Technologien und Werkstoffe", Springer, 2007
- R.M. German. "Powder metallurgy and particulate materials processing. Metal Powder Industries Federation, 2005
- F. Thümmler, R. Oberacker. "Introduction to Powder Metallurgy", Institute of Materials, 1993

T 11.187 Course: High Temperature Corrosion [T-MACH-113598]

Responsible: Prof. Dr.-Ing. Bronislava Gorr
Organisation: KIT Department of Mechanical Engineering
Part of: M-MACH-102611 - 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 24/25	2193055	High Temperature Corrosion	2 SWS	Lecture / 🗣	Gorr

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

Competence Certificate
oral exam (about 30 minutes)

Prerequisites
none

Recommendation
Knowledge from the basic materials science lecture

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

V High Temperature Corrosion

2193055, WS 24/25, 2 SWS, Language: English, Open in study portal

Lecture (V)
On-Site

Content
Oral examination (about 30 min)

Teaching content:

- High temperature functional and structural materials
- Thermodynamic fundamentals
- Kinetics and oxidation rate laws
- Defects in oxides
- Carl Wagner oxidation theory
- Oxidation of alloys
- Internal corrosion
- Protective coatings

Qualification targets:

The students gain fundamental understanding about underlying oxidation mechanisms of pure metals and complex alloys and acquire knowledge about ways to intrinsically protect high temperature materials by changing their chemical composition or/and atmospheric conditions as well as by applying protective coatings.

Recommendations:

Basic course in materials science and engineering and the course *Introduction to high temperature materials* (Gorr)

Organizational issues
Anmeldung verbindlich bis zum 18.10.2024 unter sabine.deubig@kit.edu und bronislava.gorr@kit.edu

Literature

- Birks, N., Meier, G.H. and Pettit, F.S., Introduction to the High Temperature Oxidaiton of Metals, Cambridge University Press, (Cambridge, 2006)
- Kofstad, P., High Temperature Corrosion, Elsevier Applied Science, (London, 1988)

T 11.188 Course: High Temperature Materials [T-MACH-105459]

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

Part of: M-MACH-102597 - Compulsory Elective Module Mechanical Engineering
M-MACH-102611 - Major Field: Materials Science and Engineering
M-MACH-105904 - Major Field: Advanced Materials Modelling and Data Management

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

Events					
WT 24/25	2174605	High Temperature Materials	2 SWS	Lecture / 🗣	Heilmaier
Exams					
ST 2024	76-T-MACH-105459	High Temperature Materials			Heilmaier
WT 24/25	76-T-MACH-105459	High Temperature Materials			Heilmaier

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 High Temperature Materials

2174605, WS 24/25, 2 SWS, Language: English, Open in study portal

Lecture (V)
On-Site

Content

- Phenomenology of High Temperature Deformation
- Deformation Mechanisms
- High Temperature Structural Materials

learning objectives:

Students are able to

- Define properly the term "high temperature" with respect to materials
- Describe the shape of the creep curve based on underlying deformation mechanisms
- Rationalize the influence of relevant parameters such as temperature, stress, microstructure on the high temperature deformation behavior
- Develop strategies for improving creep resistance of alloys via modifying their composition
- Select properly industrially relevant high temperature structural materials for various applications

Literature
B. Ilschner, Hochtemperaturplastizität, Springer-Verlag, Berlin

M.E. Kassner, Fundamentals of Creep in Metals and Alloys, Elsevier, Amsterdam, 2009

T 11.189 Course: Holistic Approach of Managing Power Plant Operation under Uncertainty and Volatility [T-MACH-112238]

Responsible: Dr. Marcus Seidl
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102643 - Major Field: Fusion Technology

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

Events					
WT 24/25	2189405	Holistic approach of managing power plant operation under uncertainty and volatility	2 SWS	Lecture / 🖥	Seidl
Exams					
WT 24/25	76-T-MACH-112238	Holistic approach of managing power plant operation under uncertainty and volatility			Seidl

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

Competence Certificate
oral exam of about 30 minutes

Prerequisites
none

Annotation
none

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

V Holistic approach of managing power plant operation under uncertainty and volatility

Lecture (V)
Online

2189405, WS 24/25, 2 SWS, Language: English, Open in study portal

Content
Main Contents:

The structure ofelectricity markets

Requirements from network operators

The basics of commodity markets

The impact of regulation on power plant operation

The role of behavioral economics in power plant decision making

Integration of renewable energy sources into the electricity market

Calibration of power plant operation and maintenance to market requirements

Asset management for power plant fleets

Applying financial engineering to optimize asset utilization

Day-to-day decision making for power plant operation

The lecture provides an overview of the many practical aspects of power plant operation. For this purpose, the knowledge of the energy and commodity markets, the regulatory boundary conditions, the energy trading instruments, the principles of fleet management and the requirements of power plant maintenance are required.

For the purpose of an efficient management of a power plant fleet it is explained how a variety of statistical models can be used to determine the optimal combination of resource purchases, outage management, load availability and ask prices.

Each credit point equals to 25-30 h working time of a student. Thereby, the time is based on an average student finishing with and average score. The working time can be split into: 1 attendance of the lectures, 2. pre- and post-processing of the lecture, 3 preparations for examination.

Students understand the many aspects of power plant operation: the structure of the energy and commodity markets, the regulatory boundary conditions, the energy trading instruments, the principles of fleet management and the requirements of power plant maintenance.

Furthermore, students can develop on their own a suitable strategy for the management of a power plant fleet.

Oral exam of about 25 min.

Literature
G. Balzer, C. Schorn, Asset Management für Infrastrukturanlagen - Energie und Wasser, VDI

R. Weron, Modeling and Forecasting Electricity Loads and Prices: A Statistical Approach, Wiley

D. Edwards, Energy Trading and Investing: Trading, Risk Management and Structuring Deals in the Energy Market, McGraw-Hill

T 11.190 Course: Hot Research Topics in AI for Engineering Applications [T-MACH-113669]

Responsible: Prof. Dr.-Ing. Anne Meyer
Organisation: KIT Department of Mechanical Engineering
Part of: M-MACH-102613 - Major Field: Lifecycle Engineering

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

Events					
WT 24/25	2121341	Hot Research Topics in AI for Engineering Applications	3 SWS	Project (P / 🗣	Meyer, Dörr

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

Competence Certificate
The grade is determined by an examination of another type. This consists of an individual knowledge check after the lecture part, the continuous assessment of teamwork during the implementation task and a final presentation. The overall impression is assessed; in addition to the implementation task, the knowledge test and the final presentation are also taken into account.

Prerequisites
none

Recommendation
Basic knowledge of artificial intelligence and machine learning, Programming experience, preferably in Python, English proficiency

Annotation
Limited number of participants.

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

V Hot Research Topics in AI for Engineering Applications

2121341, WS 24/25, 3 SWS, Language: English, Open in study portal

Project (PRO)
On-Site

Content
In " Hot Research Topics in AI for Engineering Applications", we explore the applicability of cutting-edge research findings in the fields of Machine Learning and Artificial Intelligence (e.g., LLM agents, Reinforcement Learning) to applications in engineering (e.g., optimization in production and logistics, creation of CAD models). Each year, we offer a different methodological focus (more on the IMI-homepage).

First, we provide the theoretical foundations and then move into a group work phase where students implement and analyze an application prototype. The event is aimed at students with prior knowledge in machine learning and programming.

- Theoretical foundations of the technologies considered in the course (e.g., Deep Learning, Transformers, LLM)
- Application possibilities of modern technologies in an industrial context
- Challenges in making current research findings usable for solving specific engineering problems and productive use
- Implementation of solutions to apply modern technologies to specified engineering problems (usually Python-based, using current frameworks)
- Independent execution of an implementation project with current, thematically relevant content (e.g., LLM agents for interaction with external systems such as robots, for algorithm construction, or for creating 3D CAD models, etc.)
- Technologies and applications are announced at the beginning of each semester

After the event, participants will be able to:

- Identify the technical and algorithmic foundations behind the relevant research topics and explain their functionalities
- Identify application possibilities of current research findings and related technologies in an industrial context, as well as the challenges that arise in the process
- Implement solutions proposed in recent publications using existing frameworks and codebases as prototypes
- Structure and execute programming projects in a team
- Clearly present the results of practical projects tailored to the audience

Participation Requirements

- Basic knowledge of artificial intelligence and machine learning
- Programming experience, preferably in Python
- English proficiency

Organizational issues
Place and time of the course can be found in ILIAS, / Ort und Zeit der Lehrveranstaltung siehe ILIAS

T 11.191 Course: Human Brain and Central Nervous System: Anatomy, Information Transfer, Signal Processing, Neurophysiology and Therapy [T-INFO-101262]

Responsible: Prof. Dr.-Ing. Tamim Asfour
Hon.-Prof. Dr. Uwe Spetzger

Organisation: KIT Department of Informatics

Part of: M-MACH-102595 - Compulsory Elective Module Natural Science/Computer Science/Electrical Engineering
M-MACH-102615 - Major Field: Medical Technology

Type	Credits	Grading scale	Recurrence	Version
Written examination	3	Grade to a third	Each term	2

Events					
ST 2024	24678	Human Brain and Central Nervous System: Anatomy, Information Transfer, Signal Processing, Neurophysiology and Therapy	2 SWS	Lecture / 🗣	Spetzger
WT 24/25	24139	Human Brain and Central Nervous System: Anatomy, Information Transfer, Signal Processing, Neurophysiology and Therapy	2 SWS	Lecture / 🗣	Spetzger
Exams					
ST 2024	7500145	Human Brain and Central Nervous System: Anatomy, Information Transfer, Signal Processing, Neurophysiology and Therapy			Spetzger
WT 24/25	7500118	Human Brain and Central Nervous System: Snatomy, Information Transfer, Signal Processing, Neurophysiology and Therapy			Spetzger

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

T 11.192 Course: Human Factors Engineering I [T-MACH-105518]

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

Part of:
M-MACH-102405 - Fundamentals and Methods of General Mechanical Engineering
M-MACH-102597 - Compulsory Elective Module Mechanical Engineering
M-MACH-102600 - Major Field: Man - Technology - Organisation
M-MACH-102642 - Major Field: Development of Innovative Appliances and Power Tools
M-MACH-102739 - Fundamentals and Methods of Automotive Engineering
M-MACH-102741 - Fundamentals and Methods of Product Development and Construction
M-MACH-102742 - Fundamentals and Methods of Production Technology

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

Events					
WT 24/25	2109035	Human Factors Engineering I: Ergonomics	2 SWS	Lecture / 🗣	Deml
Exams					
ST 2024	76-T-MACH-105518	Human Factors Engineering I			Deml
WT 24/25	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 24/25, 2 SWS, Language: German, Open in study portal

Lecture (V)
On-Site

Content
The course "Human Factors Engineering I: Ergonomics" takes place in the first half of the semester on Wednesday and Thursday.

In the second half of the semester 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 am Mittwoch und Donnerstag bis zum 12.12.2024 statt.

Ab dem 18.12.2024 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 11.193 Course: Human Factors Engineering II [T-MACH-105519]

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

Part of: M-MACH-102597 - Compulsory Elective Module Mechanical Engineering
M-MACH-102600 - Major Field: Man - Technology - Organisation

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

Events					
WT 24/25	2109036	Human Factors Engineering II: Work Organisation	2 SWS	Lecture / 🗣	Deml
Exams					
ST 2024	76-T-MACH-105519	Human Factors Engineering II			Deml
WT 24/25	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

Modeled Conditions
The following conditions have to be fulfilled:

1. The course T-MACH-110652 - Human Factors Engineering II must not have been started.

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

V Human Factors Engineering II: Work Organisation

2109036, WS 24/25, 2 SWS, Language: German, Open in study portal

Lecture (V)
On-Site

Content
The course "Human Factors Engineering I: Ergonomics" takes place in the first half of the semester on Wednesday and Thursday.

In the second half of the semester 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 am Mittwoch und Donnerstag statt.

In der zweiten Hälfte, ab dem Donnerstag, dem 18.12.2024 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 11.194 Course: Human Factors Engineering II [T-MACH-110652]

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

Part of: M-MACH-102596 - Compulsory Elective Subject Economics/Law

Type	Credits	Grading scale	Recurrence	Version
Completed coursework (written)	4	pass/fail	Each term	2

Exams			
ST 2024	76-T-MACH-110652	Human Factors Engineering II	Deml
WT 24/25	76-T-MACH-110652	Human Factors Engineering II	Deml

Competence Certificate
written success control, 60 minutes

The exams are only offered in German!

Prerequisites
none

Modeled Conditions
The following conditions have to be fulfilled:

1. The course T-MACH-105519 - Human Factors Engineering II must not have been started.

11.195 Course: Human Factors Engineering III: Empirical Research Methods [T-MACH-105830]

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

Part of: M-MACH-102600 - Major Field: Man - Technology - Organisation

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

Events					
ST 2024	2110036	Human Factors Engineering III: Empirical research methods	2 SWS	Practical course / 🗣	Deml
Exams					
ST 2024	76-T-MACH-105830	Human Factors Engineering III: Empirical research methods			Deml

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

Competence Certificate
Scientific report (about 6 pages), poster, and presentation

Prerequisites
In order to attend this lecture, it is necessary having completed "Arbeitswissenschaft I" or "Arbeitswissenschaft II" successfully.

Modeled Conditions
You have to fulfill one of 2 conditions:

1. The course T-MACH-105518 - Human Factors Engineering I must have been passed.
2. The course T-MACH-105519 - Human Factors Engineering II must have been passed.

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

V Human Factors Engineering III: Empirical research methods

2110036, SS 2024, 2 SWS, Language: German, Open in study portal

Practical course (P)
On-Site

Content
The aim of the course is for participants to become familiar with and apply research methods in occupational science. For this purpose, the participants will receive an introduction to the basics of experimental design and they will learn essential methods of data collection and statistical data analysis. Subsequently, the participants will conduct, evaluate and present their own experimental studies on the topics of driver behavior and driving simulation.
Weekly face-to-face attendance at lecture sessions as well as small group sessions in the lab is mandatory.

In addition, an approximately six-page research report and presentation are required as part of the course.

Organizational issues
Die Veranstaltung ist teilnahmebeschränkt. Die Anmeldung erfolgt über ILIAS. Die Veranstaltung kann nur belegt werden, wenn entweder Arbeitswissenschaft I (Ergonomie) oder Arbeitswissenschaft II (Arbeitsorganisation) erfolgreich absolviert worden ist.

Die Prüfungsleistung besteht in Form eines schriftlichen Forschungsberichts und einer Präsentation.

T 11.196 Course: Human-Machine-Interaction [T-INFO-101266]

Responsible: Prof. Dr.-Ing. Michael Beigl
Organisation: KIT Department of Informatics
Part of: M-MACH-102598 - Major Field: Advanced Mechatronics
M-MACH-102614 - Major Field: Mechatronics

Type	Credits	Grading scale	Recurrence	Version
Written examination	6	Grade to a third	Each summer term	3

Events					
ST 2024	24659	Human-Computer-Interaction	2 SWS	Lecture /	Beigl, Lee
Exams					
ST 2024	7500048	Human-Machine-Interaction			Beigl
WT 24/25	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 11.197 Course: Human-Machine-Interaction Pass [T-INFO-106257]

Responsible: Prof. Dr.-Ing. Michael Beigl
Organisation: KIT Department of Informatics
Part of: M-MACH-102598 - Major Field: Advanced Mechatronics
M-MACH-102614 - Major Field: Mechatronics

Type	Credits	Grading scale	Recurrence	Version
Completed coursework	0	pass/fail	Each summer term	1

Events					
ST 2024	2400095	Human-Computer-Interaction	1 SWS	Practice /	Beigl, Lee
ST 2024	24659	Human-Computer-Interaction	2 SWS	Lecture /	Beigl, Lee
Exams					
ST 2024	7500121	Human-Machine-Interaction			Beigl

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

T 11.198 Course: Humanoid Robots - Practical Course [T-INFO-105142]

Responsible: Prof. Dr.-Ing. Tamim Asfour
Organisation: KIT Department of Informatics
Part of: M-MACH-102633 - Major Field: Robotics

Type	Credits	Grading scale	Recurrence	Version
Examination of another type	3	Grade to a third	Each winter term	2

Events					
WT 24/25	24890	Humanoid Robotics Laboratory	4 SWS	Practical course / 🗣	Asfour
Exams					
WT 24/25	7500149	Humanoid Robotics Laboratory			Asfour

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

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

V Humanoid Robotics Laboratory

24890, WS 24/25, 4 SWS, Language: German/English, Open in study portal

Practical course (P)
On-Site

Content
In this practical course, a is worked on alone or in small teams with up to 3 students. Questions of humanoid robotics are dealt with, such as semantic scene interpretation, active perception, planning of grasping and manipulation tasks, action representation with motion primitives, and programming by demonstration.

The project work (alone or in groups) is performed largely independently but supported by scientific staff of the H2T. At the end of the practical course, the work has to be documented and presented in a scientific talk.

Learning Objectives:

- Students will be able to independently understand, structure, analyze, and solve a complex humanoid robotics problem using existing programming skills, alone or in a small team.
- Students can convey complex technical content in a presentation.

Recommendation:

- Very good programming skills in at least one high-level programming language are strongly recommended.
- Attendance of the lectures Robotics 1, Robotics 2, Robotics 3, as well as the robotics practical course are recommended.
- Project-specific recommendations (knowledge of C++, Python, ...) will be announced in the individual project descriptions

Organizational issues
Die Erfolgskontrolle erfolgt in Form einer mündlichen Prüfung nach § 4 Abs. 2 Nr. 2 SPO.

Die Modulnote ist die Note der mündlichen Prüfung.

Zielgruppe: Das Praktikum richtet sich an Studierende der Informatik, Elektrotechnik, Maschinenbau, Mechatronik im Masterstudium sowie alle Interessenten an der Robotik.

Arbeitsaufwand:

6 LP entspricht ca. 180h, davon

1. 10h Präsenzzeit in Praktikumsbesprechungen
2. 10h Vor- und Nachbereitung derselben
3. 150h Selbststudium zur Bearbeitung des Themas

ca. 10h Vorbereitung und Halten eines wissenschaftlichen Vortrags

T 11.199 Course: Human-oriented Productivity Management: Personnel Management [T-MACH-106374]

Responsible: Dr.-Ing. Patricia Stock
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102597 - Compulsory Elective Module Mechanical Engineering
M-MACH-102600 - Major Field: Man - Technology - Organisation
M-MACH-102613 - Major Field: Lifecycle Engineering
M-MACH-102618 - Major Field: Production Technology

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

Competence Certificate
oral exam (approx. 20 min)

The exam is offered in German only!

Annotation
The course is capacity-limited, therefore the allocation of places is based on § 5 para. 4 in the module handbook: **Registration and admission to module examinations and courses** . This results in the following selection criteria:

- Students of the degree program have priority over students from outside the degree program

- Among students within the degree program, a decision may be made based on academic progress (not just with subject semesters)
- In the case of equal academic progress according to waiting time
- In the case of equal waiting time by lot

The exact procedure is explained on **ILIAS**.

"Successful participation requires active and continuous participation in the course."

11.200 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-102599 - Major Field: Powertrain Systems
M-MACH-102607 - Major Field: Vehicle Technology
M-MACH-102614 - Major Field: Mechatronics

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

Events					
WT 24/25	2306321	Hybrid and Electric Vehicles	2 SWS	Lecture / Blended	Doppelbauer
WT 24/25	2306323	Tutorial for 2306323 Hybrid and Electric Vehicles	1 SWS	Practice / Blended	Doppelbauer
Exams					
ST 2024	7306321	Hybrid and Electric Vehicles			Doppelbauer
WT 24/25	7306321	Hybrid and Electric Vehicles			Doppelbauer

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

Prerequisites
none

T 11.201 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-102610 - Major Field: Power Plant Technology
M-MACH-102623 - Major Field: Fundamentals of Energy Technology
M-MACH-102627 - Major Field: Energy Converting Engines

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

Events					
ST 2024	2157432	Hydraulic Fluid Machinery	4 SWS	Lecture / 🗣	Pritz
Exams					
ST 2024	76-T-MACH-105326	Hydraulic Fluid Machinery			Pritz
WT 24/25	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 2024, 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 11.202 Course: Hydrodynamic Stability: From Order to Chaos [T-MACH-105425]

Responsible: apl. Prof. Dr. Andreas Class
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102597 - Compulsory Elective Module Mechanical Engineering
M-MACH-102634 - Major Field: Fluid Mechanic

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

Events					
ST 2024	2154437	Hydrodynamic Stability: From Order to Chaos	2 SWS	Lecture /	Class
Exams					
ST 2024	76-T-MACH-105425	Hydrodynamic Stability: From Order to Chaos			Class

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

Competence Certificate
oral exam, Duration: 30 minutes

Auxiliary means: none

Prerequisites
The partial performance number T-MACH-108846 - "Stability: From Order to Chaos" (Nat/Inf/Etit) must not be startet or completed. The partial services T-MACH-108846 - "Stability: From Order to Chaos" (Nat/Inf/Etit) and T-MACH-105425 - "Hydrodynamic Stability: From Order to Chaos" are mutually exclusive.

Modeled Conditions
The following conditions have to be fulfilled:

1. The course T-MACH-108846 - Stability: from Order to Chaos must not have been started.

Recommendation
Fluid Mechanics (T-MACH-105207)

Mathematical Methods in Fluid Mechanics (T-MACH-105295)

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

V Hydrodynamic Stability: From Order to Chaos

2154437, SS 2024, 2 SWS, Language: German/English, Open in study portal

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

Content
The studends can apply the analytic and numerical methods for an evaluation of stability properties of hydrodynamic systems. The are qualified to discuss the characteristic influence of parameter changes (e.g. Renolds number) on the calculated results with respect to the flow character and properties (e.g. transition laminar/turbulent flow).

Increasing a control parameter of a thermohydraulic system, e.g. the Reynolds number, the initial flow pattern (e.g. stationary flow) can be replaced by a different pattern (e.g. turbulent flow).

Typical hydrodynamic instabilities are summarized in the lecture.
The systematic analysis of thermohydraulic stability problems is developed for the case of Rayleigh-Bernard convection (fluid layer heated from below) and selected examples from fluid dynamics.

Covered is:

- linear stability analysis: determine limiting control parameter value up to which the basic flow pattern is stable against small perturbations.
- nonlinear reduced order modeling, capable to characterize more complex flow patterns
- Lorenz system: a generic system exhibiting chaotic behavior

Literature
Vorlesungsskript

T 11.203 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-102607 - Major Field: Vehicle Technology
M-MACH-102627 - Major Field: Energy Converting Engines
M-MACH-102635 - Major Field: Engineering Thermodynamics
M-MACH-102650 - Major Field: Combustion Engines Based Powertrains

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

Events					
WT 24/25	2134155	Hydrogen and reFuels - Energy Conversion in Combustion Engines	2 SWS	Lecture / 🗣	Koch
Exams					
ST 2024	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 24/25, 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 11.204 Course: Hydrogen in Materials – Exercises and Lab Course [T-MACH-112942]

Responsible: Dr. rer. nat. Stefan Wagner
Organisation: KIT Department of Mechanical Engineering
Part of: M-MACH-102611 - Major Field: Materials Science and Engineering

Type	Credits	Grading scale	Recurrence	Expansion	Version
Completed coursework	4	pass/fail	Each winter term	1 terms	1

Events					
WT 24/25	2174573	Hydrogen in Materials – Exercises and Lab Course	2 SWS	Practice / 🗣	Wagner
Exams					
ST 2024	76-T-MACH-112942	Hydrogen in Materials – Exercises and Lab Course			Wagner
WT 24/25	76-T-MACH-112942	Hydrogen in Materials – Exercises and Lab Course			Wagner

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

Competence Certificate
Regular participation and participating in lab course, protocol included.

Prerequisites
none

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

V Hydrogen in Materials – Exercises and Lab Course

2174573, WS 24/25, 2 SWS, Language: German, Open in study portal

Practice (Ü)
On-Site

Content
In this exercise with lab course the contents of the lecture “Hydrogen in Materials: from Energy Storage to Hydrogen Embrittlement” are deepened. The students know the differences in thermodynamics and kinetics of the hydrogen interaction with storage materials and construction materials. The students can describe the hydrogen interaction with microstructural defects in materials, and they know the resulting effects on the materials’ mechanical integrity. Based on this, the students can express the requirements of the respective materials classes and transfer them to engineering applications.

Utilizing proper experimental setups, the students can measure hydrogen induced stresses in materials as well as the hydrogens' diffusivity and its chemical potential. From the measurement data, the students can construct metal-hydrogen phase diagrams, and they can qualitatively assess the defect density in the metal.

T 11.205 Course: Hydrogen in Materials – Exercises and Lab Course [T-MACH-112159]

Responsible: Dr. rer. nat. Stefan Wagner
Organisation: KIT Department of Mechanical Engineering
Part of: M-MACH-102611 - Major Field: Materials Science and Engineering

Type	Credits	Grading scale	Recurrence	Expansion	Version
Completed coursework	4	pass/fail	Each summer term	1 terms	2

Competence Certificate
Regular participation and participating in lab course, protocol included.

Prerequisites
none

T 11.206 Course: Hydrogen in Materials: from Energy Storage to Hydrogen Embrittlement [T-MACH-110957]

Responsible: Prof. Dr. Astrid Pundt
Organisation: KIT Department of Mechanical Engineering
Part of: M-MACH-102611 - Major Field: Materials Science and Engineering
M-MACH-105904 - Major Field: Advanced Materials Modelling and Data Management

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

Events					
WT 24/25	2174572	Hydrogen in Materials: from energy storage to hydrogen embrittlement	2 SWS	Lecture / 🗣	Pundt, Wagner
Exams					
ST 2024	76-T-MACH-110957	Hydrogen in Materials: from Energy Storage to Hydrogen Embrittlement			Pundt
WT 24/25	76-T-MACH-110957	Hydrogen in Materials: from Energy Storage to Hydrogen Embrittlement			Pundt

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

Competence Certificate
Oral exam, about 25 minutes

Prerequisites
T-MACH-110923 - Wasserstoff in Materialien: von der Energiespeicherung zur Materialversprödung has not been started

T-MACH-108853 - Wasserstoff in Materialien has not been started

Modeled Conditions
The following conditions have to be fulfilled:

1. The course T-MACH-110923 - Hydrogen in Materials: from Energy Storage to Hydrogen Embrittlement must not have been started.

Annotation
in German

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

V Hydrogen in Materials: from energy storage to hydrogen embrittlement

Lecture (V)
On-Site

2174572, WS 24/25, 2 SWS, Language: German, Open in study portal

Content

This lecture teaches physical and chemical basics of hydrogen adsorption and absorption of different materials. It trains the understanding of the specific lattice positions that hydrogen occupies within solids, and its impact on material properties. A thermodynamical approach yields Sievert's law, allowing the students to describe the different solubilities of hydrogen (and other gases) in solid materials. Further thermodynamic data can be obtained using van't Hoff plots of phase transformation pressures. The impact of ternary alloy components, as described by semi-empirical models, will be recognized. The specific mobility of hydrogen in materials will be understood, which divides into classical diffusion and quantum mechanical tunneling processes. The students can describe the interaction of hydrogen with defects in crystal lattices, which is of special interest for properties of nano-scale materials or for the hydrogen embrittlement of steels. Basic embrittlement models can be explained by the students. Actual hydrogen storage systems can be summarized.

learning objectives:

o Hydrogen as energy storage – the hydrogen cycle and safety issues

o methods for hydrogen charging of materials and hydrogen detection

o Hydrogen adsorption at and absorption in different solids, Sievert's law

o interstitial lattice sites and lattice expansion

o Hydrides, van't Hoff plots, phase transitions, M-H binary phase diagrams

o ternary alloy effects

o hydrogen mobility in materials: interstitial diffusion and quantum mechanical tunneling

o interaction of hydrogen with defects

o hydrogen embrittlement of steels, different embrittlement models

o hydrogen in nano-scale systems and new storage materials

Organizational issues

Teilnahme nach Anmeldung.

Literature

Literaturhinweise und Unterlagen in der Vorlesung

T 11.207 Course: Hydrogen in Materials: from Energy Storage to Hydrogen Embrittlement [T-MACH-110923]

Responsible: Prof. Dr. Astrid Pundt
Organisation: KIT Department of Mechanical Engineering
Part of: M-MACH-102611 - Major Field: Materials Science and Engineering

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

Exams			
ST 2024	76-T-MACH-110923	Hydrogen in Materials: from Energy Storage to Hydrogen Embrittlement	Pundt
WT 24/25	76-T-MACH-110923	Hydrogen in Materials: from Energy Storage to Hydrogen Embrittlement	Pundt

Competence Certificate
Oral exam, about 25 minutes

Prerequisites
T-MACH-108853 - Wasserstoff in Materialien has not been started

T-MACH-110957 - Wasserstoff in Materialien: von der Energiespeicherung zur Materialversprödung has not been started

Modeled Conditions
The following conditions have to be fulfilled:

1. The course T-MACH-110957 - Hydrogen in Materials: from Energy Storage to Hydrogen Embrittlement must not have been started.

Annotation
in English

T 11.208 Course: Hydrogen Technologies [T-MACH-105416]

Responsible: Olaf Jedicke
Dr. Thomas Jordan

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102597 - Compulsory Elective Module Mechanical Engineering
M-MACH-102610 - Major Field: Power Plant Technology

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

Events					
ST 2024	2170495	Hydrogen Technologies	2 SWS	Lecture / 🗣	Jordan, Jedicke
Exams					
ST 2024	76-T-MACH-105416	Hydrogen Technologies			Jordan, Jedicke

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

Competence Certificate
Written exam, Duration: 90 minutes

Auxiliary: no tools or reference materials may be used during the exam

Prerequisites
none

Recommendation
Fundamentals Thermodynamics

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

V Hydrogen Technologies

2170495, SS 2024, 2 SWS, Language: German, Open in study portal

Lecture (V)
On-Site

Content
The course content is the cross-cutting issue of hydrogen as energy carrier. After successful participation the students may reflect on the fundamental technological basis of an energy system using predominantly hydrogen as an energy carrier or energy storage. Based on this knowledge they may objectify the principle idea of an hydrogen economy.

The students know the fundamental physical and chemical properties of hydrogen and may apply their knowledge on thermodynamics to compare efficiencies of different solutions with hydrogen. They can list, compare and evaluate established and future solutions for production, storage and distribution of hydrogen. They can explain advantages and disadvantages of using hydrogen in conventional combustion processes versus using hydrogen in different fuel cells. In particular the can describe the specific safety aspects related to hydrogen, compare them with other energy vectors and evaluate different measures for risk mitigation.

- Basic concepts
- Production
- Transport and storage
- Application
- Safety aspects

Literature
Ullmann's Encyclopedia of Industrial Chemistry
Hydrogen and Fuel Cells, Ed. S. Stolten, Wiley-VCH, 2010, ISBN 978-3-527-32711-9

T 11.209 Course: Ignition Systems [T-MACH-105985]

Responsible: Dr.-Ing. Olaf Toedter
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102597 - Compulsory Elective Module Mechanical Engineering
M-MACH-102598 - Major Field: Advanced Mechatronics
M-MACH-102627 - Major Field: Energy Converting Engines
M-MACH-102650 - Major Field: Combustion Engines Based Powertrains

Type	Credits	Grading scale	Version
Oral examination	4	Grade to a third	1

Events					
WT 24/25	2133125	Ignition systems	2 SWS	Lecture / 🗣	Toedter
Exams					
ST 2024	76-T-MACH-105985	Ignition systems			Toedter

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 24/25, 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 11.210 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-102597 - Compulsory Elective Module Mechanical Engineering
M-MACH-102607 - Major Field: Vehicle Technology
M-MACH-102634 - Major Field: Fluid Mechanic

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

Events					
WT 24/25	2153425	Industrial aerodynamics	2 SWS	/	Kröber, Frohnapfel
Exams					
ST 2024	76-T-MACH-105375	Industrial Aerodynamics			Kröber

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 24/25, 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 das Sekretariat, max. Teilnehmerzahl sind 20 Studierende.

Literature
Vorlesungsskript

T 11.211 Course: Industrial Mobile Robotics Lab [T-MACH-113701]

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

Part of: M-MACH-102591 - Laboratory Course

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

Events					
WT 24/25	2117073	Industrial Mobile Robotics Lab	2 SWS	Practical course / 🗣	Enke, Furmans

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

Competence Certificate
Certificate through colloquium with presentation, documentation of the work results and fulfilment of the attendance requirement.

Prerequisites
None

Recommendation
Basic knowledge of Python programming and basic knowledge of technical logistics of advantage.

Annotation

- The number of participants is limited to 15 students.
- The selection procedure is based on a letter of motivation in which the following questions should be answered:
  - Why do you want to attend the course?
  - What skills and previous knowledge do you have?

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

V Industrial Mobile Robotics Lab

2117073, WS 24/25, 2 SWS, Language: English, Open in study portal

Practical course (P)
On-Site

Content
This course is designed to teach students how to operate and control mobile robotic systems. Mobile robots have become a standard in the industry. This course will give students their first practical experience in this area.

For self-study, videos on the various relevant topics will be made available before the start of the course. Together with the University of Stuttgart, we will form teams at each location to implement either a vehicle control system or a control system for assigning jobs to different vehicles. The implementation will be based on a standardized communication interface - the VDA 5050 - which enables a uniform data exchange between the system participants. The teams will get to know each other at a kick-off event in Stuttgart. For the implementation, the teams will have to exchange information in order to jointly control a fleet of real mobile industrial robots in the final event at KIT. A simulation environment will also be provided for the development process, allowing testing without hardware in the early phases of the project.

Organizational issues
Das Praktikum findet in Kooperation mit der Universität Stuttgart statt. Es gibt zwei verpflichtende Präsenztage, das Kickoff findet an der Universität Stuttgart am 07.01.2025 statt, die Abschlussveranstaltung mit Live-Demo findet am KIT am 04.02.2025 statt.

Es werden an beiden Standorten Teams betreut, die sich während des Praktikums hybride austauchen und für die Abschlussveranstaltung eine gemeinsame Live-Demo vorbereiten. Während des Praktikums arbeiten die Teams selbständig an der Aufgabenstellung. Es werden dabei regelmäßige Sprechstunden, sowie weitere Input-Session angeboten. Der Fortschritt wird in zwei Zwischenmeilensteinen präsentiert.

Die Teilnehmerzahl ist beschränkt. Die Auswahl erfolgt nach einem Auswahlverfahren.
Um sich für die Teilnahme zu bewerben stellen Sie bitte einen Aufnahmeantrag für den aktuellen Ilias-Kurs mit einem kurzen Bewerbungstext. Dieser sollte ihre bisherigen Erfahrungen sowie ihre Motivation für das Praktikum beinhalten.

Voraussetzung sind Grundkentnisse im Programmieren (bspw. mit Python, C++, ...).

Geplanter Termin: 07.01.2025 - 04.02.2025

Literature
VDA 5050: https://www.vda.de/en/topics/automotive-industry/vda-5050

T 11.212 Course: Information Engineering [T-MACH-102209]

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

Part of: M-MACH-102613 - Major Field: Lifecycle Engineering

Type	Credits	Grading scale	Recurrence	Version
Examination of another type	3	Grade to a third	Each term	2

Events					
ST 2024	2122014	Information Engineering	2 SWS	Seminar /	Meyer, Mitarbeiter
WT 24/25	2121355	Information Engineering	2 SWS	Seminar /	Meyer, Rönnau
Exams					
ST 2024	76-T-MACH-102209	Information Engineering			Meyer, Rönnau, 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 2024, 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

V Information Engineering
2121355, WS 24/25, 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
Ort und Zeit siehe ILIAS

Literature
Themenspezifische Literatur

T 11.213 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-102609 - Major Field: Cognitive Technical Systems
M-MACH-102624 - Major Field: Information Technology
M-MACH-102625 - Major Field: Information Technology of Logistic Systems
M-MACH-102629 - Major Field: Logistics and Material Flow Theory

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

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

T 11.214 Course: Innovation and Project Management in Rail Vehicle Engineering [T-MACH-113068]

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

Part of: M-MACH-102597 - Compulsory Elective Module Mechanical Engineering
M-MACH-102641 - Major Field: Rail System Technology

Type	Credits	Grading scale	Version
Examination of another type	4	Grade to a third	4

Events					
ST 2024	2115921	Innovation and Project Management with Case Study "Innovative Rail Vehicle"	2 SWS	Lecture / 🗣	Cichon, Berthold
WT 24/25	2115921	Innovation and Project Management in Rail Vehicle Engineering	2 SWS	Lecture / 🗣	Cichon
Exams					
ST 2024	76-T-MACH-106427	Innovation and Project Management in Rail Vehicle Engineering			Cichon, Berthold
WT 24/25	76-T-MACH-106427	Innovation and Project Management in Rail Vehicle Engineering			Cichon

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

Competence Certificate

2/3 of the examination: approx. 20-page elaboration on project management based on a practical case study including the development and application of own project management tools
1/3 of the examination: presentation of a creativity technique and its practical application as part of a 10-minute presentation

T 11.215 Course: Innovation2Business – Innovation Strategy in the Industrial Corporate Practice [T-MACH-112882]

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

Part of:
M-MACH-102597 - Compulsory Elective Module Mechanical Engineering
M-MACH-102599 - Major Field: Powertrain Systems
M-MACH-102605 - Major Field: Engineering Design
M-MACH-102607 - Major Field: Vehicle Technology
M-MACH-102610 - Major Field: Power Plant Technology
M-MACH-102614 - Major Field: Mechatronics
M-MACH-102615 - Major Field: Medical Technology
M-MACH-102630 - Major Field: Mobile Machines
M-MACH-102642 - Major Field: Development of Innovative Appliances and Power Tools
M-MACH-102650 - Major Field: Combustion Engines Based Powertrains

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

Events					
WT 24/25	2145182	Innovation2Business – Innovation Strategy in the Industrial Corporate Practice	2 SWS	Lecture / 🗣	Albers
Exams					
WT 24/25	76-T-MACH-112882	Innovation2Business – innovation strategy in the industrial corporate practice			Albers

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

Competence Certificate
Written exam based on the lecture handout and materials, duration 90 minutes

Prerequisites
none

Recommendation
None

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

V Innovation2Business – Innovation Strategy in the Industrial Corporate Practice
Lecture (V)
On-Site
2145182, WS 24/25, 2 SWS, Language: German/English, Open in study portal

Content
lecture block at the Bühl & Herzogenaurach locations with plant tours & fireside evenings + exam-preparatory Q&A.
Exam: written, limited to 30 seats (recommended for: Master's degree; mechanical engineering, industrial engineering, electrical engineering, computer science) → see module manual for details.
In this lecture series, use Schaeffler as an example to learn how global companies continuously transform themselves to grow sustainably and become
maintain a leading position in the global market in the long term through business-oriented innovation.
Together we will go through the most important elements of the innovation and development process and learn about the successes and learnings based on
vivid examples from practice.
Join the fireside evenings with the speakers to discuss the lecture content and beyond in a relaxed atmosphere.
The event is limited to 30 students and is free for you (meals, bus transfers & accommodations).

Organizational issues
Vorlesung findet an Schaeffler-Standorten (Herzogenaurach und Bühl) statt.

Sprache: Unterlagen Englisch, Vortragssprache Deutsch

11.216 Course: Innovative Nuclear Systems [T-MACH-105404]

Responsible: Prof. Dr.-Ing. Xu Cheng
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102597 - Compulsory Elective Module Mechanical Engineering
M-MACH-102608 - Major Field: Nuclear Energy
M-MACH-102610 - Major Field: Power Plant Technology

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

Events					
ST 2024	2130973	Innovative Nuclear Systems	2 SWS	/ 🗣	Cheng
Exams					
ST 2024	76-T-MACH-105404	Innovative Nuclear Systems			Cheng

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 Innovative Nuclear Systems
2130973, SS 2024, 2 SWS, Language: German, Open in study portal **On-Site**

Content
This lecture is addressed to students of mechanical engineering, chemical engineering and physics. Goal of the lecture is the explanation of state-of-the-art development of nuclear systems. Nuclear systems, that are from todays point of view promising will be presented and explained. The main characteristics of such systems and the associated challenges are also part of the lecture.

1. state of the art and development tendencies in nuclear systems
2. advanced concepts in light water cooled systems
3. new developments in fast reactors
4. development tendencies in gas-cooled plants
5. transmutation systems for waste management
6. fusionsystems

Organizational issues
Geb. 07.08, SR 331

Mo (29.07.2024), 09:00 bis 17:00
Di (30.07.2024), 09:00 bis 17:00
Mi (31.07.2024), 09:00 bis 17:00

11.217 Course: Innovative Project [T-MACH-109185]

Responsible: apl. Prof. Dr. Andreas Class
Prof. Dr. Orestis Terzidis

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-104323 - Major Field: Innovation and Entrepreneurship

Type	Credits	Grading scale	Recurrence	Version
Examination of another type	6	Grade to a third	Each winter term	1

Competence Certificate
Students have to deliver pitch-talk supported by slides to convience a commity about their results. A fictive project proposal of 10 to 15 pages.

Prerequisites
none

Recommendation
Participates need to bring there own laptop with Skype installed.

Recommended English profiency äquivalent to:

- IELTS Academic test
  An overall band score of at least 6.5 (with no section lower than 5.5)
- University of Cambridge
  Certificate in Advanced English, CAE (grades A – C)
  Certificate of Proficiency in English, CPE (grades A – C)
- TOEFL Internet-based test, IBT
  A total score of at least 92, with a minimum score of 22 from the writing section

Annotation
The subject of the project is provided by industry partner or the innovation department from KIT or INP Grenoble. Representatives of industry partner will be addressee for the pitch-talk.

T 11.218 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-102405 - Fundamentals and Methods of General Mechanical Engineering
M-MACH-102597 - Compulsory Elective Module Mechanical Engineering
M-MACH-102739 - Fundamentals and Methods of Automotive Engineering
M-MACH-102740 - Fundamentals and Methods of Mechatronics and Microsystem Technology
M-MACH-102741 - Fundamentals and Methods of Product Development and Construction
M-MACH-102742 - Fundamentals and Methods of Production Technology

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

Events					
ST 2024	2121001	Integrated Information Systems for engineers	3 SWS	Lecture / Practice (/ 🗣	Elstermann, Meyer
WT 24/25	2121001	Integrated Information Systems for engineers	3 SWS	Lecture / Practice (/ 🗣	Elstermann
Exams					
ST 2024	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 2024, 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 24/25, 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

Organizational issues
Blockveranstaltung vom 07. - 10. Oktober

Literature
Vorlesungsfolien / lecture slides

T 11.219 Course: Integrated Product Development [T-MACH-105401]

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

Part of: M-MACH-102626 - Major Field: Integrated Product Development

Type	Credits	Grading scale	Recurrence	Version
Oral examination	16	Grade to a third	Each winter term	2

Events					
WT 24/25	2145156	Lecture: IP – Integrated Product Development	4 SWS	Lecture / 🗣	Albers
WT 24/25	2145157	Workshop: IP – Integrated Product Development	4 SWS	Practice / 🗣	Albers
WT 24/25	2145300	Project Work: IP - Integrated Product Development	2 SWS	Others (sons / 🗣	Albers
Exams					
WT 24/25	76-T-MACH-105401	Integrated Product Development			Albers

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

Competence Certificate
oral examination (60 minutes)

Prerequisites
none

Annotation
Due to organizational reasons, the number of participants is limited. Thus a selection has to be made. For registration to the selection process a standard form has to be used, that can be downloaded from IPEK hompage from april to july. The selection itself is made by Prof. Albers in personal interviews.

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

V Lecture: IP – Integrated Product Development

2145156, WS 24/25, 4 SWS, Language: German, Open in study portal

Lecture (V)
On-Site

Content
Registration required in the previous summer semester. The lecture starts in first week of October.

Prerequisites:

The participation in "Integrated Product Development" requires the concurrent participation in lectures (2145156), tutorials (2145157) and project work (2145300).

Due to organizational reasons, the number of participants is limited. Thus a selection has to be made. For registration to the selection process a standard form has to be used, that can be downloaded from IPEK hompage from april to july. The selection itself is made by Prof. Albers in personal interviews.

Recommendations:

none

Workload:

regular attendance: 84 h

self-study: 288 h

Examination:

oral examination (60 minutes)

combined examination of lectures, tutorials and project work

Course content:

organizational integration: integrated product engineering model, core team management and simultaneous engineering

informational integration: innovation management, cost management, quality management and knowledge management

personal integration: team coaching and leadership management

invited lectures

Learning objectives:

The Students are able to ...

- analyze and evaluate product development processes based on examples and their own experiences.
- plan, control and evaluate the working process systematically.
- choose and use suitable methods of product development, system analysis and innovation management under consideration of the particular situation.
- prove their results.
- develop complex technical solutions in a team and to present them to qualified persons as well as non-qualified persons
- to design overall product development processes under consideration of market-, customer- and company- aspects

Literature
Klaus Ehrlenspiel - Integrierte Produktentwicklung. Denkabläufe, Methodeneinsatz, Zusammenarbeit, Hanser Verlag, 2009

V	**Workshop: IP – Integrated Product Development** 2145157, WS 24/25, 4 SWS, Language: German, Open in study portal	**Practice (Ü)** **On-Site**

Content
Prerequisites:

The participation in "Integrated Product Development" requires the concurrent participation in lectures (2145156), tutorials (2145157) and project work (2145300).

Due to organizational reasons, the number of participants is limited to 42 persons. Thus a selection has to be made. For registration to the selection process a standard form has to be used, that can be downloaded from IPEK hompage from april to july. The selection itself is made by Prof. Albers in personal interviews.

Recommendations:

none

Workload:

regular attendance: 84 h

self-study: 288 h

Examination:

lectures: 21 h

preparation to exam: 99 h

Course content:

problem solving: analysis techniques, creativity techniques and evaluation methods

professional skills: presentation techniques, moderation and teamcoaching

development tools: MS Project, Szenario-Manager & Pro/Engineer Wildfire

Learning objectives:

The theoretical background taught in the lecture, is deepened through methodworkshops, business games and case studies. The reflexion of the onself precedure allows for an applicability and practicability of the contents in the accompnying development project as well as for the career entry.

Literature
Klaus Ehrlenspiel - Integrierte Produktentwicklung. Denkabläufe, Methodeneinsatz, Zusammenarbeit, Hanser Verlag, 2009

V	**Project Work: IP - Integrated Product Development** 2145300, WS 24/25, 2 SWS, Language: German, Open in study portal	**Others (sonst.)** **On-Site**

Content
Participation only possible in combination with the lecture 2145156 'Integrated Product Development'.

Prerequisites:

The participation in "Integrated Product Development" requires the concurrent participation in lectures (2145156), tutorials (2145157) and project work (2145300).

Due to organizational reasons, the number of participants is limited to 42 persons. Thus a selection has to be made. For registration to the selection process a standard form has to be used, that can be downloaded from IPEK hompage from april to july. The selection itself is made by Prof. Albers in personal interviews.

Recommendations:

none

Workload:

regular attendance: 21 h

self-study: 99 h

Examination:

oral examination (60 minutes)

combined examination of lectures, tutorials and project work

Course content:

The project work begins with the early stages of product development, i.e. the identification of market trends and needs. Based on this information the students develop scenarios for future markets and create product profiles, which describe the customers and their demands without anticipating possible product solutions. After having passed several following milestones for ideas, concepts and designs, virtual prototypes and function prototypes are presented to an audience.
The project work is supported by coaching through skilled faculty staff. Additionally weekly tutorials, respectively workshops are given. For doing the project the teams gain access to team workspaces featuring IT-infrastructure and relevant software, such as office, CAD or FEA. Further on the teams learn how team cooperation and knowledge management can be supported in design project by using a wiki system.s

Learning objectives:

The center of "Integrated Product Development" constitutes itself in the development of a technical product within independent working student teams on the basis of the market situation up to virtual and real prototypes. Thereby the integrate treatment of the product development process is of importance. The project teams hereby represent development departments of medium sized companies, in which the presented methods and tools are field - experienced applied and ideas are transformed into concrete product models.
For the preparation of this development project the basics of 3D-CAD-modelling (Pro/ENGINEER) as well as different tools and methods of creative designing, of sketching and solution finding are mediated in workshops. Special events impart an insight of presentation techniques and the meaning of technical design.

T 11.220 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-102618 - Major Field: Production Technology

Type	Credits	Grading scale	Recurrence	Version
Oral examination	8	Grade to a third	Each summer term	2

Events					
ST 2024	2150660	Integrated Production Planning in the Age of Industry 4.0	6 SWS	Lecture / Practice (/ 🗣	Lanza
Exams					
ST 2024	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 2024, 6 SWS, Language: German, Open in study portal

Lecture / Practice (VÜ)
On-Site

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 11.221 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-102605 - Major Field: Engineering Design
M-MACH-102607 - Major Field: Vehicle Technology
M-MACH-102618 - Major Field: Production Technology

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

Events					
ST 2024	2150601	Integrative Strategies in Production and Development of High Performance Cars	2 SWS	Lecture / 🗣	Schlichtenmayer
Exams					
ST 2024	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

Lecture (V)
On-Site

2150601, SS 2024, 2 SWS, Language: German, Open in study portal

Content

The lecture deals with the technical and organizational aspects of integrated development and production of sports cars on the example of Porsche AG. The lecture begins with an introduction and discussion of social trends. The deepening of standardized development processes in the automotive practice and current development strategies follow. The management of complex development projects is a first focus of the lecture. The complex interlinkage between development, production and purchasing are a second focus. Methods of analysis of technological core competencies complement the lecture. The course is strongly oriented towards the practice and is provided with many current examples.

The main topics are:

- Introduction to social trends towards high performance cars
- Automotive Production Processes
- Integrative R&D strategies and holistic capacity management
- Management of complex projects
- Interlinkage between R&D, production and purchasing
- The modern role of manufacturing from a R&D perspective
- Global R&D and production
- Methods to identify core competencies

Learning Outcomes:

The students …

- are capable to specify the current technological and social challenges in automotive industry.
- are qualified to identify interlinkages between development processes and production systems.
- are able to explain challenges and solutions of global markets and global production of premium products.
- are able to explain modern methods to identify key competences of producing companies.

Workload:

regular attendance: 21 hours
self-study: 99 hours

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

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

T 11.222 Course: Intellectual Property Rights and Strategies in Industrial Companies [T-MACH-105442]

Responsible: Prof. Dr.-Ing. Tobias Düser
Dipl.-Ing. Frank Zacharias

Organisation: KIT Department of Mechanical Engineering

Part of:
M-MACH-102597 - Compulsory Elective Module Mechanical Engineering
M-MACH-102598 - Major Field: Advanced Mechatronics
M-MACH-102599 - Major Field: Powertrain Systems
M-MACH-102601 - Major Field: Automation Technology
M-MACH-102607 - Major Field: Vehicle Technology
M-MACH-102610 - Major Field: Power Plant Technology
M-MACH-102614 - Major Field: Mechatronics
M-MACH-102615 - Major Field: Medical Technology
M-MACH-102616 - Major Field: Microsystem Technology
M-MACH-102618 - Major Field: Production Technology
M-MACH-102633 - Major Field: Robotics
M-MACH-102636 - Major Field: Thermal Turbomachines
M-MACH-102642 - Major Field: Development of Innovative Appliances and Power Tools
M-MACH-102650 - Major Field: Combustion Engines Based Powertrains

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

Events					
ST 2024	2147160	Patents and Patentstrategies in innovative companies	2 SWS	/ 🗣	Zacharias
WT 24/25	2147161	Intellectual Property Rights and Strategies in Industrial Companies	2 SWS	Block / 🗣	Zacharias
Exams					
ST 2024	76-T-MACH-105442	Intellectual Property Rights and Strategies in Industrial Companies			Zacharias
WT 24/25	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 2024, 2 SWS, Language: German, Open in study portal

On-Site

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 24/25, 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 11.223 Course: International Production Engineering A [T-MACH-110334]

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

Part of: M-MACH-102597 - Compulsory Elective Module Mechanical Engineering
M-MACH-102618 - Major Field: Production Technology

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

Events					
ST 2024	2150600	International Production Engineering A	2 SWS	Lecture / 🧩	Fleischer

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

Competence Certificate
Alternative test achievement (graded):
- Result of the project work and final presentation with weighting 65%
- Oral exam (ca. 15 min) with weighting 35%

Prerequisites
One of the following courses must be started:

- T-MACH-108844 - Automated Manufacturing Systems
- T-MACH-110962 - Machine Tools and High-Precision Manufacturing Systems

Modeled Conditions
You have to fulfill one of 2 conditions:

1. The course T-MACH-108844 - Automated Manufacturing Systems must have been started.
2. The course T-MACH-110962 - Machine Tools and High-Precision Manufacturing Systems must have been started.

Recommendation
This course should be attended in combination with International Production Engineering B in the next winter semester.

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

V International Production Engineering A
2150600, SS 2024, 2 SWS, Language: German/English, Open in study portal

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

Content

The course “International Production Engineering” offers a practical insight into the development of production plants in an international environment. A student team works on a current and concrete problem in the field of production engineering, which is introduced into the project by an industrial partner who is operating as well in Germany as in China.

As part of the course "International Production Engineering A", the problem will initially be transferred into work packages. According to the elaborated project plan, ideas and concepts for a solution of the problem will be generated and developed. Based on the concepts, the selected solution approach is elaborated and validated, e.g. through simulation, programming and/or design, but always in the context of production technology. The practical implementation of the developed solution is part of the course "International Production Engineering B" during an eight-week research stay in China.

The project will be carried out by the students under the guidance of scientific staff and in cooperation with the industrial partner. The results of the project will be presented and discussed with the project partner in a final presentation (respectively IPE A and B).

More details about the course are discussed in an information event (always in January/February, the exact date is published on the homepage: www.wbk.kit.edu).

The project offers students …

- the unique opportunity to put the contents of the accompanying lecture into practice in an interdisciplinary and creative context,
- to gain insights into a wide range of development activities relevant for their future careers,
- cooperation with an attractive industrial partner,
- work in a team with other students with competent support from scientific staff,
- first practical experience in project management,
- international practical experience.

Learning Outcomes:

The students …

- can develop ideas for technical solutions in the environment of production plants in a team and evaluate their feasibility according to technical and economic criteria
- are capable of selecting the essential components and modules of a production plant and carrying out the necessary calculations
- can use FEM simulations to predict and evaluate the static and dynamic behavior of an assembly
- are able to present, plan and assess their own work and decision-making processes
- are able to apply basic methods of project management in an international environment.

Workload:

regular attendance: 21 hours
self-study: 99 hours

Organizational issues

Aus organisatorischen Gründen ist die Teilnehmerzahl der Lehrveranstaltung begrenzt. Infolgedessen wird ein Auswahlprozess stattfinden. Die Bewerbung erfolgt über die Homepage des wbk (http://www.wbk.kit.edu/studium-und-lehre.php).

Die Vorlesung kann nur in Kombination mit der Lehrveranstaltung International Production Engineering B gehört werden.

Zur Vertiefung des im Rahmen der Lehrveranstaltung erworbenen Wissens werden die theoretischen Vorlesungseinheiten durch Praxiseinheiten im Umfeld der Karlsruher Forschungsfabrik (https://www.karlsruher-forschungsfabrik.de) unterstützt.

The theoretical lectures are complemented by practical lectures in the Karlsruhe Research Factory (https://www.karlsruher-forschungsfabrik.de/en.html) to deepen the acquired knowledge.

Literature

Medien:
Unterlagen zur Veranstaltung werden über (https://ilias.studium.kit.edu/) bereitgestellt.

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

T 11.224 Course: International Production Engineering B [T-MACH-110335]

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

Part of: M-MACH-102597 - Compulsory Elective Module Mechanical Engineering
M-MACH-102618 - Major Field: Production Technology

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

Events					
WT 24/25	2149620	International Production Engineering B	2 SWS	Lecture / ⯐	Fleischer

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

Competence Certificate
Alternative test achievement (graded):
- Result of the project work and final presentation with weighting 65%
- Oral exam (ca. 15 min) with weighting 35%

Prerequisites
The following course must be startet:

- T-MACH-110334 - International Production Engineering A

Furthermore successful completion of one of the following courses:

- T-MACH-108844 - Automated Manufacturing Systems
- T-MACH-110962 - Machine Tools and High-Precision Manufacturing Systems

Modeled Conditions
The following conditions have to be fulfilled:

1. You have to fulfill one of 2 conditions:
   1. The course T-MACH-108844 - Automated Manufacturing Systems must have been passed.
   2. The course T-MACH-110962 - Machine Tools and High-Precision Manufacturing Systems must have been passed.
2. The course T-MACH-110334 - International Production Engineering A must have been started.

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

V International Production Engineering B
2149620, WS 24/25, 2 SWS, Language: German/English, Open in study portal

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

Content

The course “International Production Engineering” offers a practical insight into the development of production plants in an international environment. A student team works on a current and concrete problem in the field of production engineering, which is introduced into the project by an industrial partner who is operating as well in Germany as in China.

As part of the course "International Production Engineering A", the problem will initially be transferred into work packages. According to the elaborated project plan, ideas and concepts for a solution of the problem will be generated and developed. Based on the concepts, the selected solution approach is elaborated and validated, e.g. through simulation, programming and/or design, but always in the context of production technology. The practical implementation of the developed solution is part of the course "International Production Engineering B" during an eight-week research stay in China.

The project will be carried out by the students under the guidance of scientific staff and in cooperation with the industrial partner. The results of the project will be presented and discussed with the project partner in a final presentation (respectively IPE A and B).

More details about the course are discussed in an information event (always in January/February, the exact date is published on the homepage: www.wbk.kit.edu).

The project offers students …

- the unique opportunity to put the contents of the accompanying lecture into practice in an interdisciplinary and creative context
- to gain insights into a wide range of development activities relevant for their future careers
- cooperation with an attractive industrial partner
- work in a team with other students with competent support from scientific staff
- first practical experience in project management
- international practical experience.

Learning Outcomes:

The students ...

- can develop ideas for technical solutions in the environment of production plants in a team and evaluate their feasibility according to technical and economic criteria
- are capable of selecting the essential components and modules of a production plant and carrying out the necessary calculations
- can use FEM simulations to predict and evaluate the static and dynamic behavior of an assembly
- are able to present, plan and assess their own work and decision-making processes
- are able to apply basic methods of project management in an international environment.

Workload:

Regular attendance: 21 hours
Self-study: 99 hours

Organizational issues

Aus organisatorischen Gründen ist die Teilnehmerzahl der Lehrveranstaltung begrenzt. Infolgedessen wird ein Auswahlprozess stattfinden. Die Bewerbung erfolgt über die Homepage des wbk (http://www.wbk.kit.edu/studium-und-lehre.php).

Die Vorlesung kann nur in Kombination mit International Production Engineering A gehört werden. Voraussetzung für die Vorlesung ist eine bestandene Prüfung in "Werkzeugmaschinen und Handhabungstechnik" oder "Automatisierte Produktionsanlagen" sowie die Teilnahme an der Lehrveranstaltung "International Production Engineering A" im vorhergehenden Sommersemester.

For organizational reasons, the number of participants in the course is limited. Hence, a selection process will take place. Applications can be made via the homepage of wbk (http://www.wbk.kit.edu/studium-und-lehre.php).

The lecture can only be attended in combination with International Production Engineering A. Requirements for the lecture are a passed examination in "Machine Tools and Industrial Handling" or "Automated Production Systems" as well as a participation in the course "International Production Engineering A" in the previous summer semester.

Literature

Medien:

Unterlagen zur Veranstaltung werden über (https://ilias.studium.kit.edu/) bereitgestellt.

Media:

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

11.225 Course: Introduction into Mechatronics [T-MACH-100535]

Responsible: Andre Orth
apl. Prof. Dr. Markus Reischl

Organisation: KIT Department of Mechanical Engineering

Part of:
M-MACH-102405 - Fundamentals and Methods of General Mechanical Engineering
M-MACH-102575 - Fundamentals and Methods of Energy and Environmental Engineering
M-MACH-102597 - Compulsory Elective Module Mechanical Engineering
M-MACH-102598 - Major Field: Advanced Mechatronics
M-MACH-102601 - Major Field: Automation Technology
M-MACH-102614 - Major Field: Mechatronics
M-MACH-102615 - Major Field: Medical Technology
M-MACH-102633 - Major Field: Robotics
M-MACH-102642 - Major Field: Development of Innovative Appliances and Power Tools
M-MACH-102739 - Fundamentals and Methods of Automotive Engineering
M-MACH-102740 - Fundamentals and Methods of Mechatronics and Microsystem Technology
M-MACH-102741 - Fundamentals and Methods of Product Development and Construction
M-MACH-102742 - Fundamentals and Methods of Production Technology

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

Events					
WT 24/25	2105011	Introduction into Mechatronics	3 SWS	Lecture / Blended	Reischl, Orth
Exams					
ST 2024	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:

Introduction into Mechatronics

2105011, WS 24/25, 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 11.226 Course: Introduction to Artificial Intelligence [T-INFO-112194]

Responsible: TT-Prof. Dr. Pascal Friederich
Prof. Dr. Gerhard Neumann

Organisation: KIT Department of Informatics

Part of: M-MACH-102609 - Major Field: Cognitive Technical Systems

Type	Credits	Grading scale	Recurrence	Version
Written examination	5	Grade to a third	Each winter term	6

Events					
WT 24/25	2400158	Introduction to Artificial Intelligence	3 SWS	Lecture / Practice (/ 🗣	Neumann, Schäfer, Friederich
Exams					
ST 2024	7500058	Introduction to Artificial Intelligence			Neumann, Friederich
WT 24/25	7500136	Introduction to Artificial Intelligence			Neumann, Schäfer, Friederich

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

T 11.227 Course: Introduction to Bionics [T-MACH-111807]

Responsible: apl. Prof. Dr. Hendrik Hölscher
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102597 - Compulsory Elective Module Mechanical Engineering
M-MACH-102615 - Major Field: Medical Technology
M-MACH-102616 - Major Field: Microsystem Technology

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

Events					
ST 2024	2142151	Introduction to Biomimetics	2 SWS	Lecture / 🗣	Hölscher, Greiner
Exams					
ST 2024	76-T-MACH-102172	Introduction into Biomimetics			Hölscher
WT 24/25	76-T-MACH-102172	Introduction into Biomimetics			Hölscher

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

Competence Certificate
written exam (duration: 60 minutes)

Prerequisites
none

Annotation
Brick T-MACH-102172 may not be started

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

V Introduction to Biomimetics

2142151, SS 2024, 2 SWS, Language: German, Open in study portal

Lecture (V)
On-Site

Content
Bionics focuses on the design of technical products following the example of nature. For this purpose we have to learn from nature and to understand its basic design rules. Therefore, the lecture focuses on the analysis of the fascinating effects used by many plants and animals. Possible implementations into technical products are discussed in the end.

The students should be able analyze, judge, plan and develop biomimetic strategies and products.

Basic knowledge in physics and chemistry

The successfull attandence of the lecture is controlled by a written examination.

Organizational issues
Im ILIAS werden Materialien (Videos, Originalliteratur, Übungen) zur Vertiefung zur Verfügung gestellt.

Für die schriftliche Klausur werden zwei Termine angeboten (erste Woche nach Vorlesungsende im Sommersemester und eine Woche vor Vorlesungsbeginn im Wintersemester).

Literature
Folien und Literatur werden in ILIAS zur Verfügung gestellt.

T 11.228 Course: Introduction to Ceramics [T-MACH-100287]

Responsible: apl. Prof. Dr. Günter Schell
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102597 - Compulsory Elective Module Mechanical Engineering
M-MACH-102611 - Major Field: Materials Science and Engineering
M-MACH-102619 - Major Field: Technical Ceramics and Powder Materials

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

Events					
WT 24/25	2125757	Introduction to Ceramics	3 SWS	Lecture / Blended	
Exams					
ST 2024	76-T-MACH-100287	Introduction to Ceramics			Schell, Bucharsky, Wagner
WT 24/25	76-T-MACH-100287	Introduction to Ceramics			Schell, Bucharsky, 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 24/25, 3 SWS, Language: German, Open in study portal

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

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 11.229 Course: Introduction to Industrial Production Economics [T-MACH-105388]

Responsible: Simone Dürrschnabel
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102597 - Compulsory Elective Module Mechanical Engineering
M-MACH-102613 - Major Field: Lifecycle Engineering
M-MACH-102618 - Major Field: Production Technology

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

Competence Certificate
oral exam (approx. 30 min)

The exam is offered in German only!

Prerequisites
none

T 11.230 Course: Introduction to Microsystem Technology - Practical Course [T-MACH-108312]

Responsible: Dr. Arndt Last
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102591 - Laboratory Course

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

Events					
ST 2024	2143877	Introduction to Microsystem Technology - Practical Course	2 SWS	Practical course / 🗣	Last
WT 24/25	2143877	Introduction to Microsystem Technology - Practical Course	2 SWS	Practical course / 🗣	Last
Exams					
ST 2024	76-T-MACH-108312	Introduction to Microsystem Technology - Practical Course			Last
WT 24/25	76-T-MACH-108312	Introduction to Microsystem Technology - Practical Course			Last

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

Competence Certificate
non-graded written examination

Prerequisites
none

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

V Introduction to Microsystem Technology - Practical Course

2143877, SS 2024, 2 SWS, Language: German, Open in study portal

Practical course (P)
On-Site

Content
In the practical training includes nine experiments:

1. X-ray optics
2. UVL + REM
3. Micromixer
4. Atomic force microscopy
5. 3D-Printing
6. Light dirffraction at Chromium masks
7. Moulding
8. SAW-bio-sensors
9. Nano3D-printer - material transfer of thin foils
10. Electro spinning

Each student takes part in only four experiments.
The experiments are carried out at real workstations at the IMT and coached by IMT-staff.

Organizational issues
Das Praktikum findet in den Laboren des IMT am KIT-CN statt. Treffpunkt: Eingang Bau 301.

Teilnahmeanfragen an Dr. A. Last, arndt.last@kit.edu

Literature
Menz, W., Mohr, J.: Mikrosystemtechnik für Ingenieure, VCH-Verlag, Weinheim, 1997
Unterlagen zum Praktikum zur Vorlesung ' Grundlagen der Mikrosystemtechnik'

V **Introduction to Microsystem Technology - Practical Course**
2143877, WS 24/25, 2 SWS, Language: German, Open in study portal

Practical course (P)
On-Site

Literature
Menz, W., Mohr, J.: Mikrosystemtechnik für Ingenieure, VCH-Verlag, Weinheim, 1997
Unterlagen zum Praktikum zur Vorlesung ' Grundlagen der Mikrosystemtechnik'

T 11.231 Course: Introduction to Microsystem Technology I [T-MACH-105182]

Responsible: Dr. Vlad Badilita
Dr. Mazin Jouda
Prof. Dr. Jan Gerrit Korvink

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102405 - Fundamentals and Methods of General Mechanical Engineering
M-MACH-102597 - Compulsory Elective Module Mechanical Engineering
M-MACH-102616 - Major Field: Microsystem Technology
M-MACH-102647 - Major Field: Microactuators and Microsensors
M-MACH-102740 - Fundamentals and Methods of Mechatronics and Microsystem Technology
M-MACH-102740 - Fundamentals and Methods of Mechatronics and Microsystem Technology
M-MACH-102741 - Fundamentals and Methods of Product Development and Construction
M-MACH-102742 - Fundamentals and Methods of Production Technology

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

Events					
WT 24/25	2141861	Introduction to Microsystem Technology I	2 SWS	Lecture / 🗣	Korvink, Badilita
Exams					
ST 2024	76-T-MACH-105182	Introduction to Microsystem Technology I			Korvink, Badilita
WT 24/25	76-T-MACH-105182	Introduction to Microsystem Technology I			Korvink, Badilita

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

Competence Certificate
written examination (60 min)

Prerequisites
none

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

V Introduction to Microsystem Technology I

2141861, WS 24/25, 2 SWS, Language: English, Open in study portal

Lecture (V)
On-Site

Literature
Mikrosystemtechnik für Ingenieure, W. Menz und J. Mohr, VCH Verlagsgesellschaft, Weinheim 2005

M. Madou
Fundamentals of Microfabrication
Taylor & Francis Ltd.; Auflage: 3. Auflage. 2011

T 11.232 Course: Introduction to Microsystem Technology II [T-MACH-105183]

Responsible: Dr. Mazin Jouda
Prof. Dr. Jan Gerrit Korvink

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102405 - Fundamentals and Methods of General Mechanical Engineering
M-MACH-102597 - Compulsory Elective Module Mechanical Engineering
M-MACH-102616 - Major Field: Microsystem Technology
M-MACH-102647 - Major Field: Microactuators and Microsensors
M-MACH-102740 - Fundamentals and Methods of Mechatronics and Microsystem Technology
M-MACH-102741 - Fundamentals and Methods of Product Development and Construction
M-MACH-102742 - Fundamentals and Methods of Production Technology

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

Events					
ST 2024	2142874	Introduction to Microsystem Technology II	2 SWS	Lecture / 🗣	Korvink, Badilita
Exams					
ST 2024	76-T-MACH-105183	Introduction to Microsystem Technology II			Korvink, Badilita
WT 24/25	76-T-MACH-105183	Introduction to Microsystem Technology II			Korvink, Badilita

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

Competence Certificate
written examination (60 min)

Prerequisites
none

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

V Introduction to Microsystem Technology II

Lecture (V)
On-Site

2142874, SS 2024, 2 SWS, Language: English, Open in study portal

Content
- Introduction in Nano- and Microtechnologies
- Lithography
- LIGA-technique
- Mechanical microfabrication
- Patterning with lasers
- Assembly and packaging
- Microsystems

Organizational issues
Topic: Grundlagen der Mikrosystemtechnik II (MST II) SS 21
Time: Thursdays 14:00 - 15:30

10.91 Redtenbacher-Hörsaal

Literature
Menz, W., Mohr, J., O. Paul: Mikrosystemtechnik für Ingenieure, VCH-Verlag, Weinheim, 2005

M. Madou
Fundamentals of Microfabrication
Taylor & Francis Ltd.; Auflage: 3. Auflage. 2011

T 11.233 Course: Introduction to Multi-Body Dynamics [T-MACH-105209]

Responsible: Dr.-Ing. Ulrich Römer
Organisation: KIT Department of Mechanical Engineering

Part of:
M-MACH-102405 - Fundamentals and Methods of General Mechanical Engineering
M-MACH-102575 - Fundamentals and Methods of Energy and Environmental Engineering
M-MACH-102597 - Compulsory Elective Module Mechanical Engineering
M-MACH-102598 - Major Field: Advanced Mechatronics
M-MACH-102599 - Major Field: Powertrain Systems
M-MACH-102614 - Major Field: Mechatronics
M-MACH-102739 - Fundamentals and Methods of Automotive Engineering
M-MACH-102740 - Fundamentals and Methods of Mechatronics and Microsystem Technology
M-MACH-102741 - Fundamentals and Methods of Product Development and Construction
M-MACH-102742 - Fundamentals and Methods of Production Technology
M-MACH-102743 - Fundamentals and Methods of Theoretical Foundations of Mechanical Engineering
M-MACH-102744 - Fundamentals and Methods of Materials and Structures for High Performance Systems
M-MACH-104434 - 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 2024	2162235	Introduction to Multibody Dynamics	3 SWS	Lecture /	Römer
Exams					
ST 2024	76-T-MACH-105209	Introduction to Multibody Dynamics			Römer

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 2024, 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 11.234 Course: Introduction to Nanotechnology [T-MACH-111814]

Responsible: apl. Prof. Dr. Hendrik Hölscher

Organisation: KIT Department of Mechanical Engineering
KIT Department of Economics and Management

Part of: M-MACH-102597 - Compulsory Elective Module Mechanical Engineering
M-MACH-102616 - Major Field: Microsystem Technology
M-MACH-102637 - Major Field: Tribology
M-MACH-102647 - Major Field: Microactuators and Microsensors

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

Events					
ST 2024	2142152	Introduction to Nanotechnology	2 SWS	Lecture / 🗣	Hölscher
Exams					
ST 2024	76-T-MACH-105180	An introduction into Nanotechnology			Hölscher

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

Competence Certificate
written exam 90 min

Prerequisites
none

Annotation
Brick T-MACH-111814 may not be started

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

V Introduction to Nanotechnology

2142152, SS 2024, 2 SWS, Language: German, Open in study portal

Lecture (V)
On-Site

Content
Nanotechnology deals with the fabrication and analysis of nanostructures. The topics of the lecture include

- the most common measurement principles of nanotechnology especially scanning probe methods
- the analysis of physical and chemical properties of surfaces
- interatomic forces and their influence on nanostructures
- methods of micro- and nanofabrication and lithography
- basic models of contact mechanics and nanotribology
- important functional characteristics of nanodevices

Basic knowledge in mathematics and physics is assumed

The successfull attandence of the lecture is controlled by a 30 minutes oral exam.

Organizational issues
Es werden im ILIAS Materialien (Videos, Originalliteratur, Übungen) zum Vertiefung zur Verfügung gestellt.

Für die mündlichen Prüfungen werden zwei Termine angeboten (erste Woche nach Vorlesungsende im Sommersemester und eine Woche vor Vorlesungsbeginn im Wintersemester).

Literature
Alle Folien und Originalliteratur werden auf ILIAS zur Verfügung gestellt.

T 11.235 Course: Introduction to Neutron Cross Section Theory and Nuclear Data Generation [T-MACH-105466]

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

Part of: M-MACH-102597 - Compulsory Elective Module Mechanical Engineering
M-MACH-102608 - Major Field: Nuclear Energy

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

Events					
ST 2024	2190490	Introduction to Neutron Cross Section Theory and Nuclear Data Generation	2 SWS	Lecture / 🗣	Dagan
Exams					
ST 2024	76-T-MACH-105466	Introduction to Neutron Cross Section Theory and Nuclear Data Generation			Dagan
WT 24/25	76-T-MACH-105466	Introduction to Neutron Cross Section Theory and Nuclear Data Generation			Dagan

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

Competence Certificate
oral exam of about 30 minutes

Prerequisites
none

Annotation
none

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

V Introduction to Neutron Cross Section Theory and Nuclear Data Generation
2190490, SS 2024, 2 SWS, Language: German/English, Open in study portal

Lecture (V)
On-Site

Content
Cross section characterization

Summary of basic cross section theory

Resonance cross section

Doppler broadening

Scattering kernels

Basic of slowing down theory

Unit cell based XS data generation

Cross sections Data libraries

Data Measurements

The students:

- Understand the special importance of cross sections in various domains of natural science (Reactor physics, Material research, Solar radiation etc.)
- Are familiar with the theoretical methods and experimental effort to generate cross sections data.

Regular attendance: 26 h

self study: 94 h

oral exam about 30 min.

Literature

Handbuch von Nuklearen Reaktoren Vol I . Y. Ronen CRC press 1986 (in English)

D. Emendorfer. K.H. Höcker Theorie der Kernreaktoren, Teil I, II BI- Hochschultaschenbücher 1969

P. Tippler, R. Llewellyn Modern Physics 2008 (in English)

T 11.236 Course: Introduction to Nonlinear Vibrations [T-MACH-105439]

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

Part of: M-MACH-102597 - Compulsory Elective Module Mechanical Engineering
M-MACH-102646 - Major Field: Applied Mechanics
M-MACH-104443 - Major Field: Vibration Theory

Type	Credits	Grading scale	Recurrence	Version
Oral examination	7	Grade to a third	Each winter term	1

Events					
WT 24/25	2162247	Introduction to Nonlinear Vibrations	2 SWS	Lecture / 🗣	Fidlin
WT 24/25	2162248	Introduction into the nonlinear vibrations (Tutorial)	2 SWS	Practice / 🗣	Fidlin, Singhal
Exams					
ST 2024	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 24/25, 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 24/25, 2 SWS, Language: German, Open in study portal

Practice (Ü)
On-Site

Content
Exercises related to the lecture

T 11.237 Course: Introduction to Nuclear Energy [T-MACH-105525]

Responsible: Prof. Dr.-Ing. Xu Cheng
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102597 - Compulsory Elective Module Mechanical Engineering
M-MACH-102608 - Major Field: Nuclear Energy
M-MACH-102610 - Major Field: Power Plant Technology
M-MACH-102623 - 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 24/25	2189903	Introduction to Nuclear Energy	2 SWS	Lecture / 🗣	Cheng
Exams					
ST 2024	76-T-MACH-105525	Introduction to Nuclear Energy			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

Lecture (V)
On-Site

2189903, WS 24/25, 2 SWS, Language: German, Open in study portal

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 11.238 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-102610 - Major Field: Power Plant Technology
M-MACH-102623 - Major Field: Fundamentals of Energy Technology
M-MACH-102627 - Major Field: Energy Converting Engines

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

Events					
WT 24/25	2157444	Introduction to numerical fluid dynamics	2 SWS	Practical course / 🗣	Pritz
Exams					
ST 2024	76-T-MACH-105515	Introduction to Numerical Fluid Dynamics			Pritz
WT 24/25	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 24/25, 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 11.239 Course: Introduction to numerical mechanics [T-MACH-108718]

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

Part of: M-MACH-102597 - Compulsory Elective Module Mechanical Engineering

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

Exams			
ST 2024	76-T-MACH-108718	Introduction to numerical mechanics	

Competence Certificate
Oral Exam, 20 minutes

Prerequisites
None

Annotation
The lecture notes are made available via ILIAS.

T 11.240 Course: Introduction to Rheology [T-CHEMBIO-100303]

Organisation: KIT Department of Chemistry and Biosciences

Part of: M-MACH-102595 - Compulsory Elective Module Natural Science/Computer Science/Electrical Engineering

Type	Credits	Grading scale	Version
Written examination	6	Grade to a third	1

Exams			
ST 2024	7100005	Introduction to Rheology	Dingenouts, Wilhelm

T 11.241 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-102597 - Compulsory Elective Module Mechanical Engineering
M-MACH-102628 - Major Field: Lightweight Construction

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

Events					
ST 2024	2162282	Introduction to the Finite Element Method	2 SWS	Lecture / 🗣	Langhoff, Böhlke
Exams					
ST 2024	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 2024, 2 SWS, Language: German, Open in study portal

Lecture (V)
On-Site

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 11.242 Course: Introduction to Theory of Materials [T-MACH-105321]

Responsible: apl. Prof. Marc Kamlah
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102597 - Compulsory Elective Module Mechanical Engineering
M-MACH-102602 - Major Field: Reliability in Mechanical Engineering
M-MACH-102646 - Major Field: Applied Mechanics
M-MACH-102647 - Major Field: Microactuators and Microsensors

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

Events					
ST 2024	2182732	Introduction to Theory of Materials	2 SWS	Lecture / 🗣	Kamlah
Exams					
ST 2024	76-T-MACH-105321	Introduction to Theory of Materials			Kamlah

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

Competence Certificate
oral exam

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

V Introduction to Theory of Materials
2182732, SS 2024, 2 SWS, Language: German, Open in study portal

Lecture (V)
On-Site

Content
Following a brief introduction into continuum mechanics at small deformations, the classification into elastic, viscoelastic, plastic and viscoplastic constitutive models of solids is discussed. Then, one after the other, the four groups of elastic, viscoelastic, plastic and viscoplastic constitutive models are motivated and mathematically formulated. Their properties are demonstrated by means of elementary analytical solutions and examples.

The student can judge for a problem to be computed, which constitutive model should be selected depending on choice of material and loading. For computation tools such as commercial finite element codes, the students can understand the documentation with respect to the implemented constitutive models, and they can make their choice based on their knowledge. The students have basic knowledge for the development of constitutive laws.

Qualification: Engineering Mechanics; Advanced Mathematics

regular attendance: 22,5 hours
self-study: 97,5 hours

oral exam ca. 30 minutes

Literature
[1] Peter Haupt: Continuum Mechanics and Theory of Materials, Springer
[2] Skript

T 11.243 Course: IoT Platform for Engineering [T-MACH-106743]

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

Part of: M-MACH-102613 - Major Field: Lifecycle Engineering

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

Events					
ST 2024	2123352	IoT platform for engineering	3 SWS	Project (P / 🗣	Meyer, Maier
WT 24/25	2123352	IoT platform for engineering	3 SWS	Project (P / 🗣	Meyer, Maier, Rönnau
Exams					
ST 2024	76-T-MACH-106743	IoT platform for engineering			Meyer

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

Competence Certificate
Assessment of another type (graded), Group teaching project on Industry 4.0 consisting of: Conception, implementation, accompanying documentation and final presentation.

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

V IoT platform for engineering
2123352, SS 2024, 3 SWS, Language: German, Open in study portal

Project (PRO)
On-Site

Content
Industry 4.0, IT systems for fabrication and assembly, process modelling and execution, project work in teams, practice-relevant I4.0 problems, in automation, manufacturing industry and service.

Students can

- 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 IoT platform for engineering
2123352, WS 24/25, 3 SWS, Language: German, Open in study portal

Project (PRO)
On-Site

Content
Industry 4.0, IT systems for fabrication and assembly, process modelling and execution, project work in teams, practice-relevant I4.0 problems, in automation, manufacturing industry and service.

Students can

- 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

Organizational issues
Zeit und Ort siehe Homepage oder ILIAS

Literature
Keine / None

T 11.244 Course: IT-Fundamentals of Logistics [T-MACH-105187]

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

Part of: M-MACH-102598 - Major Field: Advanced Mechatronics
M-MACH-102599 - Major Field: Powertrain Systems
M-MACH-102614 - Major Field: Mechatronics
M-MACH-102624 - Major Field: Information Technology
M-MACH-102625 - Major Field: Information Technology of Logistic Systems
M-MACH-102640 - Major Field: Technical Logistics

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

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

T 11.245 Course: Lab Computer-Aided Methods for Measurement and Control [T-MACH-105341]

Responsible: Marvin Klemp
Prof. Dr.-Ing. Christoph Stiller

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102598 - Major Field: Advanced Mechatronics
M-MACH-102601 - Major Field: Automation Technology
M-MACH-102609 - Major Field: Cognitive Technical Systems
M-MACH-102624 - Major Field: Information Technology
M-MACH-102633 - Major Field: Robotics

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

Events					
WT 24/25	2137306	Lab Computer-aided methods for measurement and control	3 SWS	Practical course / 🗣	Stiller, Immel

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 24/25, 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 11.246 Course: Lab Course Experimental Solid Mechanics [T-MACH-105343]

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

Part of: M-MACH-102591 - Laboratory Course

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

Events					
ST 2024	2162275	Lab course experimental solid mechanics	3 SWS	Practical course / 🗣	Böhlke, Dyck

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

Competence Certificate
passed / not passed

Each participant has to hand in six lab course report (eon for each day of lab course), which will be evaluated. At the end of the lab course, the participants have to give a colloquium (approx 20 min) about a given topic of the experiments done.

Prerequisites
none

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

V Lab course experimental solid mechanics

2162275, SS 2024, 3 SWS, Language: German, Open in study portal

Practical course (P)
On-Site

Content
Anisotropic materials; Experiments for determination of the five material constants of thermoelasticity; Experiments for determination of parameters of the inelatic material behaviour

Organizational issues
Vorbesprechung für interessierte Studierende: Do, 18.04.2024, 13:15 - 13:45, Raum 308.1, Geb 10.2,3 3. OG

Literature
wird im Praktikum angegeben

T 11.247 Course: Lab Course Microcontrollers for Highly Automated Rail Vehicles [T-MACH-113488]

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

Part of: M-MACH-102591 - Laboratory Course

Type	Credits	Grading scale	Recurrence	Expansion	Version
Examination of another type	4	pass/fail	Each term	1 terms	1

Events					
ST 2024	2115925	Praktikum Einsatz von Microcontrollern am Beispiel hochautomatisierter Schienenfahrzeuge	2 SWS	Practical course / 🗣	Cichon
WT 24/25	2115925	Lab Course Microcontrollers for Highly Automated Rail Vehicles	2 SWS	Practical course / 🗣	Cichon
Exams					
ST 2024	76-T-MACH-106429	Lab Course Microcontrollers for Highly Automated Rail Vehicles			Cichon
ST 2024	76-T-MACH-113488	Lab Course Microcontrollers for Highly Automated Rail Vehicles			Cichon
WT 24/25	76-T-MACH-106429	Lab Course Microcontrollers for Highly Automated Rail Vehicles			Cichon

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

T 11.248 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-102591 - Laboratory Course
M-MACH-102610 - Major Field: Power Plant Technology
M-MACH-102623 - Major Field: Fundamentals of Energy Technology

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

Events					
ST 2024	2171487	Laboratory Exercise in Energy Technology	3 SWS	Practical course / 🗣	Bauer, Maas, Bykov, Schießl
WT 24/25	2171487	Laboratory Exercise in Energy Technology	3 SWS	Practical course / 🗣	Bauer, Maas, Bykov
Exams					
ST 2024	76-T-MACH-105331	Laboratory Exercise in Energy Technology			Bauer, Maas, Wirbser
WT 24/25	76-T-MACH-105331	Laboratory Exercise in Energy Technology			Bauer, Maas, Wirbser, Bykov

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 2024, 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 24/25, 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 11.249 Course: Laboratory Laser Materials Processing [T-MACH-102154]

Responsible: Dr.-Ing. Johannes Schneider
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102591 - Laboratory Course
M-MACH-102611 - Major Field: Materials Science and Engineering
M-MACH-102618 - Major Field: Production Technology

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

Events					
ST 2024	2183640	Laboratory "Laser Materials Processing"	3 SWS	Practical course / Blended	Schneider, Pfleging
WT 24/25	2183640	Laboratory "Laser Materials Processing"	3 SWS	Practical course / Blended	Schneider, Pfleging
Exams					
ST 2024	76-T-MACH-102154	Laboratory Laser Materials Processing			Schneider
WT 24/25	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 2024, 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 2024 sind bereits ausgebucht!

Anmeldung per Email an johannes.schneider@kit.edu

Das Praktikum findet semesterbegleitend in Kleingruppen am IAM-ZM (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 24/25, 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 16 Teilnehmer/innen!
Es sind nur noch wenige Plätze frei (Stand 31.05.2024)! Registrierung für die Nachrückliste möglich per Email an johannes.schneider@kit.edu
Praktikum findet in Kleingruppen semesterbegleitend (dienstags bzw. mittwochs, halbtägig) 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

11.250 Course: Laboratory Mechatronics [T-MACH-105370]

Responsible: Prof. Dr. Veit Hagenmeyer
Prof. Dr.-Ing. Christoph Stiller

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102591 - Laboratory Course
M-MACH-102601 - Major Field: Automation Technology
M-MACH-102605 - Major Field: Engineering Design
M-MACH-102609 - Major Field: Cognitive Technical Systems
M-MACH-102614 - Major Field: Mechatronics
M-MACH-102633 - Major Field: Robotics
M-MACH-102642 - Major Field: Development of Innovative Appliances and Power Tools

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

Events					
WT 24/25	2105014	Laboratory mechatronics	3 SWS	Practical course / 🗣	Hagenmeyer, Stiller, Chen, Orth, Klemp

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 24/25, 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.

Literature
Materialien zum Mechatronik-Praktikum

Manuals for the laboratory course on Mechatronics

T 11.251 Course: Laboratory Production Metrology [T-MACH-108878]

Responsible: Prof. Dr.-Ing. Gisela Lanza
Dr. Florian Stamer

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102591 - Laboratory Course
M-MACH-102598 - Major Field: Advanced Mechatronics
M-MACH-102601 - Major Field: Automation Technology
M-MACH-102614 - Major Field: Mechatronics
M-MACH-102618 - Major Field: Production Technology
M-MACH-102628 - Major Field: Lightweight Construction
M-MACH-102633 - Major Field: Robotics

Type	Credits	Grading scale	Recurrence	Version
Examination of another type	4	Grade to a third	Each summer term	2

Events					
ST 2024	2150550	Laboratory Production Metrology	3 SWS	Practical course / 🗣	Lanza, Stamer
Exams					
ST 2024	76-T-MACH-108878	Laboratory Production Metrology			Lanza, Stamer

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 2024, 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
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).

For organizational reasons the number of participants for the course is limited. Hence a 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 11.252 Course: Large Diesel and Gas Engines for Ship Propulsions [T-MACH-110816]

Responsible: Dr.-Ing. Heiko Kubach
Organisation:
Part of: M-MACH-102597 - Compulsory Elective Module Mechanical Engineering
M-MACH-102627 - Major Field: Energy Converting Engines
M-MACH-102650 - Major Field: Combustion Engines Based Powertrains

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

Events					
ST 2024	2134154	Large Diesel and Gas Engines for Ship Propulsions	2 SWS	Lecture / 🗣	Weisser
Exams					
ST 2024	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 2024, 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

Organizational issues
ACHTUNG: abweichend von den hier aufgeführten regelmäßigen Mittwoch-Terminen muss die Vorlesung als Blockveranstaltung in KW 29 durchgeführt werden. Genaue Informationen entnehmen Sie bitte dem entsprechenden Iliaskurs.

T 11.253 Course: Laser in Automotive Engineering [T-MACH-105164]

Responsible: Dr.-Ing. Johannes Schneider
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102597 - Compulsory Elective Module Mechanical Engineering
M-MACH-102607 - Major Field: Vehicle Technology
M-MACH-102611 - Major Field: Materials Science and Engineering
M-MACH-102628 - Major Field: Lightweight Construction

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

Events					
ST 2024	2182642	Laser Material Processing	2 SWS	Lecture / 🗣	Schneider
Exams					
ST 2024	76-T-MACH-105164	Laser in Automotive Engineering / Laser Material Processing			Schneider
WT 24/25	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 Laser Material Processing [T-MACH-112763], 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.
2. The course T-MACH-109084 - Physical Basics of Laser Technology must not have been started.
3. The course T-MACH-112763 - Laser Material Processing 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 Material Processing — **Lecture (V) On-Site**
2182642, SS 2024, 2 SWS, Language: English, Open in study portal

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 material processing
- 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

Organizational issues
Die Vorlesung ersetzt die bisherige Vorlesung "Lasereinsatz im Automobilbau" und wird jetzt auf Englisch angeboten!

The lecture replaces the previous lecture "Laser Application in Automotive Engineering" and is now offered in English!

Literature
W. T. Silvast: Laser Fundamentals, 2004, Cambridge University Press

J. Eichler, H.-J. Eichler: Laser - Basics, Advances, Applications, 2018, Springer

P. Poprawe: Tailored Light 1, 2018, Springer

K. F. Renk: Basics of Laser Physics, 2017, Springer

M. W. Sigrist: Laser: Theorie, Typen und Anwendungen, 2018, Springer-Spektrum

H. Hügel, T. Graf: Materialbearbeitung mit Laser, 2022, Springer Vieweg

T. Graf: Laser - Grundlagen der Laserstrahlquellen, 2009, Vieweg-Teubner Verlag

R. Poprawe: Lasertechnik für die Fertigung, 2005, Springer

T 11.254 Course: Laser Material Processing [T-MACH-112763]

Responsible: Dr.-Ing. Johannes Schneider
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102597 - Compulsory Elective Module Mechanical Engineering
M-MACH-102607 - Major Field: Vehicle Technology
M-MACH-102611 - Major Field: Materials Science and Engineering
M-MACH-102628 - Major Field: Lightweight Construction

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

Events					
ST 2024	2182642	Laser Material Processing	2 SWS	Lecture / 🗣	Schneider
Exams					
ST 2024	76-T-MACH-112763	Laser Material Processing			Schneider
WT 24/25	76-T-MACH-112763	Laser Material Processing			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 Laser in Automotive Engineering [T-MACH-105164], 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.
2. The course T-MACH-109084 - Physical Basics of Laser Technology must not have been started.
3. The course T-MACH-105164 - Laser in Automotive Engineering 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 Material Processing
2182642, SS 2024, 2 SWS, Language: English, 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 material processing
- 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

Organizational issues

Die Vorlesung ersetzt die bisherige Vorlesung "Lasereinsatz im Automobilbau" und wird jetzt auf Englisch angeboten!

The lecture replaces the previous lecture "Laser Application in Automotive Engineering" and is now offered in English!

Literature

W. T. Silvast: Laser Fundamentals, 2004, Cambridge University Press

J. Eichler, H.-J. Eichler: Laser - Basics, Advances, Applications, 2018, Springer

P. Poprawe: Tailored Light 1, 2018, Springer

K. F. Renk: Basics of Laser Physics, 2017, Springer

M. W. Sigrist: Laser: Theorie, Typen und Anwendungen, 2018, Springer-Spektrum

H. Hügel, T. Graf: Materialbearbeitung mit Laser, 2022, Springer Vieweg

T. Graf: Laser - Grundlagen der Laserstrahlquellen, 2009, Vieweg-Teubner Verlag

R. Poprawe: Lasertechnik für die Fertigung, 2005, Springer

T 11.255 Course: Leadership and Conflict Management [T-MACH-111070]

Responsible: Hans Hatzl
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102596 - Compulsory Elective Subject Economics/Law

Type	Credits	Grading scale	Recurrence	Version
Completed coursework (oral)	4	pass/fail	Each summer term	3

Events					
ST 2024	2110017	Leadership and Conflict Management (in German)	2 SWS	Lecture / 🗣	Hatzl
Exams					
ST 2024	76-T-MACH-00002	Leadership and Conflict Management			Deml, Hatzl

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

Competence Certificate
oral competence certificate (approx. 30 min)

Prerequisites
It is not possible to combine this brick with brick Leadership and Conflict Management [T-MACH-105440].

Modeled Conditions
The following conditions have to be fulfilled:

1. The course T-MACH-105440 - Leadership and Conflict Management must not have been started.

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

V Leadership and Conflict Management (in German)

2110017, SS 2024, 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 11.256 Course: Leadership and Conflict Management [T-MACH-105440]

Responsible: Hans Hatzl
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102597 - Compulsory Elective Module Mechanical Engineering
M-MACH-102605 - Major Field: Engineering Design

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

Events					
ST 2024	2110017	Leadership and Conflict Management (in German)	2 SWS	Lecture / 🗣	Hatzl
Exams					
ST 2024	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
It is not possible to combine this brick with brick Leadership and Conflict Management [T-MACH-111070].

Modeled Conditions
The following conditions have to be fulfilled:

1. The course T-MACH-111070 - Leadership and Conflict Management must not have been started.

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 2024, 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 11.257 Course: Leadership and Management Development [T-MACH-112585]

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

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102596 - Compulsory Elective Subject Economics/Law

Type	Credits	Grading scale	Recurrence	Version
Completed coursework (oral)	4	pass/fail	Each winter term	2

Events					
WT 24/25	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
It is not possible to combine this brick with brick Leadership and Management Development [T-MACH-105231].

Modeled Conditions
The following conditions have to be fulfilled:

1. The course T-MACH-105231 - Leadership and Management Development must not have been started.

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

V Leadership and Product Development

2145184, WS 24/25, 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 11.258 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-102597 - Compulsory Elective Module Mechanical Engineering
M-MACH-102599 - Major Field: Powertrain Systems
M-MACH-102600 - Major Field: Man - Technology - Organisation
M-MACH-102605 - Major Field: Engineering Design
M-MACH-102618 - Major Field: Production Technology
M-MACH-102642 - Major Field: Development of Innovative Appliances and Power Tools

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

Events					
WT 24/25	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
It is not possible to combine this brick with brick Leadership and Management Development [T-MACH-112585].

Modeled Conditions
The following conditions have to be fulfilled:

1. The course T-MACH-112585 - Leadership and Management Development must not have been started.

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

V Leadership and Product Development

2145184, WS 24/25, 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 11.259 Course: Lean Production, Principles and Improvement Tools [T-MACH-113710]

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

Part of: M-MACH-102600 - Major Field: Man - Technology - Organisation

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

Events					
WT 24/25	2100060	Lean Production, Principles and Improvement Tools	2 SWS	Lecture	Waldhier

Competence Certificate
bitte englisch ausfüllen

Prerequisites
none

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

V Lean Production, Principles and Improvement Tools

2100060, WS 24/25, 2 SWS, Language: English, Open in study portal **Lecture (V)**

Content
Content:

1. Evolutionary history oft he Toyota Production Systeme
2. Kaizen management and culture
3. Work organisation for lean systems
4. Lean principles
5. Quality management
6. Methods and tools for continuous improvement
7. Problem solving tools
8. Design of plants and production lines

The students acquire fundamental knowledge of the Toyota Production System (TPS).

- They are able to apply the principles TPS in practise.
- They gain knowledge about the methods and tools for Kaizen.
- They have understood the underlying priciples for work organisation and quality management
- They can apply problem solving tools.
- Videos and practical training empowers them for the design of production lines and plants.

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Organizational issues
-- the exam is written, unless there are too few participants, then oral

(die Prüfung ist schriftlich, außer es sind zuwenig Teilnehmer, dann mündlich)

T 11.260 Course: Learning Factory “Global Production“ [T-MACH-105783]

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

Part of: M-MACH-102618 - Major Field: Production Technology

Type	Credits	Grading scale	Recurrence	Version
Examination of another type	6	Grade to a third	Each winter term	4

Events					
WT 24/25	2149612	Learning Factory “Global Production“	4 SWS	/	Lanza

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

Competence Certificate
Alternative test achievement (graded):

- Knowledge acquisition in the context of the seminar (4 achievements 20 min each) with weighting 40%.
- Interaction between participants with weighting 15%.
- Scientific colloquium (in groups of 3 students approx. 45 min each) with weighting 45%.

Prerequisites
none

Annotation
For organisational reasons, the number of participants for the course is limited to 20. As a result, a selection process will take place. Applications must be submitted via the wbk homepage (http://www.wbk.kit.edu/lernfabrik.php).

Due to the limited number of participants, advance registration is required.

Students should have previous knowledge in at least one of the following areas:

- Integrated Production Planning
- Global Production and Logistics
- Quality Management

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

V Learning Factory “Global Production“

2149612, WS 24/25, 4 SWS, Language: German, Open in study portal **Blended (On-Site/Online)**

Content
The learning factory “Global Production“ serves as a modern teaching environment for the challenges of global production. To make this challenges come alive, students can run a production of electric motors under real production conditions.
The course is divided into e-learning units and presence dates. The e-learning units help to learn essential basics and to immerse themselves in specific topics (e.g. selection of location, supplier selection and planning of production networks). The focus of the presence appointments is the case-specific application of relevant methods for planning and control of production systems that are suitable for the location. In addition to traditional methods and tools to organize lean production systems (e.g. Kanban and JIT/ JIS, Line Balancing) the lecture in particular deals with site-specific quality assurance and scalable automation. Essential methods for quality assurance in complex production systems are taught and brought to practical experience by a Six Sigma project. In the area of scalable automation, it is important to find solutions for the adaption of the level of automation of the production system to the local production conditions (e.g. automated workpiece transport, integration of lightweight robots for process linking) and to implement them physically. At the same time safety concepts should be developed and implemented as enablers for human-robot collaboration.
The course also includes an excursion to the production plant for the manufacturing of electric motors of an industrial partner.

Main focus of the lecture:

- site selection
- site-specific factory planning
- site-specific quality assurance
- scalable automation
- supplier selection

Learning Outcomes:

The students are able to …

- evaluate and select alternative locations using appropriate methods.
- use methods and tools of lean management to plan and manage production systems that are suitable for the location.
- use the Six Sigma method and apply goal-oriented process management.
- select an appropriate level of automation of the production units based on quantitative variables.
- make use of well-established methods for the evaluation and selection of suppliers.
- apply methods for planning a global production network depending on company-specific circumstances to sketch a suitable network and classify and evaluating it according to specific criteria.
- apply the learned methods and approaches with regard to problem solving in a global production environment and able to reflect their effectiveness.

Workload:

e-Learning: ~ 24 h
regular attendence: ~ 36 h
self-study: ~ 60 h

Organizational issues
Termine werden über die Institutshomepage bekanntgegeben.

Aus organisatorischen Gründen ist die Teilnehmerzahl für die Lehrveranstaltung auf 20 Teilnehmer begrenzt. Infolgedessen wird ein Auswahlprozess stattfinden. Die Bewerbung erfolgt über die Homepage des wbk (http://www.wbk.kit.edu/studium-und-lehre.php)

Aufgrund der begrenzten Teilnehmerzahl ist eine Voranmeldung erforderlich.

Die Studierenden sollten Vorkenntnisse in mindestens einem der folgenden Bereiche haben:

- Integrierte Produktionsplanung
- Globale Produktion und Logistik
- Qualitätsmanagement

For organisational reasons, the number of participants for the course is limited to 20. As a result, a selection process will take place. Applications must be submitted via the wbk homepage (http://www.wbk.kit.edu/studium-und-lehre.php).

Due to the limited number of participants, advance registration is required.

Students should have previous knowledge in at least one of the following areas:

- Integrated Production Planning
- Global Production and Logistics
- Quality Management

Literature
Medien:
E-Learning Plattform ilias, Powerpoint, Fotoprotokoll. Die Medien werden über ilias (https://ilias.studium.kit.edu/) bereitgestellt.

Media:
E-learning platform ilias, powerpoint, photo protocol. The media are provided through ilias (https://ilias.studium.kit.edu/).

T 11.261 Course: Lecture Series Supplementary Studies on Science, Technology and Society - Self Registration [T-FORUM-113578]

Responsible: Dr. Christine Mielke
Christine Myglas

Organisation:

Part of: M-FORUM-106753 - Supplementary Studies on Science, Technology and Society

Type	Credits	Grading scale	Recurrence	Expansion	Version
Completed coursework	2	pass/fail	Each summer term	1 terms	1

Competence Certificate
Active participation, learning protocols, if applicable.

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:

- Studium Generale. Forum Wissenschaft und Gesellschaft (FORUM) (ehem. ZAK)
- FORUM (ehem. ZAK) Begleitstudium

Recommendation
It is recommended that you complete the lecture series "Science in Society" before attending events in the advanced module and in parallel with attending the basic seminar.
If it is not possible to attend the lecture series and the basic seminar in the same semester, the lecture series can also be attended after attending the basic seminar.
However, attending events in the advanced module before attending the lecture series should be avoided.

Annotation
The basic module consists of the lecture series "Science in Society" and the basic seminar. The lecture series is only offered during the summer semester.
The basic seminar can be attended in the summer or winter semester.

T 11.262 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-102597 - Compulsory Elective Module Mechanical Engineering
M-MACH-102602 - Major Field: Reliability in Mechanical Engineering
M-MACH-102607 - Major Field: Vehicle Technology
M-MACH-102611 - Major Field: Materials Science and Engineering
M-MACH-102613 - Major Field: Lifecycle Engineering
M-MACH-102618 - Major Field: Production Technology
M-MACH-102628 - Major Field: Lightweight Construction
M-MACH-102632 - Major Field: Polymer Engineering

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

Events					
WT 24/25	2113110	Lightweight constructions with fiber-reinforced-polymers – theory and practice	4 SWS	Lecture / Practice (/	Kärger, Liebig
Exams					
WT 24/25	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 24/25, 4 SWS, Language: German, Open in study portal

Content

The cooperative educational concept of the FAST-LB 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. Mechanical properties of the semi-finished fiber products are to be determined by supervised tests on coupon samples. 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

- Fundamentals of lightweight strategies
- Basics of fiber-reinforced-polymers
- Basics of FEM simulation with anisotropic multi-material systems
- Independent development of suitable component concepts in teams of 4
- Independent development of simulation models for verification and design of own component concepts
- Calculation of anisotropic stiffness parameters from characterization tests
- Manufacturing of fiber-reinforced-polymers
- Mechanical testing

Learning Objectives

Students will be able to name and explain lightweight design strategies. 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. They learn to work independently in teams on an open task, to elaborate the necessary boundary conditions and parameters and to obtain additional information where necessary.

T 11.263 Course: Lightweight Engineering Design [T-MACH-105221]

Responsible: Prof. Dr.-Ing. Tobias Düser
Sascha Ott

Organisation: KIT Department of Mechanical Engineering

Part of:
M-MACH-102597 - Compulsory Elective Module Mechanical Engineering
M-MACH-102598 - Major Field: Advanced Mechatronics
M-MACH-102605 - Major Field: Engineering Design
M-MACH-102607 - Major Field: Vehicle Technology
M-MACH-102615 - Major Field: Medical Technology
M-MACH-102628 - Major Field: Lightweight Construction
M-MACH-102633 - Major Field: Robotics
M-MACH-102636 - Major Field: Thermal Turbomachines
M-MACH-102642 - Major Field: Development of Innovative Appliances and Power Tools

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

Events					
ST 2024	2146190	Lightweight Engineering Design	2 SWS	Lecture / 🗣	Düser, Ott
Exams					
ST 2024	76-T-MACH-105221	Lightweight Engineering Design			Düser, Ott, Albers, Burkardt
WT 24/25	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 2024, 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 11.264 Course: Localization of Mobile Agents [T-INFO-101377]

Responsible: Prof. Dr.-Ing. Uwe Hanebeck
Organisation: KIT Department of Informatics
Part of: M-MACH-102595 - Compulsory Elective Module Natural Science/Computer Science/Electrical Engineering
M-MACH-102609 - Major Field: Cognitive Technical Systems
M-MACH-102633 - Major Field: Robotics

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

Events					
ST 2024	24613	Localization of Mobile Agents	3 SWS	Lecture / 🗣	Hanebeck, Frisch
Exams					
ST 2024	7500004	Localization of Mobile Agents			Hanebeck
WT 24/25	7500020	Localization of Mobile Agents			Hanebeck

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

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

V Localization of Mobile Agents

24613, SS 2024, 3 SWS, Language: German, Open in study portal

Lecture (V)
On-Site

Content
This module provides a systematic introduction into the topic of localization methods. In order to facilitate understanding, the module is divided into four main topics. Dead reckoning treats the instantaneous determination of a vehicle's position based on dynamic parameters like velocity or steering angle. Localization with the help of measurements of known landmarks is part of static localization. In addition to the closed-form solutions for particular measurements (distances and angles), the least squares method for fusion arbitrary measurements is also introduced. Dynamic localization treats the combination of dead reckoning and static localization. The central part of the lecture is the derivation of the Kalman filter, which has been successfully applied in several practical applications. Finally, simultaneous localization and mapping (SLAM) is introduced, which allows localization in case of (partly) unknown landmark positions.

Organizational issues
Prüfungsterminvorschläge und das Verfahren dazu sind auf der Webseite der Vorlesung zu finden.

Literature
Grundlegende Kenntnisse der linearen Algebra und Stochastik sind hilfreich.

T 11.265 Course: Logistics and Supply Chain Management [T-MACH-110771]

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

Part of: M-MACH-102625 - Major Field: Information Technology of Logistic Systems
M-MACH-102629 - Major Field: Logistics and Material Flow Theory

Type	Credits	Grading scale	Recurrence	Version
Examination of another type	9	Grade to a third	Each summer term	4

Events					
ST 2024	2118078	Logistics and Supply Chain Management	4 SWS	Lecture / 🗣	Furmans, Alicke
Exams					
ST 2024	76-T-MACH-110771	Logistics and Supply Chain Management			Furmans

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

Competence Certificate
The success control takes place in the form of an examination performance of a different kind. This is composed as follows:

- 50% assessment of a written examination (60 min) during the semester break
- 50% assessment of an oral examination (20 min) during the semester break

To pass the examination, both examination performances must be passed.

Prerequisites
None

Annotation
The brick cannot be taken if one of the bricks "T-MACH-102089 – Logistics - Organisation, Design and Control of Logistic Systems" and "T-MACH-105181 – Supply Chain Management" has been taken.

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

V Logistics and Supply Chain Management

2118078, SS 2024, 4 SWS, Language: English, Open in study portal

Lecture (V)
On-Site

Content

In the lecture "Logistics and Supply Chain Management", comprehensive and well-founded fundamentals of crucial issues in logistics and supply chain management are presented. Furthermore, the interaction of different design elements of supply chains is emphasized. For this purpose, both qualitative and quantitative models are presented and applied. Additionally, methods for mapping and evaluating logistics systems and supply chains are described. The contents of the lecture are deepened in exercises and case studies and comprehension is partially reviewed in case studies. The contents will be illustrated, among other things, on the basis of supply chains in the automotive industry.

Among others, the following topics are covered:

- Inventory Management
- Forecasting
- Bullwhip Effect
- Supply Chain Segmentation and Collaboration
- Key Performance Indicators
- Supply Chain Risk Management
- Production Logistics
- Location Planning
- Route Planning

It is intended to provide an interactive format in which students can also contribute (and work alone or in groups). Since logistics and supply chain management requires working in an international environment and therefore many terms are derived from English, the lecture will be held in English.

Plenary: The plenary sessions take place on Mondays from 09:45 - 13:00 and from 14:00 - 17:15.

Exercises: There are a total of five exercise sessions, which take place on Thursdays from 14:00 to 15:30. The dates can be found in the schedule in Ilias.

Examination dates: This is a "Prüfungsleistung anderer Art", consisting of a written and an oral part. The written exam is planned on 14th August 2024 from 8:00 am to 9:00 am. The oral examinations are expected to take place the two weeks before, i.e. in calendar weeks 31 and 32. An oral examination lasts 20 minutes.

Contact person: In the summer semester 2024, the contact persons for organisational matters are Maximilian Barlang and Alexander Ernst. Please contact us at
log-scm∂ifl.kit.edu

T 11.266 Course: Machine Dynamics [T-MACH-105210]

Responsible: Prof. Dr.-Ing. Carsten Proppe
Organisation: KIT Department of Mechanical Engineering

Part of:
M-MACH-102405 - Fundamentals and Methods of General Mechanical Engineering
M-MACH-102575 - Fundamentals and Methods of Energy and Environmental Engineering
M-MACH-102599 - Major Field: Powertrain Systems
M-MACH-102614 - Major Field: Mechatronics
M-MACH-102636 - Major Field: Thermal Turbomachines
M-MACH-102650 - Major Field: Combustion Engines Based Powertrains
M-MACH-102739 - Fundamentals and Methods of Automotive Engineering
M-MACH-102740 - Fundamentals and Methods of Mechatronics and Microsystem Technology
M-MACH-102741 - Fundamentals and Methods of Product Development and Construction
M-MACH-102742 - Fundamentals and Methods of Production Technology
M-MACH-102743 - Fundamentals and Methods of Theoretical Foundations of Mechanical Engineering
M-MACH-102744 - Fundamentals and Methods of Materials and Structures for High Performance Systems
M-MACH-104434 - Major Field: Modeling and Simulation in Dynamics
M-MACH-104443 - Major Field: Vibration Theory

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

Events					
ST 2024	2161224	Machine Dynamics	2 SWS	Lecture / 🗣	Proppe
ST 2024	2161225	Machine Dynamics (Tutorial)	1 SWS	Practice / 🗣	Proppe, Fischer
WT 24/25	2161224	Machine Dynamics	2 SWS	Lecture / 🖥	Proppe
Exams					
ST 2024	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 2024, 2 SWS, Language: German/English, Open in study portal

Lecture (V)
On-Site

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 2024, 1 SWS, Language: English, Open in study portal

Practice (Ü)
On-Site

Content
Exercises related to the lecture

V **Machine Dynamics**
2161224, WS 24/25, 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 11.267 Course: Machine Dynamics II [T-MACH-105224]

Responsible: Prof. Dr.-Ing. Carsten Proppe
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102597 - Compulsory Elective Module Mechanical Engineering
M-MACH-102599 - Major Field: Powertrain Systems
M-MACH-102614 - Major Field: Mechatronics
M-MACH-102636 - Major Field: Thermal Turbomachines
M-MACH-102650 - Major Field: Combustion Engines Based Powertrains
M-MACH-104434 - Major Field: Modeling and Simulation in Dynamics
M-MACH-104443 - Major Field: Vibration Theory

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

Events					
ST 2024	2162220	Machine Dynamics II	2 SWS	Lecture / 🖥	Proppe
WT 24/25	2162220	Machine Dynamics II	2 SWS	Lecture / 🖥	Proppe
Exams					
ST 2024	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 2024, 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 24/25, 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

Organizational issues
Die Vorlesung wird ausschließlich online angeboten.

Literature
R. Gasch, R. Nordmann, H. Pfützner: Rotordynamik, Springer, 2006

T 11.268 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-102601 - Major Field: Automation Technology
M-MACH-102605 - Major Field: Engineering Design
M-MACH-102618 - Major Field: Production Technology

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

Events					
WT 24/25	2149910	Machine Tools and High-Precision Manufacturing Systems	6 SWS	Lecture / Practice (/ 🗣	Fleischer
Exams					
ST 2024	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 24/25, 6 SWS, Language: German, Open in study portal

Lecture / Practice (VÜ)
On-Site

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
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.

Zur Vertiefung des im Rahmen der Lehrveranstaltung erworbenen Wissens werden die theoretischen Vorlesungseinheiten durch Praxiseinheiten im Umfeld der Karlsruher Forschungsfabrik (https://www.karlsruher-forschungsfabrik.de) unterstützt.

The theoretical lectures are complemented by practical lectures in the Karlsruhe Research Factory (https://www.karlsruher-forschungsfabrik.de/en.html) to deepen the acquired knowledge.

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 11.269 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-102598 - Major Field: Advanced Mechatronics
M-MACH-102601 - Major Field: Automation Technology
M-MACH-102609 - Major Field: Cognitive Technical Systems
M-MACH-102624 - Major Field: Information Technology
M-MACH-102633 - Major Field: Robotics

Type	Credits	Grading scale	Recurrence	Version
Written examination	8	Grade to a third	Each winter term	2

Events					
WT 24/25	2137308	Machine Vision	4 SWS	Lecture / Practice (/	Lauer, Klemp
Exams					
ST 2024	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 24/25, 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 11.270 Course: Magnet Technology of Fusion Reactors [T-MACH-105434]

Responsible: Dr. Klaus-Peter Weiss
Dr. Michael Wolf

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102597 - Compulsory Elective Module Mechanical Engineering
M-MACH-102643 - Major Field: Fusion Technology

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

Events					
ST 2024	2190496	Magnet Technology of Fusion Reactors	2 SWS	Lecture / 🗣	Weiss, Wolf
Exams					
ST 2024	76-T-MACH-105434	Magnet Technology of Fusion Reactors			Weiss
WT 24/25	76-T-MACH-105434	Magnet Technology of Fusion Reactors			Weiss

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

Competence Certificate
Oral examination of about 30 minutes

Prerequisites
none

Annotation
none

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

V Magnet Technology of Fusion Reactors
2190496, SS 2024, 2 SWS, Language: German/English, Open in study portal

Lecture (V)
On-Site

Content

In Greifswald/Germany the fusion experiment Wendelstein 7-X is now in operation to demonstrate the performance of Stellerator-type fusion machines. In south of France the fusion reactor ITER is under construction which will demonstrate the production of energy by fusion. In both machines the plasma inclusion will be ensured by magnets and to produce high magnetic fields in an efficient way, these magnets have to be superconducting. Design, construction and operation of such magnets is a technologic challenge because low temperature (4.5 K) and high currents (typ. 68 kA) are necessary.

The lecture will show basic principles for design and construction of such magnets and includes:

- Introduction with examples to nuclear fusion and to magnetic plasma confinement
- Basics of low temperature and high temperature properties and cryotechnique
- Material testing and critical material properties at low temperatures
- Principles of magnet design, construction and safe magnet operation
- Present status and magnet examples from fusion projects ITER, W7-X and JT-60SA
- Application of high temperature superconductors on fusion and power engineering

The goal of the lecture is to impart the fundamentals of construction of superconducting magnets. Magnet technology is inherently of multidisciplinary character e.g. material properties at low temperature, high voltage and high current technique. The use of superconductors is mandatory to reach highest magnetic fields with comparable small losses. Examples of magnets from power application, basic research and fusion reactor construction are discussed.

Lecture Content:

- Basics of nuclear fusion and design aspects of fusion magnets
- Superconductors - basics and stability
- Low temperature cryogenic aspects
- Low temperature and high temperature superconductors
- Cryogenic material testing and properties of fusion materials at low temperatures
- Quench and high voltage aspects for magnets
- Status and magnets of fusion machines ITER, W7-X, JT-60SA & future DEMO
- Impact of high temperature superconductors on fusion and power engineering

Educational objective: The students know:

- Magnetic plasma confinement principles in connection with fusion machine
- Examples and basic properties of different superconductors
- Basics of formation of superconducting cables and magnet construction
- Generation of low temperature, cryostat construction
- Basics of magnet design and magnet safety
- Material testing and material properties at low temperatures
- High-temperature superconductor use in magnet construction and power application

Recommendations:

Knowledge in energy technology, power plants, material testing is welcomed

- Time of attendance: 2 SWS, Other: excursion, etc. 5 hours
- Self-study: preparation and postprocessing LV (course): 1 hour / week
- Preparation for the examination: 80 hours per semester

Oral examination of about 30 minutes

T 11.271 Course: Magnetohydrodynamics [T-MACH-105426]

Responsible: apl. Prof. Dr. Leo Bühler
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102597 - Compulsory Elective Module Mechanical Engineering
M-MACH-102634 - Major Field: Fluid Mechanic
M-MACH-102643 - Major Field: Fusion Technology

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

Events					
WT 24/25	2153429	Magnetohydrodynamics	2 SWS	Lecture / 🗣	Bühler
Exams					
ST 2024	76-T-MACH-105426	Magnetohydrodynamics			Bühler

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

Competence Certificate
oral

Duration: 30 minutes

No auxiliary means

Prerequisites
The partial performance number T-MACH-108845 "Magnetohydrodynamics" (Nat/Inf/Etit) must not be startet or completed.

The partial services T-MACH-108845 "Magnetohydrodynamics" (Nat/Inf/Etit) and T-MACH-105426 "Magnetohydrodynamics" are mutually exclusive.

Modeled Conditions
The following conditions have to be fulfilled:

1. The course T-MACH-108845 - Magnetohydrodynamics must not have been started.

Recommendation
Fluid Mechanics (T-MACH-105207)

Mathematical Methods in Fluid Mechanics (T-MACH-105295)

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

V Magnetohydrodynamics

2153429, WS 24/25, 2 SWS, Language: German, Open in study portal

Lecture (V)
On-Site

Content

- Introduction
- Basics of electro and fluid dynamics
- Exact solutions, Hartmann flow, pump, generator, channel flows
- Inductionless approximation
- Developing flows, change of cross-section, variable magnetic fields
- Alfven waves
- Stability, transition to turbulence
- Liquid dynamos

Educational objective: The students can describe the fundamentals of magnetohydrodynamics. They are qualified to explain the interrelations of electro and fluid dynamics so as to analyze magnetohydrodynamic flows in engineering applications or for phenomena in geo and astrophysics.

Literature

U. Müller, L. Bühler,2001,Magnetofluiddynamics in Channels and Containers, ISBN 3-540-41253-0, Springer Verlag

R. Moreau, 1990, Magnetohydrodynamics, Kluwer Academic Publisher

P. A. Davidson, 2001, An Introduction to Magnetohydrodynamics, Cambridge University Press

J. A. Shercliff, 1965, A Textbook of Magnetohydrodynamics, Pergamon Press

T 11.272 Course: Magnetohydrodynamics [T-MACH-108845]

Responsible: apl. Prof. Dr. Leo Bühler
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102595 - Compulsory Elective Module Natural Science/Computer Science/Electrical Engineering

Type	Credits	Grading scale	Recurrence	Version
Completed coursework (oral)	6	pass/fail	Each winter term	1

Events					
WT 24/25	2153429	Magnetohydrodynamics	2 SWS	Lecture / 🗣	Bühler
Exams					
ST 2024	76-T-MACH-105426	Magnetohydrodynamics			Bühler

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

Competence Certificate
The study performance is considered to have been passed if all exercise assignments have been successfully processed and the final colloquium (30 minutes) has been successfully passed.

No auxiliary mean

Prerequisites
The partial performance number T-MACH-105426 "Magnetohydrodynamics" must not be startet or completed.

The partial services T-MACH-108845 "Magnetohydrodynamics" (Nat/Inf/Etit) and T-MACH-105426 "Magnetohydrodynamics" are mutually exclusive.

Modeled Conditions
The following conditions have to be fulfilled:

1. The course T-MACH-105426 - Magnetohydrodynamics must not have been started.

Recommendation
Fluid Mechanics (T-MACH-105207)

Mathematical Methods in Fluid Mechanics (T-MACH-105295)

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

V Magnetohydrodynamics

2153429, WS 24/25, 2 SWS, Language: German, Open in study portal

Lecture (V)
On-Site

Content

- Introduction
- Basics of electro and fluid dynamics
- Exact solutions, Hartmann flow, pump, generator, channel flows
- Inductionless approximation
- Developing flows, change of cross-section, variable magnetic fields
- Alfven waves
- Stability, transition to turbulence
- Liquid dynamos

Educational objective: The students can describe the fundamentals of magnetohydrodynamics. They are qualified to explain the interrelations of electro and fluid dynamics so as to analyze magnetohydrodynamic flows in engineering applications or for phenomena in geo and astrophysics.

Literature

U. Müller, L. Bühler,2001,Magnetofluiddynamics in Channels and Containers, ISBN 3-540-41253-0, Springer Verlag

R. Moreau, 1990, Magnetohydrodynamics, Kluwer Academic Publisher

P. A. Davidson, 2001, An Introduction to Magnetohydrodynamics, Cambridge University Press

J. A. Shercliff, 1965, A Textbook of Magnetohydrodynamics, Pergamon Press

T 11.273 Course: Manufacturing Technology [T-MACH-102105]

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

Part of: M-MACH-102605 - Major Field: Engineering Design
M-MACH-102618 - Major Field: Production Technology

Type	Credits	Grading scale	Recurrence	Version
Written examination	8	Grade to a third	Each winter term	3

Events					
WT 24/25	2149657	Manufacturing Technology	6 SWS	Lecture / Practice (/	Schulze
Exams					
ST 2024	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 24/25, 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

Vorlesungstermine montags und dienstags, Übungstermine mittwochs.
Bekanntgabe der konkreten Übungstermine erfolgt in der ersten Vorlesung.

Die LV wird letztmalig im WS 2024/25 angeboten (Vorlesungsvideos bleiben online).

Die Prüfung wird für Erstschreiber letztmalig im SS 2025 und Wiederholer letztmalig im WS 2025/26 angeboten.

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/).

11.274 Course: Master's Thesis [T-MACH-105299]

Responsible: Prof. Dr.-Ing. Martin Heilmaier
Organisation: KIT Department of Mechanical Engineering
Part of: M-MACH-102858 - Master's Thesis

Type	Credits	Grading scale	Recurrence	Version
Final Thesis	30	Grade to a third	Each term	1

Competence Certificate
The master 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 maximal processing time of the master thesis takes three months. With consent of the examiner the thesis can be written in another language than German as well. 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 master 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 master thesis is not completed in time, this examination is "failed" (5,0), unless the student is not responsible.
The master 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 master thesis is graded by the examination board within this assessment; another expert can be appointed too. The master thesis has to be graded within a period of six weeks after the submission.

Prerequisites
The requirement for admission to the master thesis module are 74 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 74 credits in the following fields:
    - Advanced Engineering Fundamentals
    - Specialization

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

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

T 11.275 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-102611 - 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 2024	2174586	Materials Characterization	2 SWS	Lecture / 🗣	Gibmeier, Peterlechner
Exams					
ST 2024	76-T-MACH-107684	Materials Characterization			Gibmeier
WT 24/25	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 2024, 2 SWS, Language: German, Open in study portal

Lecture (V)
On-Site

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**.**

Literature
Vorlesungsskript (wird zu Beginn der Veranstaltung ausgegeben).

Literatur wird zu Beginn der Veranstaltung bekanntgegeben.

T 11.276 Course: Materials in Additive Manufacturing [T-MACH-110165]

Responsible: Dr.-Ing. Stefan Dietrich
Prof. Dr.-Ing. Volker Schulze

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102611 - 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 24/25	2173600	Materials in Additive Manufacturing	2 SWS	Lecture / 🗣	Dietrich
Exams					
ST 2024	76-T-MACH-110165	Materials in Additive Manufacturing			Dietrich
WT 24/25	76-T-MACH-110165	Materials in Additive Manufacturing			Dietrich

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 Materials in Additive Manufacturing
2173600, WS 24/25, 2 SWS, Language: German, Open in study portal

Lecture (V)
On-Site

Content
learning objectives:

requirements:
none

workload:

T 11.277 Course: Materials Modelling: Dislocation Based Plasticity [T-MACH-105369]

Responsible: Dr. Daniel Weygand
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102597 - Compulsory Elective Module Mechanical Engineering
M-MACH-102602 - Major Field: Reliability in Mechanical Engineering
M-MACH-102611 - Major Field: Materials Science and Engineering
M-MACH-102646 - Major Field: Applied Mechanics

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

Events					
ST 2024	2182740	Materials modelling: dislocation based plasticity	2 SWS	Lecture / 🗣	Weygand
Exams					
ST 2024	76-T-MACH-105369	Materials Modelling: Dislocation Based Plasticy			Weygand
WT 24/25	76-T-MACH-105369	Materials Modelling: Dislocation Based Plasticity			Weygand

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 Materials modelling: dislocation based plasticity

2182740, SS 2024, 2 SWS, Language: German, Open in study portal

Lecture (V)
On-Site

Content
1. Introduction
2. elastic fields of dislocations
3. slip, crystallography
4. equations of motion of dislocations
a) fcc
b) bcc
5. interaction between dislocations
6. molecular dynamics
7. discrete dislocation dynamics
8. continuum description of dislocations

The student

- has the basic understanding of the physical basics to describe dislocations and their interaction with point, line and area defects.
- can apply modelling approaches for dislocation based plasticity.
- can explain discrete methods for modelling of microstructural evolution processes.

preliminary knowlegde in mathematics, physics and materials science recommended

regular attendance: 22,5 hours
self-study: 97,5 hours

oral exam ca. 30 minutes

Literature

1. D. Hull and D.J. Bacon, Introduction to Dislocations, Oxford Pergamon 1994
2. W. Cai and W. Nix, Imperfections in Crystalline Solids, Cambridge University Press, 2016
3. J.P. Hirth and J. Lothe: Theory of dislocations, New York Wiley 1982. (oder 1968)
4. J. Friedel, Dislocations, Pergamon Oxford 1964.
5. V. Bulatov, W. Cai, Computer Simulations of Dislocations, Oxford University Press 2006
6. A.S. Argon, Strengthening mechanisms in crystal plasticity, Oxford materials.

T 11.278 Course: Materials of Lightweight Construction [T-MACH-105211]

Responsible: Dr.-Ing. Wilfried Liebig
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102597 - Compulsory Elective Module Mechanical Engineering
M-MACH-102611 - Major Field: Materials Science and Engineering
M-MACH-102628 - Major Field: Lightweight Construction

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

Events					
ST 2024	2174574	Materials of Lightweight Construction	2 SWS	Lecture / 🗣	Liebig
Exams					
ST 2024	76-T-MACH-105211	Materials of Lightweight Construction			Liebig
WT 24/25	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 2024, 2 SWS, Language: German, Open in study portal

Lecture (V)
On-Site

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 11.279 Course: Materials Recycling and Sustainability [T-MACH-110937]

Responsible: Dr.-Ing. Wilfried Liebig
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102611 - Major Field: Materials Science and Engineering
M-MACH-102618 - Major Field: Production Technology
M-MACH-102628 - Major Field: Lightweight Construction
M-MACH-102632 - Major Field: Polymer Engineering

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

Events					
ST 2024	2173520	Materials Recycling and Sustainability	2 SWS	Lecture / 🗣	Liebig
Exams					
ST 2024	76-T-MACH-110937	Materials Recycling and Sustainability			Liebig
WT 24/25	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 2024, 2 SWS, Language: German, Open in study portal

Lecture (V)
On-Site

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

Literature
Skript wird in der Vorlesung ausgegeben

T 11.280 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-102611 - 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 24/25	2173553	Materials Science and Engineering III	4 SWS	Lecture / 🗣	Heilmaier, Guth
WT 24/25	2173554	Exercises in Materials Science and Engineering III	1 SWS	Practice / 🗣	Heilmaier, Kauffmann
Exams					
ST 2024	76-T-MACH-105301	Materials Science III			Heilmaier, Guth
WT 24/25	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

Modeled Conditions
The following conditions have to be fulfilled:

1. The course T-MACH-110818 - Plasticity of Metals and Intermetallics must not have been started.

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

V Materials Science and Engineering III

2173553, WS 24/25, 4 SWS, Language: German, Open in study portal

Lecture (V)
On-Site

Content
Properties of pure iron; thermodynamic foundations of single-component and of binary systems; nucleation and growth; diffusion processes in crystalline iron; the phase diagram Fe-Fe3C; effects of alloying on Fe-C-alloys; nonequilibrium microstructures; multicomponent iron-based alloys; heat treatment technology; hardenability and hardenability tests.

learning objectives:
The students are familiar with the thermodynamic foundations of phase transformations, the kinetics of phase transformations in the solid states (nucleation and growth phenomena), the mechanisms of microstructure formation and microstructure-property relationships and can apply them to metallic materials. They can assess the effects of heat treatmens and of alloying on the microstructure and the properties of iron-based materials (steels in particular). The can select steels for structural applications in mechanical engineering and subject them to appropriate heat treatmens.

requirements:
Basic knowledge in materials science and engineering (Werkstoffkunde I/II)

workload:

regular attendance: 53 hours
self-study: 187 hours

Literature
Vorlesungsskript; Übungsaufgaben; Bhadeshia, H.K.D.H. & Honeycombe, R.W.K.
Steels – Microstructure and Properties
CIMA Publishing, 3. Auflage, 2006

T 11.281 Course: Mathematical Fundamentals of Numerical Mechanics [T-MACH-108957]

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

Part of: M-MACH-102597 - Compulsory Elective Module Mechanical Engineering
M-MACH-102614 - Major Field: Mechatronics

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

Events					
ST 2024	2162240	Mathematical Fundamentals of Numerical Mechanics	2 SWS	Lecture / 🗣	Schnack

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

Competence Certificate
Oral Examination Duration: 20 minutes

Prerequisites
None

Recommendation
none

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

V Mathematical Fundamentals of Numerical Mechanics
2162240, SS 2024, 2 SWS, Language: German, Open in study portal

Lecture (V)
On-Site

Content
Variational formulations. Functional analysis. Lagrange d process.Various function space definitions relating to the elasticity and dynamics of the mechanics. Measurements which enable the field calculation to be defined in applications.

Literature
E. Klingbeil: Variationsrechnung. Bibliographisches Institut. Mannheim, Wien, Zürich, 1977.

J.C. Clegg: Variationsrechnung. Teubner Studienbücher, B.G. Teubner, Stuttgart, 1970.

Variationsrechnung und ihre Anwendung in Physik und Technik. Springer-Verlag Berlin, Heidelberg, 1970.

A.E. Taylor: Introduction of functional analysis. John Wiley & Sons Verlag, New York, London, Sydney, 1958.

F. Hirzebuch und W. Scharlau: Einführung in die Funktionsanalysis. Bibliographisches Institut Mannheim, Wien, Zürich, 1971.

T 11.282 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-102405 - Fundamentals and Methods of General Mechanical Engineering
M-MACH-102594 - Mathematical Methods
M-MACH-102597 - Compulsory Elective Module Mechanical Engineering
M-MACH-102742 - Fundamentals and Methods of Production Technology
M-MACH-102743 - Fundamentals and Methods of Theoretical Foundations of Mechanical Engineering
M-MACH-102744 - Fundamentals and Methods of Materials and Structures for High Performance Systems

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

Events					
WT 24/25	2161254	Mathematical Methods in Continuum Mechanics	2 SWS	Lecture / 🗣	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 24/25, 2 SWS, Language: German, Open in study portal

Lecture (V)
On-Site

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 11.283 Course: Mathematical Methods in Dynamics [T-MACH-105293]

Responsible: Prof. Dr.-Ing. Carsten Proppe
Organisation: KIT Department of Mechanical Engineering

Part of:
M-MACH-102405 - Fundamentals and Methods of General Mechanical Engineering
M-MACH-102594 - Mathematical Methods
M-MACH-102597 - Compulsory Elective Module Mechanical Engineering
M-MACH-102598 - Major Field: Advanced Mechatronics
M-MACH-102739 - Fundamentals and Methods of Automotive Engineering
M-MACH-102740 - Fundamentals and Methods of Mechatronics and Microsystem Technology
M-MACH-102741 - Fundamentals and Methods of Product Development and Construction
M-MACH-102743 - Fundamentals and Methods of Theoretical Foundations of Mechanical Engineering
M-MACH-104434 - 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 2024	2161206	Mathematical Methods in Dynamics	2 SWS	Lecture / 🖥	Proppe
WT 24/25	2161206	Mathematical Methods in Dynamics	2 SWS	Lecture / 🧩	Proppe
WT 24/25	2161207	Übungen zu Mathematische Methoden der Dynamik	1 SWS	Practice / 🗣	Proppe, Luo
Exams					
ST 2024	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 2024, 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 24/25, 2 SWS, Language: German, Open in study portal

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

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 24/25, 1 SWS, Language: German, Open in study portal

Practice (Ü)
On-Site

Content
Excercises related to the lecture

T 11.284 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-102405 - Fundamentals and Methods of General Mechanical Engineering
M-MACH-102575 - Fundamentals and Methods of Energy and Environmental Engineering
M-MACH-102594 - Mathematical Methods
M-MACH-102597 - Compulsory Elective Module Mechanical Engineering
M-MACH-102634 - Major Field: Fluid Mechanic
M-MACH-102739 - Fundamentals and Methods of Automotive Engineering
M-MACH-102741 - Fundamentals and Methods of Product Development and Construction
M-MACH-102743 - Fundamentals and Methods of Theoretical Foundations of Mechanical Engineering

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

Events					
ST 2024	2154432	Mathematical Methods in Fluid Mechanics	4 SWS	Lecture / Practice (/	Gatti, Frohnapfel
ST 2024	2154540	Mathematical Methods in Fluid Mechanics	4 SWS	Lecture / Practice (/	Gatti, Frohnapfel
Exams					
ST 2024	76-T-MACH-105295	Mathematical Methods in Fluid Mechanics			Frohnapfel, Gatti
ST 2024	76-T-MACH-105295 (engl.)	Mathematical Methods in Fluid Mechanics			Gatti, Frohnapfel

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 2024, 4 SWS, Language: German/English, Open in study portal

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

Content
The students can simplify the Navier-Stokes equations for specific flow problems. They are able to employ mathematical methods in fluid mechanics effectively in order to solve the resulting governing equations analytically, if possible, or to enable simpler numerical solution of the problem. The students 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:

- Creeping flows (Stokes flow)
- Lubrication theory
- Potential flow theory
- Boundary-layer theory
- Laminar-turbulent transition (linear stability theory)
- Turbulent flows

Organizational issues
Die Vorlesung wird im SS2024 nur auf Englisch gehalten. Die Übungen werden in Deutsch und Englisch angeboten. Die Räume bleiben.

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 **Mathematical Methods in Fluid Mechanics**

2154540, SS 2024, 4 SWS, Language: English, Open in study portal

Lecture / Practice (VÜ)
On-Site

Content

The students can simplify the Navier-Stokes equations for specific flow problems. They are able to employ mathematical methods in fluid mechanics effectively in order to solve the resulting governing equations analytically, if possible, or to enable simpler numerical solution of the problem. The students 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:

- Creeping flows (Stokes flow)
- Lubrication theory
- Potential flow theory
- Boundary-layer theory
- Laminar-turbulent transition (linear stability theory)
- Turbulent flows

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

T 11.285 Course: Mathematical Methods in Micro Mechanics [T-MACH-111537]

Responsible: Prof. Dr.-Ing. Thomas Böhlke
Organisation: KIT Department of Mechanical Engineering
Part of: M-MACH-105904 - Major Field: Advanced Materials Modelling and Data Management

Type	Credits	Grading scale	Expansion	Version
Written examination	4	Grade to a third	1 terms	1

Events					
ST 2024	2162280	Mathematical Methods in Micromechanics	2 SWS	Lecture / 🗣	Böhlke
Exams					
ST 2024	76-T-MACH-111537	Mathematical Methods in Micro Mechanics			Böhlke

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

Competence Certificate
written exam (90 min)

Prerequisites
none

Annotation
can only be chosen within the Major Field 56 of MSc Mechanical Engineering

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

V Mathematical Methods in Micromechanics

2162280, SS 2024, 2 SWS, Language: German, Open in study portal

Lecture (V)
On-Site

Content
Fundamentals of linear isotropic and anisotropic thermoelasticity theory,
Description of microstructures,
Micro-macro relations of linear thermoelasticity theory,
Approximations and bounds for the effective thermoelastic material behavior,
Microstructure Sensitive Design of materials,
Selected problems in the context of homogenization of nonlinear material properties

Organizational issues
Nähere Informationen zu Zeit und Ort der Vorlesung im SS 2023: siehe ITM-KM Homepage

Literature

- Vorlesungsskript
- Gummert, P.; Reckling, K.-A.: Mechanik. Vieweg 1994
- Gross, D., Seelig, T.: Bruchmechanik – Mit einer Einführung in die Mikromechanik, Springer 2002
- Klingbeil, E.: Variationsrechnung, BI Wissenschaftsverlag, 1977
- Torquato, S.: Random Heterogeneous Materials. Springer, 2002

T 11.286 Course: Mathematical Methods in Micromechanics [T-MACH-110378]

Responsible: Prof. Dr.-Ing. Thomas Böhlke
Organisation: KIT Department of Mechanical Engineering
Part of: M-MACH-102594 - Mathematical Methods
M-MACH-102602 - Major Field: Reliability in Mechanical Engineering
M-MACH-102611 - Major Field: Materials Science and Engineering
M-MACH-102646 - Major Field: Applied Mechanics
M-MACH-102743 - Fundamentals and Methods of Theoretical Foundations of Mechanical Engineering
M-MACH-102744 - Fundamentals and Methods of Materials and Structures for High Performance Systems

Type	Credits	Grading scale	Recurrence	Expansion	Version
Written examination	5	Grade to a third	Each summer term	1 terms	2

Events					
ST 2024	2162280	Mathematical Methods in Micromechanics	2 SWS	Lecture / 🗣	Böhlke
Exams					
ST 2024	76-T-MACH-110378	Mathematical Methods in Micromechanics			Böhlke

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

Competence Certificate
written exam (180 min). Additives as announced.

prerequisite to registration to the exam: Passing the tutorial to Mathematical Methods in Micromechanics (T-MACH-110379)

Prerequisites
Passing the tutorial to Mathematical Methods in Micromechanics (T-MACH-110379)

Modeled Conditions
The following conditions have to be fulfilled:

1. The course T-MACH-110379 - Tutorial Mathematical Methods in Micromechanics must have been passed.

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

V Mathematical Methods in Micromechanics

Lecture (V)
On-Site

2162280, SS 2024, 2 SWS, Language: German, Open in study portal

Content
Fundamentals of linear isotropic and anisotropic thermoelasticity theory,
Description of microstructures,
Micro-macro relations of linear thermoelasticity theory,
Approximations and bounds for the effective thermoelastic material behavior,
Microstructure Sensitive Design of materials,
Selected problems in the context of homogenization of nonlinear material properties

Organizational issues
Nähere Informationen zu Zeit und Ort der Vorlesung im SS 2023: siehe ITM-KM Homepage

Literature

- Vorlesungsskript
- Gummert, P.; Reckling, K.-A.: Mechanik. Vieweg 1994
- Gross, D., Seelig, T.: Bruchmechanik – Mit einer Einführung in die Mikromechanik, Springer 2002
- Klingbeil, E.: Variationsrechnung, BI Wissenschaftsverlag, 1977
- Torquato, S.: Random Heterogeneous Materials. Springer, 2002

T 11.287 Course: Mathematical Methods in Structural Mechanics [T-MACH-105298]

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

Part of: M-MACH-102405 - Fundamentals and Methods of General Mechanical Engineering
M-MACH-102741 - Fundamentals and Methods of Product Development and Construction

Type	Credits	Grading scale	Recurrence	Version
Written examination	5	Grade to a third	Each summer term	2

Competence Certificate
written exam (180 min). Additives as announced.

Prerequisites
Passing the tutorial to Mathematical Methods in Structural Mechanics T-MACH-106831

Modeled Conditions
The following conditions have to be fulfilled:

1. The course T-MACH-106831 - Tutorial Mathematical Methods in Structural Mechanics must have been passed.

Recommendation
This course is geared to MSc students. The contents of the lecture "Mathematical methods in Strength of Materials" are assumed to be known.

T 11.288 Course: Mathematical Methods of Vibration Theory [T-MACH-105294]

Responsible: Prof. Dr.-Ing. Alexander Fidlin
Elke Höllig
Dr.-Ing. Ulrich Römer

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102405 - Fundamentals and Methods of General Mechanical Engineering
M-MACH-102594 - Mathematical Methods
M-MACH-102597 - Compulsory Elective Module Mechanical Engineering
M-MACH-102598 - Major Field: Advanced Mechatronics
M-MACH-102614 - Major Field: Mechatronics
M-MACH-102739 - Fundamentals and Methods of Automotive Engineering
M-MACH-102740 - Fundamentals and Methods of Mechatronics and Microsystem Technology
M-MACH-102741 - Fundamentals and Methods of Product Development and Construction
M-MACH-102743 - Fundamentals and Methods of Theoretical Foundations of Mechanical Engineering
M-MACH-104434 - Major Field: Modeling and Simulation in Dynamics
M-MACH-104443 - Major Field: Vibration Theory

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

Events					
ST 2024	2162241	Mathematical methods of vibration theory	2 SWS	Lecture / ✕	Römer
ST 2024	2162242	Mathematical methods of vibration theory (Tutorial)	2 SWS	Practice / ✕	Keller, Römer
Exams					
ST 2024	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 2024, 2 SWS, Language: German, Open in study portal

Lecture (V)
Cancelled

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

Organizational issues
Die Vorlesung Mathematische Methoden der Schwingungslehre wird im Sommersemester 2024 nicht angeboten.

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

V

Mathematical methods of vibration theory (Tutorial)
2162242, SS 2024, 2 SWS, Language: German, Open in study portal

Practice (Ü)
Cancelled

Content
Seven tutorials with examples of the contents of the course

Organizational issues
Die Vorlesung und Übungen zu Mathematische Methoden der Schwingungslehre werden im Sommersemester 2024 nicht angeboten.

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

T 11.289 Course: Mathematical Models and Methods for Production Systems [T-MACH-105189]

Responsible: Dr.-Ing. Marion Baumann
Prof. Dr.-Ing. Kai Furmans

Organisation: KIT Department of Mechanical Engineering

Part of:
M-MACH-102405 - Fundamentals and Methods of General Mechanical Engineering
M-MACH-102594 - Mathematical Methods
M-MACH-102597 - Compulsory Elective Module Mechanical Engineering
M-MACH-102613 - Major Field: Lifecycle Engineering
M-MACH-102618 - Major Field: Production Technology
M-MACH-102633 - Major Field: Robotics
M-MACH-102742 - Fundamentals and Methods of Production Technology
M-MACH-102743 - Fundamentals and Methods of Theoretical Foundations of Mechanical Engineering

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

Events					
WT 24/25	2117059	Mathematical models and methods for Production Systems	4 SWS	Lecture / Practice (/ 🗣	Baumann, Furmans
Exams					
ST 2024	76-T-MACH-105189-02	Mathematical Models and Methods for Production Systems			Furmans, Baumann

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 Mathematical models and methods for Production Systems

2117059, WS 24/25, 4 SWS, Language: English, Open in study portal

Lecture / Practice (VÜ)
On-Site

Content
Media:

black board, lecture notes, presentations

Learning Content:

- single server systems: M/M/1, M/G/1: priority rules, model of failures
- networks: open and closed approximations, exact solutions and approximations
- application to flexible manufacturing systems, AGV (automated guided vehicles) - systems
- modeling of control approaches like constant work in process (ConWIP) or kanban
- discrete-time modeling of queuing systems

Learning Goals:

Students are able to:

- Describe queueing systems with analytical solvable stochastic models,
- Derive approches for modeling and controlling material flow and production systems based on models of queueing theory,
- Use simulation and exakt methods.

Recommendations:

- Basic knowledge of statistic
- recommended compusory optional subject: Stochastics
- recommended lecture: Materials flow in logistic systems (also parallel)

Workload:

regular attendance: 42 hours
self-study: 198 hours

Organizational issues

- **Im Wintersemester 2024/2025 ist die Veranstaltung auf maximal 30 Teilnehmer beschränkt.**
- **Die Anmeldung erfolgt durch Beitritt zum ILIAS-Kurs und Ausfüllen des Anmeldungsformulars (erforderliche Felder beim Beitritt zum ILIAS-Kurs).**
- **Die Anmeldung ist vom 01.09.2024 bis zum 30.09.2024 möglich. Die verfügbaren Plätze werden anschließend vergeben.**

Literature

Ronald W. Wolff (1989) Stochastic Modeling and the Theory of Queues, Englewood Cliffs, NJ : Prentice-Hall.
John A. Buzacott, J. George Shanthikumar (1993) Stochastic Models of Manufacturing Systems, Upper Saddle River, NJ : Prentice Hall.

T 11.290 Course: Mathematical Models and Methods in Combustion Theory [T-MACH-105419]

Responsible: Dr. Viatcheslav Bykov
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102597 - Compulsory Elective Module Mechanical Engineering
M-MACH-102612 - Major Field: Modeling and Simulation in Energy- and Fluid Engineering
M-MACH-102635 - Major Field: Engineering Thermodynamics

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

Events					
WT 24/25	2165525	Mathematical models and methods in combustion theory	2 SWS	Lecture / 🗣	Bykov

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 Mathematical models and methods in combustion theory
2165525, WS 24/25, 2 SWS, Language: German, Open in study portal

Lecture (V)
On-Site

Content
The lecture shall introduce the basics of the mathematical modeling and the analysis of reacting flow systems. The fundamental models of combustion processes are outlined together with asymptotical methods, which deliver reasonable approximate solutions for numerous combustion processes. Many examples of simplified models for the description of auto-ignition, explosions, flame quenching and detonations will be presented and discussed. The main analytical methods will be illustrated using these simple examples.

Organizational issues
Termine und Raum: siehe Aushang und Internetseite des Instituts.

Literature
Combustion Theory, F A Williams, (2nd Edition), 1985, Benjamin Cummins.

Combustion - Physical and Chemical Fundamentals, Modeling and Simulation, Experiments, Pollutant Formation, J. Warnatz, U. Mass and R. W. Dibble, (3nd Edition), Springer-Verlag, Heidelberg, 2003.

The Mathematical Theory of Combustion and Explosions, Ya.B. Zeldovich, G.I. Barenblatt, V.B. Librovich, G.M. Makhviladze, Springer, New York and London, 1985.

T 11.291 Course: Measurement II [T-MACH-105335]

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

Part of:
M-MACH-102597 - Compulsory Elective Module Mechanical Engineering
M-MACH-102598 - Major Field: Advanced Mechatronics
M-MACH-102601 - Major Field: Automation Technology
M-MACH-102609 - Major Field: Cognitive Technical Systems
M-MACH-102614 - Major Field: Mechatronics
M-MACH-102624 - Major Field: Information Technology
M-MACH-102633 - Major Field: Robotics

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

Events					
ST 2024	2138326	Measurement II	2 SWS	Lecture / 🗣	Stiller, Steiner
Exams					
ST 2024	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 — **Lecture (V) On-Site**
2138326, SS 2024, 2 SWS, Language: German, Open in study portal

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 11.292 Course: Measurement Instrumentation Lab [T-MACH-105300]

Responsible: Marvin Klemp
Prof. Dr.-Ing. Christoph Stiller

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102591 - Laboratory Course

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

Events					
ST 2024	2138328	Measurement Instrumentation Lab	2 SWS	Practical course / 🗣	Stiller, Klemp
Exams					
ST 2024	76-T-MACH-105300	Measurement Instrumentation Lab			Stiller

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

Competence Certificate
Non graded colloquia

Prerequisites
none

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

V Measurement Instrumentation Lab

2138328, SS 2024, 2 SWS, Language: German/English, Open in study portal

Practical course (P)
On-Site

Content
Please consider the bulletin on our website!

A Signal recording

- measurement of temperature
- measurement of lengths

B Signal pre-precessing

- bridge circuits and principles of measurement
- analog/digital transducers

C Signal processing

- measuring stochastic signals

D Complete systems

- system identification
- inverse pendulum
- mobile robot platform

Recommendations:

Basic studies and preliminary examination; basic lectures in automatic control

Arbeitsaufwand: 90 hours

Lernziele (EN):

The laboratory complements the course "Introduction to Measurement and Control". While the course is organized into principles and subsystems, the laboratory presents complete measurement systems and methods for the most relevant industrial measurands.

Literature

Anleitungen auf der Homepage des Instituts erhältlich.

Instructions to the eyperiments are available on the institute's website

11.293 Course: Measurement Technology [T-ETIT-112147]

Responsible: Prof. Dr.-Ing. Michael Heizmann
Organisation: KIT Department of Electrical Engineering and Information Technology
Part of: M-MACH-102615 - Major Field: Medical Technology

Type	Credits	Grading scale	Version
Written examination	5	Grade to a third	1

Events					
WT 24/25	2302117	Measurement Technology	2 SWS	Lecture / Blended	Heizmann
WT 24/25	2302118	Exercise for 2302117 Measurement Technology	1 SWS	Practice / On-Site	Heizmann, Panther
Exams					
ST 2024	7302118	Measurement Technology			Heizmann

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

Competence Certificate
The examination takes place in form of a written examination lasting 120 minutes. The module grade is the grade of the written examination.

Prerequisites
T-ETIT-101937 – Messtechnik (German version) must not have started.

T 11.294 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-102597 - Compulsory Elective Module Mechanical Engineering
M-MACH-102611 - Major Field: Materials Science and Engineering
M-MACH-102632 - Major Field: Polymer Engineering

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

Events					
WT 24/25	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 24/25, 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 11.295 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-102597 - Compulsory Elective Module Mechanical Engineering
M-MACH-102598 - Major Field: Advanced Mechatronics
M-MACH-102602 - Major Field: Reliability in Mechanical Engineering
M-MACH-102614 - Major Field: Mechatronics
M-MACH-102615 - Major Field: Medical Technology
M-MACH-102616 - Major Field: Microsystem Technology
M-MACH-102647 - Major Field: Microactuators and Microsensors

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

Events					
WT 24/25	2181710	Mechanics in Microtechnology	2 SWS	Lecture / 🗣	Gruber, Greiner
Exams					
ST 2024	76-T-MACH-105334	Mechanics in Microtechnology			Gruber, Greiner
WT 24/25	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 24/25, 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 11.296 Course: Mechanics of Laminated Composites [T-MACH-108717]

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

Part of: M-MACH-102597 - Compulsory Elective Module Mechanical Engineering
M-MACH-102607 - Major Field: Vehicle Technology
M-MACH-102611 - Major Field: Materials Science and Engineering
M-MACH-102628 - Major Field: Lightweight Construction

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

Events					
WT 24/25	2161983	Mechanics of laminated composites	2 SWS	Lecture / 🗣	Schnack
Exams					
ST 2024	76-T-MACH-108717	Mechanics of Laminated Composites			

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

Competence Certificate
Oral exam, approx. 20 minutes

Prerequisites
none

Annotation
The lecture notes are made available via ILIAS.

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

V Mechanics of laminated composites

2161983, WS 24/25, 2 SWS, Language: German, Open in study portal

Lecture (V)
On-Site

Content
Definition of composites, definition of static and kinematic groups. Definition of material laws. Transformation of the state values of composites and transformation of the material properties for the coordinate systems in the design of machine structures.

T 11.297 Course: Medical Imaging Technology [T-ETIT-113625]

Responsible: Prof. Dr.-Ing. Maria Francesca Spadea
Organisation: KIT Department of Electrical Engineering and Information Technology
Part of: M-MACH-102595 - Compulsory Elective Module Natural Science/Computer Science/Electrical Engineering
M-MACH-102615 - Major Field: Medical Technology

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

Competence Certificate
The examination takes place in form of a written examination lasting 90 minutes. The course grade is the grade of the written exam.

Prerequisites
none

T 11.298 Course: Medical Measurement Technology [T-ETIT-113607]

Responsible: Prof. Dr. Werner Nahm
Organisation: KIT Department of Electrical Engineering and Information Technology
Part of: M-MACH-102595 - Compulsory Elective Module Natural Science/Computer Science/Electrical Engineering
M-MACH-102615 - Major Field: Medical Technology

Type	Credits	Grading scale	Recurrence	Version
Written examination	6	Grade to a third	Each winter term	1

Events					
WT 24/25	2305269	Medical Measurement Techniques	4 SWS	Lecture / Blended	Nahm

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

Competence Certificate
The assessment takes place in the form of a written examination lasting 120 min. and 120 points.

The module grade is the grade of the written exam.

Bonus points can also be awarded for a student presentation within the lecture. Bonus points are awarded as follows:

- solving bonus tasks is voluntary.
- students register in ILIAS in groups of max. 3 participants for a bonus task.
- the solution to the bonus task must be entered in ILIAS by the specified submission deadline.
- the solutions are read by the lecture assistants and, if necessary, corrected and approved.
- the groups present their solutions in the lecture (20 min).
- the bonus points are awarded individually to each student by the lecturer on the basis of the written solution and the presentation.
- Each student can earn a maximum of 6 bonus points.
- Bonus points can only be earned once.

The bonus points are credited as follows:

- A maximum of 6 points can be credited to the exam result for the passed bonus task.
- The grade can thus be improved by a maximum of one grade step.
- The total number of points remains limited to 120 points. The bonus points are only taken into account if the exam is passed. Bonus points do not expire and are retained for any examinations taken at a later date.

Prerequisites
none

T 11.299 Course: Metal Forming [T-MACH-105177]

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

Part of: M-MACH-102597 - Compulsory Elective Module Mechanical Engineering
M-MACH-102618 - Major Field: Production Technology

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

Events					
ST 2024	2150681	Metal Forming	2 SWS	Lecture / 🗣	Herlan
Exams					
ST 2024	76-T-MACH-105177	Metal Forming			Herlan

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 Metal Forming
2150681, SS 2024, 2 SWS, Language: German, Open in study portal

Lecture (V)
On-Site

Content
At the beginning of the lecture the basics of metal forming are briefly introduced. The focus of the lecture is on massive forming (forging, extrusion, rolling) and sheet forming (car body forming, deep drawing, stretch drawing). This includes the systematic treatment of the appropriate metal forming Machines and the corresponding tool technology. Aspects of tribology, as well as basics in material science and aspects of production planning are also discussed briefly. The plastic theory is presented to the extent necessary in order to present the numerical simulation method and the FEM computation of forming processes or tool design. The lecture will be completed by product samples from the forming technology.

The topics are as follows:

- Introduction and basics
- Hot forming
- Metal forming machines
- Tools
- Metallographic fundamentals
- Plastic theory
- Tribology
- Sheet forming
- Extrusion
- Numerical simulation

Learning Outcomes:

The students …

- are able to reflect the basics, forming processes, tools, Machines and equipment of metal forming in an integrated and systematic way.
- are capable to illustrate the differences between the forming processes, tools, machines and equipment with concrete examples and are qualified to analyze and assess them in terms of their suitability for the particular application.
- are also able to transfer and apply the acquired knowledge to other metal forming problems.

Workload:

regular attendance: 21 hours
self-study: 99 hours

Organizational issues
Vorlesungstermine freitags, wöchentlich.
Die konkreten Termine werden in der ersten Vorlesung bekannt gegeben und auf der Institutshomepage und ILIAS veröffentlicht.

Zur Vertiefung des im Rahmen der Lehrveranstaltung erworbenen Wissens werden die theoretischen Vorlesungseinheiten durch Praxiseinheiten im Umfeld der Karlsruher Forschungsfabrik (https://www.karlsruher-forschungsfabrik.de) unterstützt.

The theoretical lectures are complemented by practical lectures in the Karlsruhe Research Factory (https://www.karlsruher-forschungsfabrik.de/en.html) to deepen the acquired knowledge.

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 11.300 Course: Metallographic Lab Class [T-MACH-105447]

Responsible: Prof. Dr.-Ing. Martin Heilmaier
Dr.-Ing. Alexander Kauffmann

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102591 - Laboratory Course
M-MACH-102611 - Major Field: Materials Science and Engineering

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

Events					
WT 24/25	2175590	Metallographic Lab Class	3 SWS	Practical course / 🗣	Kauffmann
Exams					
WT 24/25	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
none

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

V Metallographic Lab Class

2175590, WS 24/25, 3 SWS, Language: German, Open in study portal

Practical course (P)
On-Site

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

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 11.301 Course: Metals [T-MACH-105468]

Responsible: Prof. Dr.-Ing. Martin Heilmaier
Prof. Dr. Astrid Pundt

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102597 - Compulsory Elective Module Mechanical Engineering

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

Events					
ST 2024	2174598	Metals	4 SWS	Lecture / 🗣	Wagner
ST 2024	2174599	Exercises in Metals	1 SWS	Practice / 🗣	Wagner
Exams					
ST 2024	76-T-MACH-105468	Metals			Pundt, Wagner

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

Competence Certificate
Oral exam, about 20 minutes

Prerequisites
none

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

V Metals
2174598, SS 2024, 4 SWS, Language: German, Open in study portal

Lecture (V)
On-Site

Content
Properties of pure elements; thermodynamic foundations of single-component and of binary systems, as well as multiphase systems; nucleation and growth; diffusion processes in crystalline materials; phase diagrams; effects of alloying; nonequilibrium microstructures; heat treatment technology

learning objectives:
The students are familiar with the thermodynamic foundations of phase transformations, the kinetics of phase transformations in the solid state, the mechanisms of microstructure formation and microstructure-property relationships and can apply them to metallic materials. They can assess the effects of heat treatments and of alloying on the microstructure and the mechanicla and physical properties of metallic materials. This competence is in particular deepened for iron- and aluminum-based alloys.
requirements:
Materials physics
workload:

Regular attendance: 42 h

Self-study: 138 h

Organizational issues
Weitere Informationen zu dieser Veranstaltung finden Sie hier: https://www.iam.kit.edu/wk/lehre.php

Literature
D.A. Porter, K. Easterling, Phase Transformation in Metals and Alloys, 2nd edition, Chapman & Hall, London 1997,

G. Gottstein. Physikalische Grundlagen der Materialkunde, Springer 2007

E. Hornbogen, H. Warlimont, Metalle (Struktur und Eigenschaften von Metallen und Legierungen), Springer-Verlag, Berlin 2001

H.-J. Bargel, G. Schulze, Werkstoffkunde, Springer-Verlag Berlin 2005

J. Rösler, H. Harders, M. Bäker, Mechanisches Verhalten der Werkstoffe, Vieweg+Teubner Wiesbaden, 2008

J. Freudenberger: http://www.ifw-dresden.de/institutes/imw/lectures/lectures/pwe

V Exercises in Metals
2174599, SS 2024, 1 SWS, Language: German, Open in study portal

Practice (Ü)
On-Site

Content
Properties of pure elements; thermodynamic foundations of single-component and of binary systems, as well as multiphase systems; nucleation and growth; diffusion processes in crystalline materials; phase diagrams; effects of alloying; nonequilibrium microstructures; heat treatment technology

Learning objectives:
The Students have hands-on experience in the application of thermodynamic foundations of phase transformations, the kinetics of phase transformations in the solid state, the mechanisms of microstructure formation and microstructure-property relationships. They can assess the effects of heat treatments and of alloying on the microstructure and the mechanicla and physical properties of metallic materials. This competence is in particular practiced for iron- and aluminum-based alloys.

Requirements:
Lecture and Tutorials on Materials Physics as well as the lecture on Metals

Workload:

Regular attendance: 14 h

Self-study: 16 h

Organizational issues
Weitere Informationen zu dieser Veranstaltung finden Sie hier: https://www.iam.kit.edu/wk/lehre.php

Literature
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 11.302 Course: Methods and Processes of PGE - Product Generation Engineering [T-MACH-109192]

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

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102718 - Product Development – Methods of Product Engineering

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

Events					
ST 2024	2146176	Methods and Processes of PGE – Product Generation Engineering	4 SWS	Lecture / 🗣	Albers, Düser
Exams					
ST 2024	76-T-MACH-105382	Product Development - Methods of Product Development			Albers, Düser
ST 2024	76-T-MACH-105382-en	Methods and Processes of PGE - Product Generation Engineering			Albers, Düser
WT 24/25	76-T-MACH-105382	Methods and Processes of PGE - Product Generation Engineering			Albers, Burkardt
WT 24/25	76-T-MACH-105382-en	Methods and Processes of PGE - Product Generation Engineering			Albers

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

Competence Certificate
Written exam (processing time: 120 min + 10 min reading time)

Auxiliaries:

- Calculator
- German dictionary (books only)

Prerequisites
None

Annotation
This lecture is the basis for the main subject Integrated Product Development, which is offered as a specialisation.

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

V Methods and Processes of PGE – Product Generation Engineering

Lecture (V)
On-Site

2146176, SS 2024, 4 SWS, Language: German, Open in study portal

Content
Note:

This lecture is the basis for the main subject Integrated Product Development, which is offered as a specialisation.

Recommendations:

none

Workload:

regular attendance: 39 h

self-study: 141 h

Examination:

Written exam

Duration: 120 minutes (+10 minutes reading time)

Auxiliaries:

- Calculator
- German dictionary (books only)

Course content:

Basics of Product Development: Basic Terms, Classification of the Product
Development into the industrial environment, generation of costs / responsibility for costs

Concept Development: List of demands / Abstraction of the Problem Definition / Creativity Techniques / Evaluation and selection of solutions

Drafting : Prevailing basic rules of Design / Design Principles as a
problem oriented accessory

Rationalization within the Product Development: Basics of Development
Management/ Simultaneous Engineering and Integrated Product Development/Development of Product
Lines and Modular Construction Systems

Quality Assurance in early Development Phases : Methods of Quality Assurance
in an overview/QFD/FMEA

Learning objectives:

The students are able to ...

- classify product development in companies and differentiate between different types of product development.
- name the relevant influencing factors of a market for product development.
- name, compare and use the central methods and process models of product development within moderate complex technical systems.
- explain problem solving techniques and associated development methods.
- explain product profiles and to differentiate and choose suitable creative techniques of solution/idea generation finding on this basis.
- use design guidelines to create simple technical systems and to explain these guidelines.
- name and compare quality assurance methods; to choose and use suitable methods for particular applications.
- explain the differents methods of design of experiment.
- explain the costs in development process.

Literature
Vorlesungsunterlagen
Pahl, Beitz: Konstruktionslehre, Springer-Verlag 1997
Hering, Triemel, Blank: Qualitätssicherung für Ingenieure; VDI-Verlag,1993

T 11.303 Course: Micro- and nanotechnology in implant technology [T-MACH-111030]

Responsible: Dr. Ralf Ahrens
Dr. Patrick Wolfgang Doll

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102597 - Compulsory Elective Module Mechanical Engineering

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

Events					
ST 2024	2141871	Micro- and nanotechnology in implant technology:	2 SWS	Lecture / 🗘	Doll, Ahrens, Guber
WT 24/25	2141871	Micro- and nanotechnology in implant technology:	2 SWS	Lecture / 🗣	Doll, Ahrens, Guber

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 Micro- and nanotechnology in implant technology:
2141871, SS 2024, 2 SWS, Language: German, Open in study portal

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

Content
siehe oben

Organizational issues
****

Entfällt in diesem Sommersemester und wird nächstes Wintersemester angeboten!

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Literature
Wintermantel, Erich, Ha, Suk-Woo, Medizintechnik, Springer-Verlag Berlin Heidelberg 2009. ISBN 978-3-540-93936-8 .

Brunette, D.M., Tengvall, P., Textor, M., Thomsen, P. Titanium in Medicine, Springer-Verlag Berlin Heidelberg 2001. ISBN 978-3-642-56486-4 .

Vorlesungsskript

V Micro- and nanotechnology in implant technology:
2141871, WS 24/25, 2 SWS, Language: German, Open in study portal

Lecture (V)
On-Site

Content
siehe oben

Literature
Wintermantel, Erich, Ha, Suk-Woo, Medizintechnik, Springer-Verlag Berlin Heidelberg 2009. ISBN 978-3-540-93936-8 .

Brunette, D.M., Tengvall, P., Textor, M., Thomsen, P. Titanium in Medicine, Springer-Verlag Berlin Heidelberg 2001. ISBN 978-3-642-56486-4 .

Vorlesungsskript

T 11.304 Course: Micro Magnetic Resonannce [T-MACH-105782]

Responsible: Prof. Dr. Jan Gerrit Korvink
Dr. Neil MacKinnon

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102616 - Major Field: Microsystem Technology
M-MACH-102647 - Major Field: Microactuators and Microsensors

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

Events					
WT 24/25	2141501	Micro Magnetic Resonance	2 SWS	Seminar / Blended	MacKinnon, Badilita, Jouda, Korvink

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

Competence Certificate
Own Presentation, participation at the course discussions, result is passed or failed.

Prerequisites
none

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

V Micro Magnetic Resonance

2141501, WS 24/25, 2 SWS, Language: English, Open in study portal

Seminar (S)
Blended (On-Site/Online)

T 11.305 Course: Microactuators [T-MACH-101910]

Responsible: Prof. Dr. Manfred Kohl
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102597 - Compulsory Elective Module Mechanical Engineering
M-MACH-102598 - Major Field: Advanced Mechatronics
M-MACH-102616 - Major Field: Microsystem Technology
M-MACH-102642 - Major Field: Development of Innovative Appliances and Power Tools
M-MACH-102647 - Major Field: Microactuators and Microsensors

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

Events					
ST 2024	2142881	Microactuators	2 SWS	Lecture / 🗣	Kohl
Exams					
ST 2024	76-T-MACH-101910	Microactuators			Kohl
WT 24/25	76-T-MACH-101910	Microactuators			Kohl

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 Microactuators
2142881, SS 2024, 2 SWS, Language: German, Open in study portal

Lecture (V)
On-Site

Content
- Basic knowledge in the material science of the actuation principles
- Layout and design optimization
- Fabrication technologies
- Selected developments
- Applications

The lecture includes amongst others the following topics:

- Microelectromechnical systems: linear actuators, microrelais, micromotors
- Medical technology and life sciences: Microvalves, micropumps, microfluidic systems
- Microrobotics: Microgrippers, polymer actuators (smart muscle)
- Information technology: Optical switches, mirror systems, read/write heads

Literature
- Folienskript "Mikroaktorik"
- D. Jendritza, Technischer Einsatz Neuer Aktoren: Grundlagen, Werkstoffe, Designregeln und Anwendungsbeispiele, Expert-Verlag, 3. Auflage, 2008
- M. Kohl, Shape Memory Microactuators, M. Kohl, Springer-Verlag Berlin, 2004
- N.TR. Nguyen, S.T. Wereley, Fundamentals and applications of Microfluidics, Artech House, Inc. 2002
- H. Zappe, Fundamentals of Micro-Optics, Cambride University Press 2010

T 11.306 Course: Microenergy Technologies [T-MACH-105557]

Responsible: Prof. Dr. Manfred Kohl
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102597 - Compulsory Elective Module Mechanical Engineering
M-MACH-102598 - Major Field: Advanced Mechatronics
M-MACH-102614 - Major Field: Mechatronics
M-MACH-102616 - Major Field: Microsystem Technology
M-MACH-102623 - Major Field: Fundamentals of Energy Technology
M-MACH-102647 - Major Field: Microactuators and Microsensors

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

Events					
ST 2024	2142897	Microenergy Technologies	2 SWS	Lecture / 🗣	Kohl, Xu
Exams					
ST 2024	76-T-MACH-105557	Microenergy Technologies			Kohl
WT 24/25	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 2024, 2 SWS, Language: English, Open in study portal

Lecture (V)
On-Site

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 using different conversion principles (piezo, electrostatic, electromagnetic, etc.)
- Thermoelectric energy generation
- Novel thermal energy conversion principles (thermomagnetic, pyroelectric)
- Miniature scale solar devices
- RF energy harvesting
- Miniature scale heat pumping
- Solid-state cooling technologies (magneto-, electro-, mechanocalorics)
- Power management
- Energy storage technologies (microbatteries, supercapacito4rs, fuel cells)

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 11.307 Course: Microscale Fluid Mechanics [T-MACH-113144]

Responsible: Dr.-Ing. Philipp Marthaler
Organisation: KIT Department of Mechanical Engineering
Part of: M-MACH-102634 - Major Field: Fluid Mechanic

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

Competence Certificate
Oral exam, duration: approximately 30 minutes

no tools or reference materials may be used during the exam

Prerequisites
none

T 11.308 Course: Microstructure Characteristics Relationships [T-MACH-105467]

Responsible:	Dr. Patric Gruber Prof. Dr. Oliver Kraft
Organisation:	KIT Department of Mechanical Engineering
Part of:	M-MACH-102597 - Compulsory Elective Module Mechanical Engineering

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

Events					
ST 2024	2178124	Microstructure-Property-Relationships	3 SWS	Lecture / 🗣	Kirchlechner, Gruber
ST 2024	2178125	Exercices in Microstructure-Property-Relationships	1 SWS	Practice / 🗣	Kirchlechner, Wagner, Gruber
Exams					
ST 2024	76-T-MACH-107604	Microstructure-Property-Relationships			Kirchlechner, Gruber

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 Microstructure-Property-Relationships

Lecture (V)
On-Site

2178124, SS 2024, 3 SWS, Language: German, Open in study portal

Content
The following microstructure-property-relationships will be discussed for all material classes:

- Elasticity and plasticity
- Fracture mechanics
- Fatigue
- Creep
- Elektrical conductivity: Metallic conductors, semiconductors, superconductors, conductive polymers
- Magnetic propetries und materials

In addition to the phenomenological description and physical explanation of the material properties an overview on the corresponding experimental techniques will be given.

The students fundamentally understand the interrelation between the microstructure and the properties of a material. This interrelation will be elaborated for mechanical properties (elasticity, plasticity, fracture, fatigue, creep) as well as functional properties (conductivity, magnetic properties) for all material classes, respectively. The students are able to phenomenological describe the material properties, to explain the underlying physical mechanisms and to understand how the properties can be specifically modified by the microstructure of the material. In the other way they are able to deduce the mechanical and functional properties of a material on the basis of its microstructure.

oral exam ca. 30 minutes

V Exercices in Microstructure-Property-Relationships

Practice (Ü)
On-Site

2178125, SS 2024, 1 SWS, Language: German, Open in study portal

Content
Exercise course for the lecture Microstructure-Property-Relationships LV Nr. 2178124.

T 11.309 Course: Microsystem Product Design for Young Entrepreneurs [T-MACH-105814]

Responsible: Prof. Dr. Jan Gerrit Korvink
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102616 - Major Field: Microsystem Technology

Type	Credits	Grading scale	Recurrence	Version
Examination of another type	6	Grade to a third	Each winter term	1

Events					
ST 2024	2141503	Microsystem product design for young entrepreneurs	4 SWS	Practical course / 🧩	Korvink, Mager
WT 24/25	2141503	Microsystem product design for young entrepreneurs	4 SWS	Practical course / 🧩	Korvink, Mager

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

Competence Certificate
The class is a laboratory course that is taken in groups, hence the active and productive participation in the team effort is evaluated. To check the individual performance, there will be weekly discussions about the project. To evaluate each group's progress, there will be 2 presentation during the duration of the course. The final mark is determined from the marks obtained in the presentation and an oral group examination of 1 hour.

Prerequisites
none

T 11.310 Course: Microsystem Simulation [T-MACH-108383]

Responsible: Prof. Dr. Jan Gerrit Korvink
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102616 - Major Field: Microsystem Technology

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

Competence Certificate
written exam

Prerequisites
none

T 11.311 Course: Miniaturized Heat Exchangers [T-MACH-108613]

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

Part of: M-MACH-102616 - Major Field: Microsystem Technology

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

Events					
ST 2024	2142880	Miniaturized Heat Exchangers	2 SWS	Lecture / 🗣	Brandner

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

Competence Certificate
oral exam, 20 min.

Prerequisites
none

T 11.312 Course: Mobile Computing and Internet of Things [T-INFO-102061]

Responsible: Prof. Dr.-Ing. Michael Beigl
Organisation: KIT Department of Informatics
Part of: M-MACH-102595 - Compulsory Elective Module Natural Science/Computer Science/Electrical Engineering

Type	Credits	Grading scale	Recurrence	Version
Written examination	3	Grade to a third	Each winter term	5

Events					
WT 24/25	2400051	Mobile Computing and Internet of Things		Lecture / Practice (	Beigl, Röddiger
Exams					
ST 2024	7500350	Mobile Computing and Internet of Things			Beigl
WT 24/25	7500287_1	Mobile Computing and Internet of Things			Beigl

Modeled Conditions
The following conditions have to be fulfilled:

1. The course T-INFO-113119 - Mobile Computing and Internet of Things - Exercise must have been started.

T 11.313 Course: Mobile Computing and Internet of Things - Exercise [T-INFO-113119]

Responsible: Prof. Dr.-Ing. Michael Beigl
Organisation: KIT Department of Informatics
Part of: M-MACH-102595 - Compulsory Elective Module Natural Science/Computer Science/Electrical Engineering

Type	Credits	Grading scale	Recurrence	Version
Examination of another type	2	Grade to a third	Each winter term	2

Events					
WT 24/25	2400051	Mobile Computing and Internet of Things		Lecture / Practice (	Beigl, Röddiger
Exams					
WT 24/25	7500358	Mobile Computing and Internet of Things			Beigl

T 11.314 Course: Mobile Machines [T-MACH-105168]

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

Part of: M-MACH-102630 - Major Field: Mobile Machines

Type	Credits	Grading scale	Recurrence	Version
Oral examination	8	Grade to a third	Each summer term	2

Events					
ST 2024	2114073	Mobile Machines	4 SWS	Lecture / 🗣	Geimer, Kazenwadel
Exams					
ST 2024	76-T-MACH-105168	Mobile Machines			Geimer
WT 24/25	76T-MACH-105168	Mobile Machines			Geimer

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

Competence Certificate
The assessment consists of an oral exam (45 min) taking place in the recess period. The exam takes place in every semester. Re-examinations are offered at every ordinary examination date.

Prerequisites
none

Recommendation
Knowledge in Fluid Power Systems is required. It is recommended to attend the course *Fluid Power Systems* [2114093] beforehand.

Annotation
After completion of the course the students have knowledge of:

- a wide range of mobile machines
- operation modes and working cycles of importmant mobile machines
- selected subsystems and components

Content:

- Introduction of the required components and machines
- Basics and structure of mobile machines
- Practical insight in the development techniques

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

V Mobile Machines

2114073, SS 2024, 4 SWS, Language: German, Open in study portal

Lecture (V)
On-Site

Content

- Introduction of the required components and machines
- Basics of the structure of the whole system
- Practical insight in the development techniques

Knowledge in Fluid Power is required.

Recommendations:

It is recommended to attend the course *Fluid Power Systems* [2114093] beforehand.

- regular attendance: 42 hours
- self-study: 184 hours

11.315 Course: Model Based Application Methods [T-MACH-102199]

Responsible: Dr. Frank Kirschbaum
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102597 - Compulsory Elective Module Mechanical Engineering

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

Competence Certificate
take-home exam, short presentation with oral examination

Prerequisites
none

T 11.316 Course: Modeling and Simulation [T-MACH-105297]

Responsible: Prof. Dr.-Ing. Kai Furmans
Prof. Dr.-Ing. Marcus Geimer
Prof. Dr.-Ing. Luise Kärger
Prof. Dr.-Ing. Carsten Proppe

Organisation: KIT Department of Mechanical Engineering

Institute of Thermal Turbomachinery

Part of: M-MACH-102592 - Modeling and Simulation

Type	Credits	Grading scale	Recurrence	Version
Written examination	7	Grade to a third	Each winter term	1

Events					
WT 24/25	2185227	Modelling and Simulation	2 SWS	Lecture / 🗣	Proppe, Furmans, Geimer, Kärger
WT 24/25	2185228	Modeling and Simulation	2 SWS	Practice / 🗣	Proppe, Furmans, Kärger, Geimer
Exams					
ST 2024	76-T-MACH-105297	Modeling and Simulation			Geimer, Furmans, Proppe, Kärger

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

Competence Certificate
The assessment consists of a 180 minutes written examination.

Prerequisites
none

Annotation
Last held in winter semester 24/25. From winter semester 25/26, this course will no longer be offered. It will be replaced by two new courses, one of which (Numerical Methods for Engineering Applications, 4 CP, starting summer semester 25) will always be offered in the summer semester and a second course (3 CP) will always be offered in the winter semester.

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

V Modelling and Simulation

2185227, WS 24/25, 2 SWS, Language: German/English, Open in study portal

Lecture (V)
On-Site

Content
Introduction: Overview, concept formation, simulation studies, time/event-discrete models, event-oriented/process orientated/ transaction-oriented view, typical model classes (operation/maintenance, storekeeping, loss-susceptible systems)

Time-continuous models with concentrated parameters, model characteristics and model analysis Numerical treatment of ordinary differential equations and differential-algebraic sets of equations coupled simulations with concentrated parameters

Time-continuous models with distributed parameters, description of systems by means of partial differential equations, model reduction, numerical solution procedures for partial differential equations (FDM, FEM, FVM)

Organizational issues

Wichtiger Hinweis: die Veranstaltung findet in geraden Wintersemestern (z.B. WS2024/25) auf Englisch, in ungeraden Wintersemestern (z.B. WS2023/24) auf Deutsch statt. Die Klausur ist zweisprachig.

Letzte Durchführung im Wintersemester 24/25. Ab Wintersemester 25/26 wird diese Teilleistung nicht mehr angeboten. Sie wird durch zwei neue Teilleistungen ersetzt werden, von denen eine (Numerische Methoden für Ingenieuranwendungen, 4 LP, ab Sommersemester 25) immer im Sommersemester und eine zweite Veranstaltung (3 LP) immer im Wintersemester angeboten wird.

Important note: in even winter semesters (e.g. WS2024/25) the course is held in English language, in odd winter semesters (e.g. WS2023/24) in German language. The exam is bilingual.

Last held in winter semester 24/25. From winter semester 25/26, this course will no longer be offered. It will be replaced by two new courses, one of which (Numerical Methods for Engineering Applications, 4 CP, starting summer semester 25) will always be offered in the summer semester and a second course (3 CP) will always be offered in the winter semester.

Literature

Keine.

T 11.317 Course: Modeling of polymer and suspension flows for industrial manufacturing processes [T-MACH-113367]

Responsible: Prof. Dr.-Ing. Luise Kärger
Dr.-Ing. Florian Wittemann

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102597 - Compulsory Elective Module Mechanical Engineering
M-MACH-102628 - Major Field: Lightweight Construction
M-MACH-102632 - Major Field: Polymer Engineering

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

Events					
ST 2024	2114105	Modelling of polymer and suspension flows for industrial manufacturing processes	2 SWS	Lecture / 🗣	Wittemann
Exams					
ST 2024	76-T-MACH-113367	Modeling of polymer and suspension flows for industrial manufacturing processes			Wittemann, Kärger

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

Competence Certificate
Oral exam, duration approx. 20 minutes

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

V Modelling of polymer and suspension flows for industrial manufacturing processes

Lecture (V)
On-Site

2114105, SS 2024, 2 SWS, Language: German, Open in study portal

Content
The lecture deals with the behaviour of (fibre-reinforced) polymers in the molten state and in the context of industrially relevant manufacturing processes. The manufacturing process of fibre composite components has a significant influence on the subsequent component behaviour. Accordingly, it is just as important to be able to map the material behaviour during production as the subsequent component behaviour. To this end, the lecture deals with modelling the viscosity and flow of polymers (with and without fibres). The basics of numerical simulation of flows are taught and advanced models for the description of certain manufacturing processes are explained. Correspondingly, important advantages and disadvantages of different manufacturing processes and their respective modelling approaches are taught. At the end of the lecture, students will be able to select suitable modelling approaches for specific processes and to mathematically describe the behaviour of polymers in the molten state.

T 11.318 Course: Modeling of Thermodynamical Processes [T-MACH-105396]

Responsible: Prof. Dr. Ulrich Maas
Dr.-Ing. Robert Schießl

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102597 - Compulsory Elective Module Mechanical Engineering
M-MACH-102604 - Major Field: Computational Mechanics
M-MACH-102612 - Major Field: Modeling and Simulation in Energy- and Fluid Engineering
M-MACH-102635 - Major Field: Engineering Thermodynamics
M-MACH-102743 - Fundamentals and Methods of Theoretical Foundations of Mechanical Engineering

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

Events					
ST 2024	2167523	Modeling of Thermodynamical Processes	3 SWS	Lecture / 🗣	Maas, Schießl
WT 24/25	2167523	Modeling of Thermodynamical Processes	3 SWS	Lecture / 🗣	Schießl
Exams					
ST 2024	76-T-MACH-105396	Modeling of Thermodynamical Processes			Maas
WT 24/25	76-T-MACH-105396	Modeling of Thermodynamical Processes			Maas

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 Modeling of Thermodynamical Processes

2167523, SS 2024, 3 SWS, Language: German, Open in study portal

Lecture (V)
On-Site

Content
Thermodynamic basics
Numerical solver strategies for algebraic equations
Optimization issues
Ordinary and partial differential equations
Application to various problems in thermodynamics (engine processes, determination of equilibrium states, unsteady processes in inhomogeneous systems)

Literature
Vorlesungsskript

Numerical Recipes C, FORTRAN; Cambridge University Press
R.W. Hamming; Numerical Methods for scientists and engineers; Dover Books On Engineering; 2nd edition; 1973

J. Kopitz, W. Polifke; Wärmeübertragung; Pearson Studium; 1. Auflage

V Modeling of Thermodynamical Processes

2167523, WS 24/25, 3 SWS, Language: German, Open in study portal

Lecture (V)
On-Site

Content
Principles of modelling: Representation of physical systems by equations
Numerical solution strategies for nonlinear equation systems
Constrained Optimization
Ordinary and partial differential equations
Application to various problems in thermodynamics (engine processes, determination of equilibrium states, unsteady processes in inhomogeneous systems)

Literature
Vorlesungsskript

Numerical Recipes C, FORTRAN; Cambridge University Press
R.W. Hamming; Numerical Methods for scientists and engineers; Dover Books On Engineering; 2nd edition; 1973

J. Kopitz, W. Polifke; Wärmeübertragung; Pearson Studium; 1. Auflage

T 11.319 Course: Modeling of Turbulent Flows - RANS and LES [T-BGU-110842]

Responsible: Prof. Dr.-Ing. Markus Uhlmann
Organisation: KIT Department of Civil Engineering, Geo and Environmental Sciences
Part of: M-MACH-102634 - Major Field: Fluid Mechanic

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

Events					
WT 24/25	6221911	Modelling of Turbulent Flows - RANS and LES	4 SWS	Lecture / Practice (/ 🗣	Uhlmann

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

Competence Certificate
oral exam, appr. 45 min.

Prerequisites
none

Recommendation
none

Annotation
none

T 11.320 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-102405 - Fundamentals and Methods of General Mechanical Engineering
M-MACH-102597 - Compulsory Elective Module Mechanical Engineering
M-MACH-102739 - Fundamentals and Methods of Automotive Engineering
M-MACH-102742 - Fundamentals and Methods of Production Technology
M-MACH-102743 - Fundamentals and Methods of Theoretical Foundations of Mechanical Engineering
M-MACH-102744 - Fundamentals and Methods of Materials and Structures for High Performance Systems

Type	Credits	Grading scale	Recurrence	Version
Written examination	5	Grade to a third	Each term	3

Events					
ST 2024	2183703	Modelling and Simulation		Lecture / Practice (/ 🗣	Nestler, August, Prahs
WT 24/25	2183703	Numerical methods and simulation techniques	3 SWS	Lecture / Practice (/ 🗣	Nestler, August, Prahs
Exams					
ST 2024	76-T-MACH-100300	Modelling and Simulation			Nestler
WT 24/25	76-T-MACH-100300	Modelling and Simulation			Nestler, August, Prahs

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 2024, SWS, Language: German, Open in study portal

Lecture / Practice (VÜ)
On-Site

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 Vorlesungen und für das Praktikum werden 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 24/25, 3 SWS, Language: German, Open in study portal	**Lecture / Practice (VÜ)** **On-Site**

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 11.321 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-102405 - Fundamentals and Methods of General Mechanical Engineering
M-MACH-102597 - Compulsory Elective Module Mechanical Engineering
M-MACH-102611 - Major Field: Materials Science and Engineering
M-MACH-102646 - Major Field: Applied Mechanics
M-MACH-102647 - Major Field: Microactuators and Microsensors
M-MACH-102743 - Fundamentals and Methods of Theoretical Foundations of Mechanical Engineering
M-MACH-102744 - Fundamentals and Methods of Materials and Structures for High Performance Systems

Type	Credits	Grading scale	Recurrence	Version
Oral examination	5	Grade to a third	Each winter term	3

Events					
WT 24/25	2183702	Modelling of Microstructures	3 SWS	Lecture / Practice (/	August, Prahs, Nestler
Exams					
ST 2024	76-T-MACH-105303	Modelling of Microstructures			August, Nestler, Weygand
WT 24/25	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 24/25, 3 SWS, Language: German, Open in study portal

Lecture / Practice (VÜ)
On-Site

Content

- Brief Introduction in thermodynamics
- Gibbs free energy and phase diagrams
- Free energy functional
- Phasefield equation
- Driving forces
- Grand chemical potential functional and the evolution equations
- Numeric solution of the phasefield equation

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.
- explain the mechanisms of phase boundary motion induced under driving forces
- use the phase-field method for simulation of microstructure formation processes
- have 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

oral exam ca. 30 min

Organizational issues
Terminvereinbarung für die mündliche Prüfung: Sobald Sie wissen, wann Sie die Prüfung ablegen möchten, schreiben Sie bitte eine Mail an die Prüferin Anastasia August (anastasia.august2@kit.de) und schlagen Sie einen oder mehrere Termin/e vor. Die Prüfung dauert ca. 30 Minuten.

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

11.322 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-102598 - Major Field: Advanced Mechatronics
M-MACH-102601 - Major Field: Automation Technology
M-MACH-102614 - Major Field: Mechatronics
M-MACH-102633 - Major Field: Robotics

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

Events					
ST 2024	2105024	Modern Control Concepts I	2 SWS	Lecture / Blended	Matthes, Groell
ST 2024	2106020	Tutorial on Modern Control Concepts I	2 SWS	Practice / Online	Matthes
Exams					
ST 2024	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 2024, 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 2024, 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 11.323 Course: Modern Control Concepts II [T-MACH-106691]

Responsible: apl. Prof. Dr. Lutz Groell
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102598 - Major Field: Advanced Mechatronics
M-MACH-102601 - Major Field: Automation Technology

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

Events					
WT 24/25	2106032	Modern Control Concepts II	2 SWS	Lecture / 🗣	Groell
Exams					
ST 2024	76-T-MACH-106691	Modern Control Concepts II			Groell

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

Competence Certificate
oral exam (Duration: 30min)

Prerequisites
none

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

V Modern Control Concepts II
2106032, WS 24/25, 2 SWS, Language: German, Open in study portal

Lecture (V)
On-Site

Content
Learning Content:

1. Discrete time systems
2. The role of zeros (different kinds of zeros, zero dynamics, internal model principle, repetitive control, 2Dof structures, controller design via Diophantine equations)
3. Limitations of control systems
4. Linear multivariable systems
5. Multivariable control for LTI systems (coprime factorization, relative gain array, decentral and cooperative controls, decoupling controls)
6. Internal model control (internal stability, Youla parametrization, predictive structures, different 2DoF structures)
7. Extended control loop structures (serial and parallel cascades, multiple controller structures, inferential control, split range control)
8. Differential-algebraic systems of equations
9. Model reduction
10. Linear time-varying systems
11. Solution and simulation of complicated dynamical systems (ODEs, Cauchy problems, boundary value problems, PDEs, hybrid systems, DAEs, DDEs, computer algebra, etc.)

Recommendations

- Basics in Measurement and Control Systems
- Modern Control Concepts I
- Alternatively, comparable courses of the faculty of electrical engineering

Literature

- Aström, K.-J., Murray, R.M.: Feedback Systems, 2012
- Skogestad, S., Postlethwaite, I.: Multivariable Feedback Control, 2001

T 11.324 Course: Modern Control Concepts III [T-MACH-106692]

Responsible: apl. Prof. Dr. Lutz Groell
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102598 - Major Field: Advanced Mechatronics
M-MACH-102601 - Major Field: Automation Technology

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

Events					
ST 2024	2106035	Modern Control Concepts III	2 SWS	Lecture / 🗣	Groell
Exams					
ST 2024	76-T-MACH-106692	Modern Control Concepts III			Groell

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

Competence Certificate
oral exam (Duration: 30min)

Prerequisites
none

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

V Modern Control Concepts III

2106035, SS 2024, 2 SWS, Language: German, Open in study portal

Lecture (V)
On-Site

Content
Learning Content:

1. Qualitative theory of ODEs
2. Lyapunov stability
3. Alternative stability concepts
4. Feedback linearization
5. Modifications of feedback linearization
6. Flatness-based controller design
7. Lyapunov-based controller design (nonlinear damping, modifications)
8. Passivity-based controller design
9. Sliding mode control
10. Alternative linearization concepts
11. Predictive control and observation of time delay systems
12. Complex example

Recommendations:

Basics in Measurement and Control Systems

Modern Control Concepts I and II

Alternatively, comparable courses of the faculty of electrical engineering

Organizational issues
Für die VL ist eine Anmeldung per E-Mail an adam.kastner@kit.edu erforderlich.

T 11.325 Course: Motor Vehicle Labor [T-MACH-105222]

Responsible: Dr.-Ing. Michael Frey
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102591 - Laboratory Course

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

Events					
ST 2024	2115808	Motor Vehicle Laboratory	2 SWS	Practical course / 🗣	Frey
WT 24/25	2115808	Motor Vehicle Laboratory	2 SWS	Practical course / 🗣	Frey
Exams					
ST 2024	76-T-MACH-105222	Motor Vehicle Labor			Frey

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

Competence Certificate
Colloquium before each experiment

After completion of the experiments: written examination

Duration: 90 minutes

Auxiliary means: none

Prerequisites
none

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

V Motor Vehicle Laboratory

2115808, SS 2024, 2 SWS, Language: German, Open in study portal

Practical course (P)
On-Site

Content
1. Determination of the driving resistances of a passenger vehicle on a roller dynamometer; measurement of the engine performance of the test vehicle

2. Investigation of a twin-tube and a single-tube shock absorber

3. Behavior of car tyres under longitudinal forces and lateral forces

4. Behavior of car tires on wet road surface

5. Rolling resistance, energy dissipation and high-speed strength of car tires

6. Investigation of the moment transient characteristic of a Visco clutch

Learning Objectives:

The students have deepened their knowledge on motor vehicles acquired in lectures and can apply it practically. They have an overview of the applied measuring technique and can execute and analyse measurements for the handling of given problem definitions. They are ready to analyze and to judge measurement results.

Organizational issues
Genauer Ort und Termine sowie weitere Infos siehe Institutshomepage.

Einteilung in
- Gruppe A: Mo 14:00 - 15:30
- Gruppe B: Mo 16:00 - 17:30
- Gruppe C: Di 09:00 - 10:30
- Gruppe D: Di 11:00 - 12:30
- Gruppe E: Di 14:00 - 15:30
- Gruppe F: Di 16:00 - 17:30

Literature
1. Matschinsky, W: Radführungen der Straßenfahrzeuge, Verlag TÜV Rheinland, 1998

2. Reimpell, J.: Fahrwerktechnik: Fahrzeugmechanik, Vogel Verlag, 1992

3. Gnadler, R.: Versuchsunterlagen zum Kraftfahrzeuglaboratorium

V	**Motor Vehicle Laboratory** 2115808, WS 24/25, 2 SWS, Language: German, Open in study portal	**Practical course (P)** **On-Site**

Content
1. Determination of the driving resistances of a passenger vehicle on a roller dynamometer; measurement of the engine performance of the test vehicle

2. Investigation of a twin-tube and a single-tube shock absorber

3. Behavior of car tyres under longitudinal forces and lateral forces

4. Investigation of acoustic behaviour of vehicles

5. Rolling resistance, energy dissipation and high-speed strength of car tires

6. Investigation of the moment transient characteristic of a Visco clutch

Learning Objectives:

The students have deepened their knowledge on motor vehicles acquired in lectures and can apply it practically. They have an overview of the applied measuring technique and can execute and analyse measurements for the handling of given problem definitions. They are ready to analyze and to judge measurement results.

Organizational issues
Genaue Termine und weitere Hinweise: siehe Institutshomepage.

Einteilung:

Gruppe A: Mo 14:00-15:30

Gruppe B: Mo 16:00-17:30

Gruppe C: Di 09:00-10:30

Gruppe D: Di 11:00-12:30

Gruppe E: Di 14:00-15:30

Gruppe F: Di 16:00-17:30

Literature
1. Matschinsky, W: Radführungen der Straßenfahrzeuge, Verlag TÜV Rheinland, 1998

2. Reimpell, J.: Fahrwerktechnik: Fahrzeugmechanik, Vogel Verlag, 1992

3. Gnadler, R.: Versuchsunterlagen zum Kraftfahrzeuglaboratorium

T 11.326 Course: Multi-Scale Plasticity [T-MACH-105516]

Responsible: Prof. Dr. Christian Greiner
PD Dr.-Ing. Katrin Schulz

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102597 - Compulsory Elective Module Mechanical Engineering
M-MACH-102602 - Major Field: Reliability in Mechanical Engineering
M-MACH-102611 - Major Field: Materials Science and Engineering

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

Events					
WT 24/25	2181750	Multi-scale Plasticity	2 SWS	Lecture / 🗣	Greiner, Schulz
Exams					
WT 24/25	76-T-MACH-105516	Multi-Scale Plasticity			Schulz, Greiner

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

Competence Certificate
oral exam, about 30 min

Prerequisites
none

Recommendation
preliminary knowlegde in mathematics, physics, mechanics and materials science

Annotation

- limited number of participants
- mandatory registration
- mandatory attendance

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

V Multi-scale Plasticity

2181750, WS 24/25, 2 SWS, Language: German, Open in study portal

Lecture (V)
On-Site

Content
This module will attempt to provide an overview to complex subjects in the field of material mechanics. For this purpose important scientific papers will be presented and discussed.
This will be done by having students read and critique one paper each week in a short review. In addition, each week will include presentation from one of the participants which aim to advocate or criticise each piece of work using the short reviews. He will also be the discussion leader, while students discuss the content, ideas, evaluation and open research questions of the paper. Using a professional conference management system (HotCRP), the student assume the role of reviewers and gain insight into the work of researchers.

The student

- can explain the physical foundations of plasticity as well as results of latest research.
- can independently read and evaluate scientific research papers.
- can present specific, technical information in structured, precise, and readable manner.
- is able to argue for and/or against a particular approach or idea using the knowledge acquired within the lecture.

preliminary knowlegde in mathematics, physics, mechanics and materials science recommended

regular attendance: 22,5 hours
self-study: 97,5 hours

Exam: presentation (40%), oral examination (30 min, 60%)

The maximum number of students is 14 per semester.

Organizational issues

Blockveranstaltung in 5 Blöcken, Termine und Ort werden bekannt gegeben.

Anmeldung per Email an katrin.schulz@kit.edu bis zum 29.09.2024

T 11.327 Course: Nanotribology and -Mechanics [T-MACH-102167]

Responsible: Prof. Dr. Martin Dienwiebel
apl. Prof. Dr. Hendrik Hölscher

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102597 - Compulsory Elective Module Mechanical Engineering
M-MACH-102637 - Major Field: Tribology

Type	Credits	Grading scale	Recurrence	Version
Oral examination	4	Grade to a third	Each summer term	5

Events					
ST 2024	2182712	Nanotribology and -Mechanics	2 SWS	Lecture / Practice (/ 🗣	Dienwiebel
WT 24/25	2182712	Nanotribology and -Mechanics	2 SWS	Block / 🗣	Dienwiebel
Exams					
ST 2024	7600055	Nanotribology and -Mechanics			Dienwiebel

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

Competence Certificate
oral exam, about 25 min

Prerequisites
none

Recommendation
preliminary knowlegde in mathematics and physics

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

V Nanotribology and -Mechanics

2182712, SS 2024, 2 SWS, Language: German, Open in study portal

Lecture / Practice (VÜ)
On-Site

Content
In the summer semester the lecture is offered in German and in the winter semester in English!

Part 1: Fundamentals of nanotribology

- General tribology / nanotechnology
- Forces and dissipation on the nanometer scale
- Experimental methods (SFA, QCM, FFM)
- Prandtl-Tomlinson model
- Superlubricity
- Carbon-based tribosystems
- Electronic friction
- Nanotribology in liquids
- Atomic abrasion
- nanolubrication

Part 2: Topical papers

The student can

- explain the physical foundations and common models used in the field of nanotribology and nanomechanics
- describe the most important experimental methods in nanotribology
- critically evaluate scientific papers on nanotribological issues with respect to their substantial quality

preliminary knowlegde in mathematics and physics recommended

regular attendance: 22,5 hours
preparation for presentation: 22,5 hours
self-study: 75 hours

presentation (40%) and oral examination (30 min, 60%)
no tools or reference materials

Organizational issues
Die Vorlesung wird auf Deutsch (SoSe) und auf Englisch (WiSe) angeboten!

Kontakt: martin.dienwiebel@kit.edu

Literature
Edward L. Wolf
Nanophysics and Nanotechnology, Wiley-VCH, 2006

C. Mathew Mate
Tribology on the Small Scale: A Bottom Up Approach to Friction, Lubrication, and Wear (Mesoscopic Physics and Nanotechnology) 1st Edition, Oxford University Press

Tafelbilder, Folien, Kopien von Artikeln

V	**Nanotribology and -Mechanics** 2182712, WS 24/25, 2 SWS, Language: English, Open in study portal	**Block (B)** **On-Site**

Content
In the summer semester the lecture is offered in German and in the winter semester in English!

Part 1: Fundamentals of nanotribology

- General tribology / nanotechnology
- Forces and dissipation on the nanometer scale
- Experimental methods (SFA, QCM, FFM)
- Prandtl-Tomlinson model
- Superlubricity
- Carbon-based tribosystems
- Electronic friction
- Nanotribology in liquids
- Atomic abrasion
- nanolubrication

Part 2: Topical papers

The student can

- explain the physical foundations and common models used in the field of nanotribology and nanomechanics
- describe the most important experimental methods in nanotribology
- critically evaluate scientific papers on nanotribological issues with respect to their substantial quality

preliminary knowlegde in mathematics and physics recommended

regular attendance: 22,5 hours
preparation for presentation: 22,5 hours
self-study: 75 hours

presentation (40%) and oral examination (30 min, 60%)
no tools or reference materials

Organizational issues
Email registration to lecturer by 10/10/2024: martin.dienwiebel@kit.edu

Anmeldung per Email bis zum 10.10.2024 an den Dozenten: martin.dienwiebel@kit.edu

Literature
Tafelbilder, Folien, Kopien von Artikeln

T 11.328 Course: NMR Micro Probe Hardware Conception and Construction [T-MACH-108407]

Responsible: Prof. Dr. Jan Gerrit Korvink
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102616 - Major Field: Microsystem Technology

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

Events					
ST 2024	2142551	NMR micro probe hardware conception and construction	2 SWS	Practical course /	Korvink, Jouda
Exams					
ST 2024	76-T-MACH-108407	NMR micro probe hardware conception and construction			Korvink

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

Competence Certificate
Successful participation.

Prerequisites
none

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

V NMR micro probe hardware conception and construction

2142551, SS 2024, 2 SWS, Language: English, Open in study portal

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

Content
In order to prepare attendees, the following chapters will be offered, spread over the week as lecture units, and accompanying the practical work:

- Theory of magnetic resonance imaging

-The MRI probe and the principle of reciprocity

- RF resonators

- Coaxial cables and cable traps

- Tuning and matching the MRI probe

- Effects of material susceptibility

- The mechanical support of the MRI probe

- Introduction to ParaVision, the MRI imaging software.

Organizational issues
Blockveranstaltung am CN, Bau 301, Raum 322, Anmeldung an Mazin.Jouda@kit.edu

T 11.329 Course: Non-ferros metals and alloys [T-MACH-111826]

Responsible: Prof. Dr.-Ing. Bronislava Gorr
Prof. Dr.-Ing. Martin Heilmaier

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102611 - Major Field: Materials Science and Engineering

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

Competence Certificate
oral exam (about 25 min.)

Prerequisites
none

T 11.330 Course: Nonlinear Continuum Mechanics [T-MACH-111026]

Responsible: Prof. Dr.-Ing. Thomas Böhlke
Organisation:
Part of: M-MACH-102597 - Compulsory Elective Module Mechanical Engineering
M-MACH-102611 - Major Field: Materials Science and Engineering
M-MACH-102646 - Major Field: Applied Mechanics
M-MACH-102743 - Fundamentals and Methods of Theoretical Foundations of Mechanical Engineering

Type	Credits	Grading scale	Recurrence	Version
Oral examination	3	Grade to a third	Each summer term	1

Events					
ST 2024	2162344	Nonlinear Continuum Mechanics	2 SWS	Lecture / 🗣	Böhlke

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

Competence Certificate
oral examination (approx. 25 min)

Prerequisites
Passing the "Tutorial Nonlinear Continuum Mechanics" (T-MACH-111027) is a prerequisite for taking part in the exam.

Modeled Conditions
The following conditions have to be fulfilled:

1. The course T-MACH-111027 - Tutorial Nonlinear Continuum Mechanics must have been passed.

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

V Nonlinear Continuum Mechanics

2162344, SS 2024, 2 SWS, Language: German, Open in study portal

Lecture (V)
On-Site

Content

- tensor calculus, kinematics, balance equations
- principles of material theory
- finite elasticity
- infinitesimal elasto(visco)plasticity
- exact solutions ov infinitesimal Platicity
- finite elasto(visco)plasticity
- infinitesimal and finite crystal(visco)plasticity
- hardening and failure
- strain localization

Organizational issues
Vorbesprechung für interessierte Studierende mit Prof. Böhlke: Di, 16.04.2024, 13:15, Raum 308.1, Geb 10.2,3 3. OG

Literature

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

T 11.331 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-102405 - Fundamentals and Methods of General Mechanical Engineering
M-MACH-102575 - Fundamentals and Methods of Energy and Environmental Engineering
M-MACH-102598 - Major Field: Advanced Mechatronics
M-MACH-102599 - Major Field: Powertrain Systems
M-MACH-102614 - Major Field: Mechatronics
M-MACH-102616 - Major Field: Microsystem Technology
M-MACH-102633 - Major Field: Robotics
M-MACH-102642 - Major Field: Development of Innovative Appliances and Power Tools
M-MACH-102647 - Major Field: Microactuators and Microsensors
M-MACH-102739 - Fundamentals and Methods of Automotive Engineering
M-MACH-102740 - Fundamentals and Methods of Mechatronics and Microsystem Technology
M-MACH-102741 - Fundamentals and Methods of Product Development and Construction
M-MACH-102742 - Fundamentals and Methods of Production Technology

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

Events					
WT 24/25	2141865	Novel actuators and sensors	2 SWS	Lecture / 🗣	Kohl, Sommer
Exams					
ST 2024	7600010	Novel Actuators and Sensors			Kohl
ST 2024	76-T-MACH-102152	Novel Actuators and Sensors			Sommer, Kohl
WT 24/25	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 24/25, 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 11.332 Course: Nuclear Fusion Technology [T-MACH-110331]

Responsible: Dr. Aurelian Florin Badea
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102608 - Major Field: Nuclear Energy

Type	Credits	Grading scale	Expansion	Version
Oral examination	4	Grade to a third	1 terms	1

Events					
WT 24/25	2189920	Nuclear Fusion Technology	2 SWS	Lecture / 🗣	Badea
Exams					
WT 24/25	76-T-MACH-110331	Nuclear Fusion Technology			Badea

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 Nuclear Fusion Technology
2189920, WS 24/25, 2 SWS, Language: English, Open in study portal

Lecture (V)
On-Site

Content
This lecture is dedicated to Master students of mechanical engineering and other engineering studies. Goal of the lecture is the understanding of the physics of fusion, the components of a fusion reactor and their functions. The technological requirements for using fusion technology for future commercial production of electricity and the related environmental impact are also addressed. The students are capable of giving technical assessment of the usage of the fusion energy with respect to its safety and sustainability. The students are qualified for further training in fusion energy field and for research-related professional activity.

- nuclear fission & fusion
- neutronics for fusion
- fuel cycles, cross sections
- gravitational, magnetic and inertial confinement
- fusion experimental devices
- energy balance for fusion systems; Lawson criterion and Q-factor
- materials for fusion reactors
- plasma physics, confinement
- plasma heating
- timeline of the fusion technology
- ITER, DEMO
- safety and waste management

T 11.333 Course: Nuclear Power and Reactor Technology [T-MACH-110332]

Responsible: Dr. Aurelian Florin Badea
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102608 - Major Field: Nuclear Energy

Type	Credits	Grading scale	Expansion	Version
Oral examination	4	Grade to a third	1 terms	1

Events					
WT 24/25	2189921	Nuclear Power and Reactor Technology	3 SWS	Lecture / 🗣	Badea
Exams					
WT 24/25	76-T-MACH-110332	Nuclear Power and Reactor Technology			Badea

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 Nuclear Power and Reactor Technology
2189921, WS 24/25, 3 SWS, Language: English, Open in study portal

Lecture (V)
On-Site

Content
This lecture is dedicated to Master students of mechanical engineering and other engineering studies. Goal of the lecture is the understanding of reactor technology and of the major physical processes in converting nuclear power into electrical energy. The students acquire comprehensive knowledge on the physics of nuclear fission reactors: neutron flux, cross sections, fission, breeding processes, chain reaction, critical size of a nuclear system, moderation, reactor dynamics, transport- and diffusion-equation for the neutron flux distribution, power density distributions in reactor, one-group, two-group and multi-group theories for the neutron spectrum. Students are able to analyze and understand the obtained results. The students are capable of understanding the advantages and disadvantages of different reactor technologies - LWR, heavy water reactors, nuclear power systems of generation IV -by using the delivered knowledge on reactor physics, thermal-hydraulics, reactor design, control, safety and requirements of the front-end and back-end of the fuel cycle. The students are qualified for further training in nuclear energy and safety field and for (also research-related) professional activity in the nuclear industry.

- nuclear fission & fusion,
- radioactive decay, neutron excess, fission, fast and thermal neutrons, fissile and fertile nuclei, enrichment, neutron flux, cross section, reaction rate, mean free path,
- chain reaction, critical size, moderation,
- reactor dynamics,
- transport- and diffusion-equation for the neutron flux distribution,
- power distributions in reactor,
- one-group and two-group theories,
- light-water reactors,
- reactor safety,
- design of nuclear reactors,
- breeding processes,
- nuclear power systems of generation IV

T 11.334 Course: Nuclear Power Plant Technology [T-MACH-105402]

Responsible: Dr. Aurelian Florin Badea
Prof. Dr.-Ing. Xu Cheng

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102597 - Compulsory Elective Module Mechanical Engineering
M-MACH-102608 - Major Field: Nuclear Energy
M-MACH-102610 - Major Field: Power Plant Technology

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

Events					
ST 2024	2170460	Nuclear Power Plant Technology	2 SWS	Lecture / 🗣	Cheng, Schulenberg
Exams					
ST 2024	76-T-MACH-105402	Nuclear Power Plant Technology			Cheng, Schulenberg

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

Competence Certificate
oral exam, Duration: approximately 30 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 **Nuclear Power Plant Technology**
2170460, SS 2024, 2 SWS, Language: English, Open in study portal

Lecture (V)
On-Site

Content
The training objective of the course is the qualification for a research-related professional activity in nuclear power plant engineering. The participants can describe the most important components of nuclear power plants and their function. You can design or modify nuclear power plants independently and creatively. They have acquired a broad knowledge of this power plant technology, including specific knowledge of core design, design of primary and secondary systems, and of nuclear safety technologies. Based on the acquired knowledge in thermodynamics and neutron physics, they can describe and analyze the specific behavior of the nuclear power plant components and assess risks. Participants of the lecture have a trained analytical thinking and judgment in the design of nuclear power plants.

Power plants with pressurized water reactors:

Design of the pressurized water reactor

- Fuel assemblies
- Control rods and drives
- Core instrumentation
- Reactor pressure vessel and its internals

Components of the primary system

- Primary coolant pumps
- Pressurizer
- Steam generator
- Water make-up system

Secondary system:

- Turbines
- Reheater
- Feedwater system
- Cooling systems

Containment

- Containment design
- Components of safety systems
- Components of residual heat removal systems

Control of a nuclear power plant with PWR

Power plants with boiling water reactors:

Design of the boiling water reactor

- Fuel assemblies
- Control elements and drives
- Reactor pressure vessel and its internals

Containment and components of safety systems

Control of a nuclear power plant with boiling water reactors

Literature
Vorlesungsmanuskript

T 11.335 Course: Numerical Fluid Mechanics [T-BGU-106758]

Responsible: Prof. Dr.-Ing. Markus Uhlmann
Organisation: KIT Department of Civil Engineering, Geo and Environmental Sciences
Part of: M-MACH-102634 - Major Field: Fluid Mechanic

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

Events					
WT 24/25	6221702	Numerical Fluid Mechanics I	4 SWS	Lecture / Practice (/ 🗣	Uhlmann
Exams					
ST 2024	8244106758	Numerical Fluid Mechanics			Uhlmann

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

Competence Certificate
written exam, 90 min.

Prerequisites
none

Modeled Conditions
The following conditions have to be fulfilled:

1. The course T-MACH-105338 - Numerical Fluid Mechanics must not have been started.

Recommendation
none

Annotation
none

T 11.336 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-102597 - Compulsory Elective Module Mechanical Engineering
M-MACH-102604 - Major Field: Computational Mechanics
M-MACH-102610 - Major Field: Power Plant Technology
M-MACH-102612 - Major Field: Modeling and Simulation in Energy- and Fluid Engineering
M-MACH-102623 - Major Field: Fundamentals of Energy Technology
M-MACH-102627 - Major Field: Energy Converting Engines
M-MACH-102634 - Major Field: Fluid Mechanic

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

Events					
WT 24/25	2153441	Numerical Fluid Mechanics	4 SWS	Lecture / Practice (/	Gatti
Exams					
ST 2024	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

Modeled Conditions
The following conditions have to be fulfilled:

1. The course T-BGU-106758 - Numerical Fluid Mechanics must not have been started.

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

V Numerical Fluid Mechanics

2153441, WS 24/25, 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 11.337 Course: Numerical Fluid Mechanics with PYTHON [T-MACH-110838]

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

Part of: M-MACH-102634 - Major Field: Fluid Mechanic

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

Events					
ST 2024	2154405	Numerical Fluid Mechanics with Python	2 SWS	Practical course /	Gatti
Exams					
ST 2024	76-T-MACH-110838	Numerical Fluid Mechanics with Python			Frohnapfel, Gatti

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

Competence Certificate
ungraded homework

Prerequisites
none

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

V Numerical Fluid Mechanics with Python

2154405, SS 2024, 2 SWS, Language: German, Open in study portal

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

Content
Numerical Fluid Mechanics with Phyton

- Introduction to Numerics and Matlab
- Finite-Difference-Method
- Finite-Volume-Method
- boundary conditions and intial conditions
- explicit and implicite schemes
- pressure correction
- Solving the Navier-Stokes equation numerically for 2D flow problems

Organizational issues
Bitte bis zum 26.07.24 per E-Mail anmelden sekretariat@istm.kit.edu.

Literature
H. Ferziger, M. Peric, *Numerische Strömungsmechanik*, Springer-Verlag, ISBN: 978-3-540-68228-8, 2008

E. Laurien, H. Oertel jr, *Numerische Strömungsmechanik*, Vieweg+Teubner Verlag, ISBN: 973-3-8348-0533-1, 2009

T 11.338 Course: Numerical Mathematics for Students of Computer Science [T-MATH-102242]

Responsible: Prof. Dr. Andreas Rieder
Dr. Daniel Weiß
Prof. Dr. Christian Wieners

Organisation: KIT Department of Mathematics

Part of: M-MACH-102575 - Fundamentals and Methods of Energy and Environmental Engineering
M-MACH-102594 - Mathematical Methods
M-MACH-102646 - Major Field: Applied Mechanics
M-MACH-102739 - Fundamentals and Methods of Automotive Engineering
M-MACH-102740 - Fundamentals and Methods of Mechatronics and Microsystem Technology
M-MACH-102742 - Fundamentals and Methods of Production Technology
M-MACH-102743 - Fundamentals and Methods of Theoretical Foundations of Mechanical Engineering

Type	Credits	Grading scale	Recurrence	Version
Written examination	6	Grade to a third	Each term	4

Events					
ST 2024	0187400	Numerische Mathematik für die Fachrichtungen Informatik und Ingenieurwesen	2 SWS	Lecture	Weiß
ST 2024	0187500	Übungen zu Numerische Mathematik für die Fachrichtungen Informatik und Ingenieurwesen	1 SWS	Practice	Weiß
Exams					
ST 2024	7700013	Numerical Mathematics for Students of Computer Science			Weiß

Competence Certificate
written exam, 120 min.

Prerequisites
none

T 11.339 Course: Numerical Mechanics for Industrial Applications [T-MACH-108720]

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

Part of: M-MACH-102597 - Compulsory Elective Module Mechanical Engineering
M-MACH-102607 - Major Field: Vehicle Technology

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

Events					
ST 2024	2162298	Numerical mechanics for industrial applications	3 SWS	Lecture / 🗣	Schnack
Exams					
ST 2024	76-T-MACH-108720	Numerical Mechanics for Industrial Applications			

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 Numerical mechanics for industrial applications

2162298, SS 2024, 3 SWS, Language: German, Open in study portal

Lecture (V)
On-Site

Content
Brief overview of finite element methods. Structure of boundary element methods (BEM). Explanation of hybrid tension methods. Higher-grade finite element processes. Non-linear FEM processes.

Literature
Brebbia, C.A.; Telles, J.C.F.; Wrobel, L.C.: Boundary element techniques - Theory and applications in engineering. Berlin, Springer, 1984.

Gaul, L.; Fiedler, C.: Methode der Randelemente in Statik und Dynamik. Braunschweig und Wiesbaden. Vieweg, 1997.

Reddy, J.N.: An introduction to the finite element method. New York (u.a.). McGraw-Hill, 1993.

T 11.340 Course: Numerical Simulation of Multi-Phase Flows [T-MACH-105420]

Responsible: Dr. Martin Wörner
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102597 - Compulsory Elective Module Mechanical Engineering
M-MACH-102604 - Major Field: Computational Mechanics
M-MACH-102612 - Major Field: Modeling and Simulation in Energy- and Fluid Engineering
M-MACH-102634 - Major Field: Fluid Mechanic

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

Events					
ST 2024	2130934	Numerical Modeling of Multiphase Flows	2 SWS	Lecture / 🗣	Wörner
Exams					
ST 2024	76-T-MACH-105420	Numerical Simulation of Multi-Phase Flows			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 Modeling of Multiphase Flows
2130934, SS 2024, 2 SWS, Language: German, Open in study portal

Lecture (V)
On-Site

Content

1. Introduction in the subject of multi-phase flows (terms and definitions, examples)
2. Physical fundamentals (dimensionless numbers, phenomenology of single bubbles, conditions at fluid interfaces, forces on a suspended particle)
3. Mathematical fundamentals (governing equations, averaging, closure problem)
4. Numerical fundamentals (discretization in space and time, truncation error and numerical diffusion)
5. Models for interpenetrating continua (homogeneous model, algebraic slip model, standard two-fluid model and its extensions)
6. Euler-Lagrange model (particle equation of motion, particle response time, one-/two-/four-way coupling)
7. Interface resolving methods (volume-of-fluid, level-set and front-capturing method)

Organizational issues
Mündliche Prüfung, Dauer: 30 Minuten, Hilfsmittel: keine

Oral examination (in German or English language), Duration: 30 minutes, Auxiliary means: none

Literature
Ein englischsprachiges Kurzskriptum kann unter https://publikationen.bibliothek.kit.edu/270056199 heruntergeladen werden.

Die Powerpoint-Folien werden nach jeder Vorlesung im ILIAS-System zum Herunterladen bereitgestellt.

Eine Liste mit Buchempfehlungen wird in der ersten Vorlesungsstunde ausgegeben.

T 11.341 Course: Numerical Simulation of Reacting Two Phase Flows [T-MACH-105339]

Responsible: Dr.-Ing. Rainer Koch

Organisation: KIT Department of Mechanical Engineering
Institute of Thermal Turbomachinery

Part of: M-MACH-102597 - Compulsory Elective Module Mechanical Engineering
M-MACH-102604 - Major Field: Computational Mechanics
M-MACH-102612 - Major Field: Modeling and Simulation in Energy- and Fluid Engineering
M-MACH-102623 - Major Field: Fundamentals of Energy Technology
M-MACH-102634 - Major Field: Fluid Mechanic
M-MACH-102636 - Major Field: Thermal Turbomachines

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

Exams			
ST 2024	76-T-MACH-105339	Numerical Simulation of Reacting Two Phase Flows	Koch
ST 2024	76-T-MACH-105339-Wdh	Numerical Simulation of Reacting Two Phase Flows for repeater	Koch
WT 24/25	76-T-MACH-105339	Numerical Simulation of Reacting Two Phase Flows	Koch

Competence Certificate
Oral exam
Duration: approximately 30 minutes

no tools or reference materials are allowed

Prerequisites
none

T 11.342 Course: Numerical Simulation of Turbulent Flows [T-MACH-105397]

Responsible: Dr. Günther Grötzbach
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102597 - Compulsory Elective Module Mechanical Engineering
M-MACH-102604 - Major Field: Computational Mechanics
M-MACH-102612 - Major Field: Modeling and Simulation in Energy- and Fluid Engineering
M-MACH-102634 - Major Field: Fluid Mechanic

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

Events					
WT 24/25	2153449	Numerical Simulation of Turbulent Flows	3 SWS	Lecture / 🗣	Grötzbach
Exams					
ST 2024	76-T-MACH-105397	Numerical Simulation of Turbulent Flows			Grötzbach

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

Competence Certificate
oral

Duration: 30 minutes

no auxiliary means

Prerequisites
none

Recommendation
Basics in fluid mechanics

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

V Numerical Simulation of Turbulent Flows

2153449, WS 24/25, 3 SWS, Language: German, Open in study portal

Lecture (V)
On-Site

Content
The students are qualified to describe the fundamentals of direct numerical simulation (DNS) and large eddy simulation (LES) of turbulent flows. They understand the principle differences between these simulation methods and the respective properties of the conventional turbulence modelling approaches basing on Reynolds Averaged Navier-Stokes equations (RANS). They can describe subgrid scale models, peculiarities of wall and inlet/outlet modelling, suitable numerical solution schemes and evaluation methods. They have obtained the knowledge and understanding required to identify the best modelling approach (among the available methods) for the problem at hand, thus being able to solve given thermal and fluid dynamical problems appropriately.

The lecture series will introduce in following subjects of the turbulence simulation method:

- Appearance of turbulence and deduction of requirements and limits of the simulation method.
- Conservation equations for flows with heat transfer, filtering them in time or space.
- Some subgrid scale models for small scale turbulence and their physical justification.
- Peculiarities in applying boundary and initial conditions.
- Suitable numerical schemes for integration in space and time.
- Statistical and graphical methods to analyse the simulation results.
- Application examples for turbulence simulations in research and engineering

Organizational issues
Dauer der Vorlesung 3 h von 14:00 - 15:30 h und von 15:45 - 16:30 h./Duration of the lecture 3 h from 14:00 - 15:30 h and from 15:45 - 16:30 h

Literature

J. Piquet, *Turbulent Flows – Models and Physics,* Springer, Berlin (2001)

J. Fröhlich, *Large Eddy Simulation turbulenter Strömungen.* Lehrbuch Maschinenbau, B.G. Teubner Verlag, Wiesbaden (2006)

P. Sagaut, C. Meneveau, *Large-eddy simulation for incompressible flows: An introduction.* Springer Verlag (2010)

G. Grötzbach, *Revisiting the Resolution Requirements for Turbulence Simulations in Nuclear Heat Transfer.* Nuclear Engineering & Design Vol. 241 (2011) pp. 4379-4390

G. Grötzbach,Script in English

T 11.343 Course: Optical Flow Measurement: Fundamentals and Applications [T-MACH-105424]

Responsible: Prof. Dr.-Ing. Bettina Frohnapfel
Prof. Dr.-Ing. Friedrich Seiler

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102597 - Compulsory Elective Module Mechanical Engineering

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

Competence Certificate
oral exam 30 minutes

Prerequisites
none

T 11.344 Course: Optical Measuring Systems [T-MACH-111249]

Responsible: apl. Prof. Dr. Ingo Sieber
Organisation: KIT Department of Mechanical Engineering

Part of:
M-MACH-102598 - Major Field: Advanced Mechatronics
M-MACH-102601 - Major Field: Automation Technology
M-MACH-102614 - Major Field: Mechatronics
M-MACH-102615 - Major Field: Medical Technology
M-MACH-102633 - Major Field: Robotics

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

Events					
ST 2024	2106010	Optical Measuring Systems	2 SWS	Lecture / 🗣	Sieber
Exams					
ST 2024	76-T-MACH-111249	Optical Measuring Systems			Sieber

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

Competence Certificate
oral exam (Duration: appr. 30min)

Prerequisites
none

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

V Optical Measuring Systems
2106010, SS 2024, 2 SWS, Language: German, Open in study portal

Lecture (V)
On-Site

Content
The lecture gives an introduction to optical measuring systems and optical metrology. Optical metrology offers the advantages of non-contact and fast measurement and is therefore also suitable for direct measurements during the process.

The measuring systems are described on the basis of the underlying physical principles and their practical application is demonstrated using specific examples.

Content:

- Introduction
- Optical measurement principles
- System / Optics and Light
- Optical components
- Optical systems for
  - Distance measurement
  - Surface measurement
  - Gas sensing

Learning objectives:

The students…

- know the basics of optical metrology.
- know different optical measuring principles.
- know the function of optical components.
- are able to find and use the appropriate measuring system for different measuring tasks.

Literature

- M. Schuth, W. Buerakov, „Handbuch optische Messtechnik“, Hanser, München (2017)
- „Optische Messtechnik“, In: Hering E., Martin R. (eds) Photonik. Springer, Berlin (2006)
- G. Wiegleb, „Gasmesstechnik in Theorie und Praxis“, Springer Vieweg, Wiesbaden (2016)

T 11.345 Course: Organ Support Systems [T-MACH-105228]

Responsible: apl. Prof. Dr. Christian Pylatiuk
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102597 - Compulsory Elective Module Mechanical Engineering
M-MACH-102615 - Major Field: Medical Technology

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

Events					
ST 2024	2106008	Organ support systems	2 SWS	Lecture / 🗣	Pylatiuk
Exams					
ST 2024	76-T-MACH-105228	Organ Support Systems			Pylatiuk

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

Competence Certificate
Written examination (Duration: 45min)

Prerequisites
none

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

V Organ support systems
2106008, SS 2024, 2 SWS, Language: German, Open in study portal

Lecture (V)
On-Site

Content
Content:

- Introduction: Definitions and classification of organ support and replacement.
- Special topics: acoustic and visual prostheses, exoskeletons, neuroprostheses, tissue-engineering, hemodialysis, heart-lung machine, artificial hearts, biomaterials.

Learning objectives:

Students have fundamental knowledge about functionality of organ support systems and its components. An analysis of historical developments can be done and limitations of current systems can be found. The limits and possibilities of transplantations can be elaborated.

Organizational issues
Die Vorlesung findet in Präsenz statt.

Literature

- Jürgen Werner: Kooperative und autonome Systeme der Medizintechnik: Funktionswiederherstellung und Organersatz. Oldenbourg Verlag.
- Rüdiger Kramme: Medizintechnik: Verfahren - Systeme – Informationsverarbeitung. Springer Verlag.
- E. Wintermantel, Suk-Woo Ha: Medizintechnik. Springer Verlag.

T 11.346 Course: Particle Dynamics and Atomistic Simulation [T-MACH-113742]

Responsible: Prof. Dr. Peter Gumbsch
Dr.-Ing. Johannes Schneider
Dr. Daniel Weygand
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102602 - Major Field: Reliability in Mechanical Engineering

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

Events					
ST 2024	2181740	Particle Dynamics and Atomistic Simulations	3 SWS	Lecture / Practice (/ 🗣	Weygand, Gumbsch

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

Competence Certificate
Oral exam: approximately 30 minutes

Prerequisites
none

Recommendation
Recommended Prerequisites: mathematics, physics, and materials science

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

V Particle Dynamics and Atomistic Simulations

Lecture / Practice (VÜ)
On-Site

2181740, SS 2024, 3 SWS, Language: English, Open in study portal

Content

Particle-based methods are numerical techniques used to simulate and analyse systems consisting of many discrete particles. They are particularly useful in fields where traditional continuum mechanical approaches are insufficient, such as granular materials, complex fluids, and defects in solids. In the lecture, the Discrete Element Method (DEM) for particles and Molecular Dynamics (MD) for the atomistic description of material behaviour will be covered. These methods span different length and time scales.

1. Introduction to Particle-Based Methods
   a) origin and application
   b) classification of particle-based methods
2. Fundamentals of Particle Dynamics
   a) Newtonian mechanics and conservation laws
   b) contact mechanics and friction laws
   c) kinematics and dynamics of particles
3. Discrete Element Method (DEM)
   a) principles and fundamentals
   b) numerical implementation: discretizing space and time
   c) particle detection and contact modelling
   d) application examples
4. Atomistic Methods: Molecular Dynamics (MD) and Statics (MS)
   a) fundamentals of atomistic models
   b) interaction: interatomic potentials
      i. pair potentials and their limits
      ii. many-body potentials
   c) integration methods (e.g., Verlet, Leap-Frog)
   d) periodic boundary conditions and neighbour lists
   e) applications in materials scienc
5. Structural Analysis:
   a) classification of neighbourhoods, distribution functions
   b) defect energy
   c) stresses, strains
6. Statistical Aspects of Atomistic Models
   a) phase space
   b) physical ensembles: microcanonical, canonical, grand canonical
   c) control of temperature, pressure, stresses: thermostats and barostats
   d) fluctuations and physical properties

The lecture covers both fundamental and advanced aspects of particle-based methods, with a particular focus on simple atomistic approaches. The accompanying computer exercises are designed to deepen and complement the lecture content through practical examples using the freely available particle simulation tool "LAMMPS" and to serve as a forum for detailed questions from students.

Objective: The student will be able to

- explain the physical principles of particle-based simulations,
- describe the application areas of particle-based simulation methods,
- apply particle-based simulation methods to address problems in materials science, materials engineering, and process engineering.

Recommended Prerequisites: mathematics, physics, and materials science

Lecture: 22.5 hours

Exercises: 12 hours

Self-study: 85.5 hours

Oral exam: approximately 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.
3. Computational Granular Dynamics. T. Pöschel, T. Schwager, Springer, 2005. Diskrete Element Methoden.
4. Lecture Slides and Exercises.

T 11.347 Course: Phase Transformations in Materials [T-MACH-111391]

Responsible: Prof. Dr.-Ing. Martin Heilmaier
Dr.-Ing. Alexander Kauffmann
Organisation: KIT Department of Mechanical Engineering
Part of: M-MACH-102611 - Major Field: Materials Science and Engineering

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

Events					
WT 24/25	2173421	Phase Transformations in Materials	3 SWS	Lecture / 🗣	Kauffmann, Heilmaier, Sen
Exams					
ST 2024	76-T-MACH-111391	Phase Transformations in Materials			Kauffmann

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

Competence Certificate
oral exam (about 25 min.)

Prerequisites
none

Recommendation
Materials Science and Engineering I/II and some additional fundamentals on thermodynamics and diffusion or Materials Physics and Metals

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

V Phase Transformations in Materials

Lecture (V)
On-Site

2173421, WS 24/25, 3 SWS, Language: English, Open in study portal

Content
Learning objectives:

Students are familiar with a generalized scheme of phase transformations important in materials science and engineering. This includes qualitative and quantitative description of thermodynamics and kinetics of phase transformations. The students are able to apply their fundamental knowledge in order to describe important phase transformations and to deduce properties of materials undergoing these transformations.

Content:

Ch. 0: General Information

Ch. 1: Thermodynamic and Kinetic Fundamentals

- Thermodynamics
- Kinetics
- Overview About Phase Transformations/Schemes

Ch. 2: Experimental Techniques

- General Terms
- Structural Investigations
- Physical Investigations
- Chemical Investigations
- Microstructural Investigations

Ch. 3: Single-Component Systems

- Solidification and Allotropic Transformations
    - Soldification of Elements
        - Nucleation
        - Homogeneous
        - Heterogeneous
        - Growth
            - Temperature-Time-Dependence
            - Facet Energies
            - Facet Growth
            - Heat Transfer (Thermal Dendrites)
    - Allotropic Transformations
        - Nucleation
            - Impact of Elastic Strain Energy
            - Interface Types
        - Growth
            - Temperature-Time-Dependence
- Continuous Phase Transitions

Ch. 4: Multi-Component Systems

- Reconstructive Transformation
    - Solidification of Solid Solutions
    - Spinodal Decomposition
    - Eutectic and Eutectoid Reactions
    - Peritectic and Peritectoid Reactions
    - Precipitation and Ageing
- Displacive Transformation
    - Intermediate Transformations
    - Order Transition
    - Massive Transformation

Work Load

lectures***:*** 36 h

private studies*: 64* h

Organizational issues
Details about the lecture are distributed via: https://www.iam.kit.edu/wk/english/studies.php

Literature
Powerpoint slides will be distributed via the ILIAS system.

Detailed information are available for different sub topics of the lecture from:

D. A. Porter, K. E. Easterling, M. Y. Sherif: “Phase transformations in metals and alloys”, CRC Press (2009)
https://services.bibliothek.kit.edu/primo/start.php?recordid=KITSRC27759961X

H.K.D.H. Bhadeshia: “Diffusional formation of ferrite in iron and its alloys” in Progress in Materials Science 29 (1985) 321-386
https://doi.org/10.1016/0079-6425(85)90004-0 [currently not available from KIT network but maybe accessed by LEA]

H.K.D.H. Bhadeshia, R.W.K. Honeycomb: “Steels: microstructures and properties”, Butterworth-Heinemann imprint by Elsevier (2017)
https://services.bibliothek.kit.edu/primo/start.php?recordid=KITSRC518051110 [free online access from within KIT network]

H.K.D.H. Bhadeshia: “Bainite in steels: transformations, microstructure and properties”, Institute of Materials, London (1992)
https://services.bibliothek.kit.edu/primo/start.php?recordid=KITSRC030295610

R.W. Cahn, P. Haasen (Editoren): „Physical Metallurgy“, Serie, North Holland und andere (1996)
http://services.bibliothek.kit.edu/primo/start.php?recordid=KITSRC052463656

J. Freudenberger: „Skript zur Vorlesung Physikalische Werkstoffeigenschaften“, IFW Dresden (2004)
https://www.ifw-dresden.de/institutes/imw/events/lectures/lecture-notes/physikalische-werkstoffeigenschaften/ [public domain]

T 11.348 Course: Phase-Field Method in Thermomechanics [T-MACH-113694]

Responsible: Dr.-Ing. Andreas Prahs
Organisation: KIT Department of Mechanical Engineering
Part of: M-MACH-102743 - Fundamentals and Methods of Theoretical Foundations of Mechanical Engineering

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

Events					
WT 24/25	2183705	Phase-field method in thermomechanics	3 SWS	Lecture / 🗣	Prahs
Exams					
WT 24/25	76-T-MACH-113694	Phasenfeldmethode in der Thermomechanik			Prahs

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

Competence Certificate
Oral examination, duration approximately 30 minutes

Prerequisites
none

T 11.349 Course: Photovoltaic System Design [T-ETIT-100724]

Responsible: Dipl.-Ing. Robin Grab
Organisation: KIT Department of Electrical Engineering and Information Technology
Part of: M-MACH-102648 - Major Field: Energy Technology for Buildings

Type	Credits	Grading scale	Recurrence	Version
Written examination	3	Grade to a third	Each summer term	1

Events					
ST 2024	2307380	Photovoltaische Systemtechnik	2 SWS	Lecture / 🗣	Grab
Exams					
ST 2024	7307380	Photovoltaics			Leibfried, Grab

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

Prerequisites
none

T 11.350 Course: Photovoltaics [T-ETIT-101939]

Responsible: Prof. Dr.-Ing. Michael Powalla
Organisation: KIT Department of Electrical Engineering and Information Technology
Part of: M-MACH-102595 - Compulsory Elective Module Natural Science/Computer Science/Electrical Engineering
M-MACH-102623 - 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 2024	2313737	Photovoltaics	3 SWS	Lecture / 🗣	Powalla, Lemmer
ST 2024	2313738	Tutorial 2313737 Photovoltaik	1 SWS	Practice / 🗣	Powalla, Lemmer
Exams					
ST 2024	7313737	Photovoltaics			Powalla, Lemmer
WT 24/25	7313737	Photovoltaics			Powalla, Lemmer

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

Prerequisites
"M-ETIT-100524 - Solar Energy" must not have started.

T 11.351 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-102623 - 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 24/25	2189906	Physical and chemical principles of nuclear energy in view of reactor accidents and back-end of nuclear fuel cycle	2 SWS	Lecture / 🗣	Dagan, Metz
Exams					
ST 2024	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 24/25	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 24/25, 2 SWS, Language: German, Open in study portal

Content

- Relevant physical terms of nuclear physics
- Decay heat removal- Borst-Wheeler equation
- The accidents in TMI- Three Mile Island, and Fukushima .
- Fission , chain reaction and reactor control systems
- Basics of nuclear cross sections
- Principles of reactor dynamics
- Reactor poisoning
- The Idaho and Chernobyl accidents
- Principles of the nuclear fuel cycle
- Reprocessing of irradiated fuel elements and vitrification of fission product solutions
- Interim storage of nuclear residues in surface facilities
- Multi barrier concepts for final disposal in deep geological formations
- The situation in the repositories Asse II, Konrad and Morsleben

The students

- understand the physical explanations of the known nuclear accidents
- can perform simplified calculations to demonstrate the accidents outcome.
- Define safety relevant properties of low/ intermediate / high level waste products
- Are able to evaluate principles and implications of reprocessing, storage and disposal options for nuclear waste.

Regular attendance: 14 h

self study 46 h

oral exam about 20 min.

Literature

AEA öffentliche Dokumentation zu den nukleare Ereignissen

K. Wirtz: Grundlagen der Reaktortechnik Teil I, II, Technische Hochschule Karlsruhe 1966

D. Emendorfer. K.H. Höcker: Theorie der Kernreaktoren, Teil I, II BI- Hochschultaschenbücher 1969

J. Duderstadt and L. Hamilton: Nuclear reactor Analysis, J. Wiley $ Sons , Inc. 1975 (in Englisch)

R.C. Ewing: The nuclear fuel cycle: a role for mineralogy and geochemistry. Elements vol. 2, p.331-339, 2006 (in Englisch)

J. Bruno, R.C. Ewing: Spent nuclear fuel. Elements vol. 2, p.343-349, 2006 (in Englisch)

T 11.352 Course: Physical Basics of Laser Technology [T-MACH-109084]

Responsible: Dr.-Ing. Johannes Schneider
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102595 - Compulsory Elective Module Natural Science/Computer Science/Electrical Engineering

Type	Credits	Grading scale	Recurrence	Version
Completed coursework	6	pass/fail	Each winter term	2

Events					
WT 24/25	2181612	Physical basics of laser technology	3 SWS	Lecture / Practice (/ 🗣	Schneider
Exams					
ST 2024	76-T-MACH-109084	Physical Basics of Laser Technology			Schneider
WT 24/25	76-T-MACH-109084	Physical Basics of Laser Technology			Schneider

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

Competence Certificate
colloquium (30 min)

no tools or reference materials

Prerequisites
It is not possible, to combine this brick with brick Laser Material Processing [T-MACH-112763], brick Laser Application in Automotive Engineering [T-MACH-105164] and brick Physical Basics of Laser Technology [T-MACH-102102]

Modeled Conditions
The following conditions have to be fulfilled:

1. The course T-MACH-105164 - Laser in Automotive Engineering must not have been started.
2. The course T-MACH-102102 - Physical Basics of Laser Technology must not have been started.
3. The course T-MACH-112763 - Laser Material Processing 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 24/25, 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 11.353 Course: Physical Basics of Laser Technology [T-MACH-102102]

Responsible: Dr.-Ing. Johannes Schneider
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102405 - Fundamentals and Methods of General Mechanical Engineering
M-MACH-102575 - Fundamentals and Methods of Energy and Environmental Engineering
M-MACH-102597 - Compulsory Elective Module Mechanical Engineering
M-MACH-102739 - Fundamentals and Methods of Automotive Engineering
M-MACH-102740 - Fundamentals and Methods of Mechatronics and Microsystem Technology
M-MACH-102741 - Fundamentals and Methods of Product Development and Construction
M-MACH-102742 - Fundamentals and Methods of Production Technology
M-MACH-102744 - Fundamentals and Methods of Materials and Structures for High Performance Systems

Type	Credits	Grading scale	Recurrence	Version
Oral examination	5	Grade to a third	Each winter term	4

Events					
WT 24/25	2181612	Physical basics of laser technology	3 SWS	Lecture / Practice (/ 🗣	Schneider
Exams					
ST 2024	76-T-MACH-102102	Physical Basics of Laser Technology			Schneider
WT 24/25	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 Material Processing [T-MACH-112763], 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.
2. The course T-MACH-109084 - Physical Basics of Laser Technology must not have been started.
3. The course T-MACH-112763 - Laser Material Processing 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 24/25, 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 11.354 Course: Physical Measurement Technology [T-MACH-111022]

Responsible: Dr. Dominique Buchenau
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102627 - Major Field: Energy Converting Engines

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

Competence Certificate
Oral exam of about 25 minutes

Prerequisites
none

Annotation
none

T 11.355 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-102405 - Fundamentals and Methods of General Mechanical Engineering
M-MACH-102575 - Fundamentals and Methods of Energy and Environmental Engineering
M-MACH-102597 - Compulsory Elective Module Mechanical Engineering
M-MACH-102739 - Fundamentals and Methods of Automotive Engineering
M-MACH-102740 - Fundamentals and Methods of Mechatronics and Microsystem Technology
M-MACH-102743 - Fundamentals and Methods of Theoretical Foundations of Mechanical Engineering
M-MACH-102744 - Fundamentals and Methods of Materials and Structures for High Performance Systems

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

Events					
ST 2024	2142890	Physics for Engineers	4 SWS	Lecture / Practice (/ 🗣	Weygand, Dienwiebel, Nesterov-Müller, Gumbsch
Exams					
ST 2024	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

2142890, SS 2024, 4 SWS, Language: German, Open in study portal

Lecture / Practice (VÜ)
On-Site

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 11.356 Course: Physiology and Anatomy for Biomedical Engineering [T-ETIT-111815]

Responsible: Prof. Dr. Werner Nahm
Organisation: KIT Department of Electrical Engineering and Information Technology
Part of: M-MACH-102595 - Compulsory Elective Module Natural Science/Computer Science/Electrical Engineering

Type	Credits	Grading scale	Recurrence	Version
Written examination	6	Grade to a third	Each winter term	1

Events					
ST 2024	2305282	Physiology and Anatomy for Engineers II	2 SWS	Lecture /	Nahm
WT 24/25	2305281	Physiology and Anatomy for Engineers I	2 SWS	Lecture /	Nahm
Exams					
ST 2024	7305283	Physiology and Anatomy for Biomedical Engineering			Nahm, Weiß, Krames
WT 24/25	7300014	Physiology and Anatomy for Biomedical Engineering			Nahm

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

Competence Certificate
The exmaniation is carried out in the form of a written test of 120 minutes.

The examination includes the contents of Physiologie und Anatomie I (offered every winter term) and Physiologie und Anatomie II (offered every summer term).

Prerequisites
The courses "T-ETIT-101932 - Physiologie und Anatomie I" und "T-ETIT-101933 - Physiologie und Anatomie II" must not been started.

Annotation
Winter/summer term:

WT: Physiologie und Anatomie I
ST: Physiologie und Anatomie II

T 11.357 Course: Physiology/Sports Medicine II [T-GEISTSOZ-103290]

Responsible: Prof. Dr. Achim Bub
Organisation: KIT Department of Humanities and Social Sciences
Part of: M-MACH-102615 - Major Field: Medical Technology

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

Events					
WT 24/25	5016108	Foundations of physiology/sports medicine I	2 SWS	Lecture / 🗣	Bub
Exams					
ST 2024	7400253	Physiology/sports medicine I			Bub
WT 24/25	7400211	Physiology/sports medicine I			Bub

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

11.358 Course: Plasticity of Metals and Intermetallics [T-MACH-110818]

Responsible: Prof. Dr.-Ing. Martin Heilmaier
Dr.-Ing. Alexander Kauffmann

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102611 - Major Field: Materials Science and Engineering

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

Events					
ST 2024	2173648	Plasticity of Metals and Intermetallics	4 SWS	Lecture / 🗣	Kauffmann, Heilmaier, Schliephake
Exams					
ST 2024	76-T-MACH-110818	Plasticity of Metals and Intermetallics			Kauffmann, Heilmaier
WT 24/25	76-T-MACH-110818	Plasticity of Metals and Intermetallics			Kauffmann, Heilmaier

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

Competence Certificate
oral exam (about 25 minutes)

Prerequisites
T-MACH-110268 – Plastizität von metallischen und intermetallischen Werkstoffen has not been started

T-MACH-105301 - Werkstoffkunde III has not been started

Modeled Conditions
The following conditions have to be fulfilled:

1. The course T-MACH-105301 - Materials Science and Engineering III must not have been started.

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

V **Plasticity of Metals and Intermetallics** — **Lecture (V) On-Site**
2173648, SS 2024, 4 SWS, Language: English, Open in study portal

Content

Learning Objectives

Students are familiar with macroscopic, mesoscopic and microscopic mechanisms of plastic deformation in metals, alloys and intermetallics including the qualitative and quantitative descriptions. Furthermore, students can apply their knowledge in order to deduce and explain mechanism-property relationships in this kind of materials and their use in materials manufacturing.

Content

Chapter overview

Ch. 0: General Information
Ch. 1: Relevance of Plasticity in Industry and Research
Ch. 2: Macroscopic Features of Plastic Deformation
Ch. 3: Fundamentals and Interrelations to other Lectures

- Fundamental Concepts of Elasticity
- Macroscopic Strength and Strengthening/Hardening
- Fundamentals of Crystallography
- Fundamentals of Defects in Crystalline Solids

Ch. 4: Dislocations

- Fundamental Concept
- Observation of Dislocations
- Properties of Dislocations
- Dislocations in fcc Metals
- Dislocations in bcc Metals
- Dislocations in hcp Metals and Complex Intermetallics

Ch. 5: Single Crystal Plasticity

- General Stages of Plastic Deformation and Fundamentals of the Stress-Strain curve (fcc Metals)
- Influence of Temperature, Orientation, Strain Rate, etc. (fcc Metals)
- Further Examples (Extension of the Results to bcc, hcp and Intermetallic Materials)
- Deformation Twinning

Ch. 6: Plasticity of Polycrystalline Materials

- Transition from Single Crystals to Polycrystals
- Strength of Polycrystals
    - Solute Atoms
    - Dislocations (incl. Dislocation Patterning)
    - Grain Boundaries (incl. Homogenization of Critical Stress)
    - Precipitates and Dispersoids

Ch. 7: Other Mechanisms of Plastic Deformation

Work Load

lectures: 56 h

private studies: 187 h

Organizational issues

Details about the lecture are distributed via: https://www.iam.kit.edu/wk/english/studies.php

Literature

Powerpoint slides will be distributed via the ILIAS system.

Detailed information are available for different sub topics of the lecture:

P. Hirth, J. Lothe: „Theory of Dislocations“, Krieger (1992)
http://services.bibliothek.kit.edu/primo/start.php?recordid=KITSRC070938105

D. Hull, D. J. Bacon: „Introduction to Dislocations“, Elsevier (2011)
http://services.bibliothek.kit.edu/primo/start.php?recordid=KITSRC383083990 (free vie KIT license)

R. W. Cahn, P. Haasen (Editoren): „Physical Metallurgy“, Serie, North Holland (1996)
http://services.bibliothek.kit.edu/primo/start.php?recordid=KITSRC052463656

J. Freudenberger: „Skript zur Vorlesung Physikalische Werkstoffeigenschaften“, IFW Dresden (2004)
https://www.ifw-dresden.de/de/ifw-institutes/ikm/lectures/vorlesungsskript-physikalische-werkstoffeigenschaften (public domain)

T 11.359 Course: PLM for Product Development in Mechatronics [T-MACH-102181]

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

Part of: M-MACH-102597 - Compulsory Elective Module Mechanical Engineering
M-MACH-102613 - Major Field: Lifecycle Engineering

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

Events					
ST 2024	2122376	PLM for product development in mechatronics	2 SWS	Lecture / 🗣	Eigner
Exams					
ST 2024	76-T-MACH-102181	PLM for Product Development in Mechatronics			Eigner

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 PLM for product development in mechatronics

2122376, SS 2024, 2 SWS, Language: German, Open in study portal

Lecture (V)
On-Site

Content
Students are able to

- compare product data management and product lifecycle management.
- describe the components and core functions of a PLM solution
- explain trends from research and practice in the field of PLM form mechatronic product development

Organizational issues
Blockveranstaltung, Teilnehmerzahl begrenzt.

Literature
Vorlesungsfolien / lecture slides

T 11.360 Course: Polymer Engineering I [T-MACH-102137]

Responsible: Dr.-Ing. Wilfried Liebig
Organisation: KIT Department of Mechanical Engineering

Part of:
M-MACH-102597 - Compulsory Elective Module Mechanical Engineering
M-MACH-102611 - Major Field: Materials Science and Engineering
M-MACH-102628 - Major Field: Lightweight Construction
M-MACH-102632 - Major Field: Polymer Engineering
M-MACH-102637 - Major Field: Tribology

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

Events					
WT 24/25	2173590	Polymer Engineering I	2 SWS	Lecture / 🗣	Liebig
Exams					
ST 2024	76-T-MACH-102137	Polymer Engineering I			Liebig
WT 24/25	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 24/25, 2 SWS, Language: German, Open in study portal

Lecture (V)
On-Site

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 11.361 Course: Polymer Engineering II [T-MACH-102138]

Responsible: Dr.-Ing. Wilfried Liebig
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102597 - Compulsory Elective Module Mechanical Engineering
M-MACH-102632 - Major Field: Polymer Engineering

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

Events					
ST 2024	2174596	Polymer Engineering II	2 SWS	Lecture / 🗣	Liebig
Exams					
ST 2024	76-T-MACH-102138	Polymerengineering II			Liebig
WT 24/25	76-T-MACH-102138	Polymerengineering II			Liebig

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

Competence Certificate
Oral exam, about 25 minutes

Prerequisites
none

Recommendation
Knowledge in Polymerengineering I

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

V Polymer Engineering II

2174596, SS 2024, 2 SWS, Language: German, Open in study portal

Lecture (V)
On-Site

Content
1. Processing of polymers
2. Properties of polymer components
Based on practical examples and components
2.1 Selection of material
2.2 Component design
2.3 Tool engineering
2.4 Production technology
2.5 Surface engineering
2.6 Sustainability, recycling

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, that the students gather knowledge and technical skills to use the material "polymer" meeting its requirements in an economical and ecological way.

The students

- can describe and classify different processing techniques
  and can exemplify mould design principles based on technical parts.
- know about practical applications and processing of polymer parts
- are able to design polymer parts according to given restrictions
- can choose appropriate polymers based on the technical requirements
- can decide how to use polymers regarding the production, economical and ecological requirements

requirements:
Polymerengineering I
workload:

The workload for the lecture Polymerengineering II is 120 h per semester and consists of the presence during the lecture (21 h) as well as preparation and rework time at home (99 h).

Literature
Literaturhinweise, Unterlagen und Teilmanuskript werden in der Vorlesung ausgegeben.

Recommended literature and selected official lecture notes are provided in the lecture.

T 11.362 Course: Polymers [T-CHEMBIO-100294]

Organisation: KIT Department of Chemistry and Biosciences
Part of: M-MACH-102628 - Major Field: Lightweight Construction

Type	Credits	Grading scale	Version
Written examination	6	Grade to a third	1

Events					
ST 2024	5501	Chemie und Physik der Makromoleküle II	2 SWS	Lecture / 🗣	Wilhelm, Dingenouts
WT 24/25	5501	Chemie und Physik der Makromoleküle I	2 SWS	Lecture / 🗣	Wilhelm, Dingenouts
Exams					
ST 2024	7100004	Chemistry and Physics of macromolecules			Dingenouts, Wilhelm

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

T 11.363 Course: Polymers in MEMS A: Chemistry, Synthesis and Applications [T-MACH-102192]

Responsible: Dr.-Ing. Bastian Rapp
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102597 - Compulsory Elective Module Mechanical Engineering
M-MACH-102616 - Major Field: Microsystem Technology

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

Events					
WT 24/25	2141853	Polymers in MEMS A: Chemistry, Synthesis and Applications	2 SWS	/ Blended	Worgull
Exams					
ST 2024	76-T-MACH-102192	Polymers in MEMS A: Chemistry, Synthesis and Applications			Rapp, Worgull

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

Competence Certificate
Oral examination

Prerequisites
none

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

V Polymers in MEMS A: Chemistry, Synthesis and Applications
2141853, WS 24/25, 2 SWS, Language: German, Open in study portal

Blended (On-Site/Online)

Organizational issues
Findet als Blockveranstaltung am Semesterende statt.

T 11.364 Course: Polymers in MEMS B: Physics, Microstructuring and Applications [T-MACH-102191]

Responsible: Dr.-Ing. Matthias Worgull
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102597 - Compulsory Elective Module Mechanical Engineering
M-MACH-102616 - Major Field: Microsystem Technology

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

Events					
WT 24/25	2141854	Polymers in MEMS B: Physics, Microstructuring and Applications	2 SWS	Lecture / Blended	Worgull
Exams					
ST 2024	76-T-MACH-102191	Polymers in MEMS B: Physics, Microstructuring and Applications			Worgull

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

Competence Certificate
Oral examination

Prerequisites
none

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

V Polymers in MEMS B: Physics, Microstructuring and Applications

2141854, WS 24/25, 2 SWS, Language: German, Open in study portal

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

T 11.365 Course: Polymers in MEMS C: Biopolymers and Bioplastics [T-MACH-102200]

Responsible: Dr.-Ing. Bastian Rapp
Dr.-Ing. Matthias Worgull

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102597 - Compulsory Elective Module Mechanical Engineering
M-MACH-102616 - Major Field: Microsystem Technology

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

Events					
ST 2024	2142855	Polymers in MEMS C - Biopolymers and Bioplastics	2 SWS	/	Worgull
Exams					
ST 2024	76-T-MACH-102200	Polymers in MEMS C: Biopolymers and Bioplastics			Worgull, Rapp

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

Competence Certificate
Oral examination

Prerequisites
none

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

V Polymers in MEMS C - Biopolymers and Bioplastics
2142855, SS 2024, 2 SWS, Language: German, Open in study portal **Blended (On-Site/Online)**

Content
Polymers are ubiquitous in everyday life: from packaging materials all the way to specialty products in medicine and medical engineering. Today it is difficult to find a product which does not (at least in parts) consist of polymeric materials. The question of how these materials can be improved with respect to their disposal and consumption of (natural) resources during manufacturing is often raised. Today polymers must be fully recycled in Germany and many other countries due to the fact that they do not (or only very slowly) decompose in nature. Furthermore significant reductions of crude oil consumption during synthesis are of increasing importance in order to improve the sustainability of this class of materials. With respect to disposal polymers which do not have to be disposed by combustion but rather allow natural decomposition (composting) are of increasing interest. Polymers from renewable sources are also of interest for modern microelectromechanical systems (MEMS) especially if the systems designed are intended as single-use products.

This lecture will introduce the most important classes of these so-called biopolymers and bioplastics. It will also discuss and highlight polymers which are created from naturally created analogues (e.g. via fermentation) to petrochemical polymer precursors and describe their technical processing. Numerous examples from MEMS as well as everyday life will be given.

Some of the topics covered are:

- What are biopolyurethanes and how can you produce them from castor oil?
- What are "natural glues" and how are they different from chemical glues?
- How do you make tires from natural rubbers?
- What are the two most important polymers for life on earth?
- How can you make polymers from potatoes?
- Can wood be formed by injection molding?
- How do you make buttons from milk?
- Can you play music on biopolymers?
- Where and how do you use polymers for tissue engineering?
- How can you built LEGO with DNA?

The lecture will be given in German language unless non-German speaking students attend. In this case, the lecture will be given in English (with some German translations of technical vocabulary). The lecture slides are in English language and will be handed out for taking notes. Additional literature is not required.

For further details, please contact the lecturer, PD Dr.-Ing. Matthias Worgull (matthias.worgull@kit.edu). Preregistration is not necessary.

Organizational issues

Für weitere Rückfragen, wenden Sie sich bitte an PD Dr.-Ing- Matthias Worgull (matthias.worgull@kit.edu). Eine Voranmeldung ist nicht notwendig.

Literature

Zusätzliche vorlesungsbegleitende Literatur ist nicht notwendig.

T 11.366 Course: Powertrain Systems Technology B: Stationary Machinery [T-MACH-105216]

Responsible: Prof. Dr.-Ing. Tobias Düser
Sascha Ott

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102599 - Major Field: Powertrain Systems
M-MACH-102605 - Major Field: Engineering Design
M-MACH-102633 - Major Field: Robotics

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

Events					
WT 24/25	2145150	Powertrain Systems Technology B: Stationary Machinery	2 SWS	Lecture / 🗣	Düser, Ott
Exams					
ST 2024	76-T-MACH-105216	Powertrain Systems Technology B: Stationary Machinery			Albers, Ott
WT 24/25	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 24/25, 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: "Schaltbare 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 11.367 Course: Practical Aspects of Electrical Drives [T-ETIT-100711]

Responsible: Prof. Dr. Martin Doppelbauer
Organisation: KIT Department of Electrical Engineering and Information Technology
Part of: M-MACH-102595 - Compulsory Elective Module Natural Science/Computer Science/Electrical Engineering

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

Events					
ST 2024	2306311	Practical Aspects of Electrical Drives	2 SWS	Lecture /	Doppelbauer
ST 2024	2306313	Übungen zu 2306311 Praxis elektrischer Antriebe	1 SWS	Practice /	Doppelbauer
WT 24/25	2306311	Practical Aspects of Electrical Drives	2 SWS	Lecture / ✕	Brodatzki, Doppelbauer
WT 24/25	2306313	Übungen zu 2306311 Praxis elektrischer Antriebe	1 SWS	Practice / ✕	Doppelbauer
Exams					
ST 2024	7306311	Practical Aspects of Electrical Drives			Doppelbauer
WT 24/25	7306313	Practical Aspects of Electrical Drives			Doppelbauer

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

Prerequisites
none

Annotation
Shift from SoSe to WiSe, does not take place in WiSe24/25 and SoSe25.

T 11.368 Course: Practical Course “Tribology” [T-MACH-105813]

Responsible: Prof. Dr. Martin Dienwiebel
Dr.-Ing. Johannes Schneider

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102591 - Laboratory Course
M-MACH-102637 - Major Field: Tribology

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

Events					
ST 2024	2182115	Praktikum "Tribologie"	3 SWS	Practical course / On-Site	Schneider, Dienwiebel
Exams					
ST 2024	76-T-MACH-105813	Praktikum "Tribologie"			Schneider, Dienwiebel

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
The attendance to one of the course Tribology (2181114) is strongly recommended!

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

V Praktikum "Tribologie"
2182115, SS 2024, 3 SWS, Language: German, Open in study portal

Practical course (P)
On-Site

Content
The laboratory compromises five full-day experiments, which address the following topics:

- tribological system analysis
- basics of tribological measurement techniques
- topographical surface characterization
- tribological model tests under sliding, rolling and abrasive conditions
- microscopical characterization of worn surfaces

The student

- knows the most common methods of friction and wear measurement
- knows the most common tribological model tests for the characterization of materials under sliding, rolling and abrasive conditions
- can carry out a tribological system analysis and based on that derive suitable loading parameters for model tests

The attendance to one of the course Tribology (2181114) is recommended.

regular attendance: 35 hours

self-study: 85 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
Anmeldung per Email bis zum 26.04.2024 an johannes.schneider@kit.edu

Das Praktikum wird voraussichtlich als Block vom 29.07. bis 02.08.2024 am Campus Süd (MZE, 30.48) angeboten.

Literature

H. Czichos, K.-H. Habig: Tribologie-Handbuch. Vieweg + Teubner Verlag, Wiesbaden, 2010 (http://www.springerlink.com/content/nl4kn1/?MUD=MP)

K. Sommer, R. Heinz, J. Schöfer: Verschleiß metallischer Werkstoffe: Erscheinungsformen sicher beurteilen. Vieweg + Teubner Verlag, Wiesbaden, 2010 (http://www.springerlink.com/content/u24843/#section=806215&page=1)

Gesellschaft für Tribologie e.V. (GFT): Arbeitsblatt 7: Tribologie – Verschleiß, Reibung: Definitionen, Begriffe, Prüfung. GFT, Moers, 2002. (Download unterwww.gft-ev.de/arbeitsblaetter.htm)

K.-H. Zum Gahr: Microstructure and wear of materials. Elsevier, Amsterdam, 1987.

T 11.369 Course: Practical Course Polymers in MEMS [T-MACH-105556]

Responsible: Dr.-Ing. Bastian Rapp
Dr.-Ing. Matthias Worgull

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102616 - Major Field: Microsystem Technology

Type	Credits	Grading scale	Recurrence	Version
Completed coursework	2	pass/fail	Each summer term	1

Events					
ST 2024	2142856	Practical Course Polymers in MEMS	2 SWS	Block /	Worgull

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

Competence Certificate
The practical course will close with an oral examination.There will be only passed and failed results, no grades.

Prerequisites
none

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

V Practical Course Polymers in MEMS
2142856, SS 2024, 2 SWS, Language: German, Open in study portal

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

Content
This practical course complements the lectures "Polymers in MEMS A", "Polymers in MEMS B" and "Polymers in MEMS C" and will allow students to gain a deeper understanding of polymers and their processing. During the course of this practical course, various polymers will be synthesized and molded into components suitable for microelectromechanical systems (MEMS) applications. The aim of the course is to bring a polymer all the way from synthesis to application.

The practical course will be given in German language unless non-German speaking students attend. In this case, the course will be given in English (with some German translations of technical vocabulary). Lecture notes for the experiments are in English language and will be handed out to the students. The practical course will be held "en block" at the end of the semester (presumably beginning of October)

For further details, please contact PD Dr.-Ing. Matthias Worgull (matthias.worgull@kit.edu). Preregistration is mandatory. The number of participants is limited to 5 students.

Organizational issues
Anmeldung und Terminabsprache in der Vorlesung (2142855)

Für weitere Rückfragen, wenden Sie sich bitte an PD Dr.-Ing- Matthias Worgull (matthias.worgull@kit.edu). Eine Voranmeldung ist notwendig. Die Platzanzahl ist auf 5 Teilnehmer beschränkt.

Literature
Vorlesungsunterlagen, dort empfohlene Literatur

T 11.370 Course: Practical Course Technical Ceramics [T-MACH-105178]

Responsible: apl. Prof. Dr. Günter Schell
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102619 - Major Field: Technical Ceramics and Powder Materials

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

Events					
WT 24/25	2125751	Practical Course Technical Ceramics	2 SWS	Practical course / 🗣	Schell
Exams					
WT 24/25	76-T-MACH-105178	Practical Course Technical Ceramics			Schell

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

Competence Certificate
Colloquium and laboratory report for the respective experiments.

Prerequisites
none

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

V Practical Course Technical Ceramics

2125751, WS 24/25, 2 SWS, Language: German, Open in study portal

Practical course (P)
On-Site

Organizational issues
Elektronisch über das ILIAS-Portal

Literature
Salmang, H.: Keramik, 7. Aufl., Springer Berlin Heidelberg, 2007. - Online-Ressource

Richerson, D. R.: Modern Ceramic Engineering, CRC Taylor & Francis, 2006

T 11.371 Course: Practical Course: Autonomous Driving [T-MACH-113713]

Responsible: Dr.-Ing. Michael Frey
Dr.-Ing. Martin Gießler

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102597 - Compulsory Elective Module Mechanical Engineering
M-MACH-102607 - Major Field: Vehicle Technology

Type	Credits	Grading scale	Version
Completed coursework	6	pass/fail	1

Events					
WT 24/25	2113820	Practical Course: Autonomous Driving	3 SWS	Practical course / 🗣	Frey

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

Competence Certificate
To pass the course it is neccessary to successfully complete the colloquia, the homework and the final demonstration of the driving task.

Prerequisites
none

T 11.372 Course: Practical Course: Smart Energy System Lab [T-INFO-112030]

Responsible: Dr.-Ing. Simon Waczowicz
Organisation: KIT Department of Informatics
Part of: M-MACH-102598 - Major Field: Advanced Mechatronics
M-MACH-102601 - Major Field: Automation Technology
M-MACH-102614 - Major Field: Mechatronics
M-MACH-102623 - Major Field: Fundamentals of Energy Technology
M-MACH-102648 - Major Field: Energy Technology for Buildings

Type	Credits	Grading scale	Recurrence	Version
Examination of another type	6	Grade to a third	Each term	1

Events					
ST 2024	2400082	Laboratory: Smart Energy System Lab	4 SWS	Practical course / 🗣	Hagenmeyer, Waczowicz, Süß
Exams					
ST 2024	7500318	Practical Course: Smart Energy System Lab			Hagenmeyer

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

T 11.373 Course: Practical Training in Basics of Microsystem Technology [T-MACH-102164]

Responsible: Dr. Arndt Last
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102615 - Major Field: Medical Technology
M-MACH-102616 - Major Field: Microsystem Technology

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

Events					
ST 2024	2143875	Introduction to Microsystem Technology - Practical Course	2 SWS	Practical course / 🗣	Last
WT 24/25	2143875	Introduction to Microsystem Technology - Practical Course	2 SWS	Practical course / 🗣	Last
WT 24/25	2143877	Introduction to Microsystem Technology - Practical Course	2 SWS	Practical course / 🗣	Last
Exams					
ST 2024	76-T-MACH-102164	Practical Training in Basics of Microsystem Technology			Last
WT 24/25	76-T-MACH-102164	Practical Training in Basics of Microsystem Technology			Last

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

Competence Certificate
The assessment consists of a written exam

Prerequisites
none

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

V Introduction to Microsystem Technology - Practical Course

2143875, SS 2024, 2 SWS, Language: German, Open in study portal

Practical course (P)
On-Site

Content
In the practical training includes ten experiments:

1. Röntgenoptik
2. UVL + REM
3. Mischerbauteil
4. Rasterkraftmikroskopie
5. 3D-Printing
6. Lichtstreuung an Chrommasken
7. Abformung
8. SAW-Biosensorik
9. Nano3D-Drucker - Materialtransfer dünnster Schichten
10. Elektrospinning

Each student takes part in only four experiments.
The experiments are carried out at real workstations at the IMT and coached by IMT-staff.

Organizational issues
Das Praktikum findet in den Laboren des IMT am CN statt. Treffpunkt: Bau 301, vor dem Eingang.

Teilnahmeanfragen an arndt.last@kit.edu

Literature
Menz, W., Mohr, J.: Mikrosystemtechnik für Ingenieure, VCH-Verlag, Weinheim, 1997
Unterlagen zum Praktikum zur Vorlesung ' Grundlagen der Mikrosystemtechnik'

V	**Introduction to Microsystem Technology - Practical Course** 2143875, WS 24/25, 2 SWS, Language: German, Open in study portal	**Practical course (P)** **On-Site**

Literature
Menz, W., Mohr, J.: Mikrosystemtechnik für Ingenieure, VCH-Verlag, Weinheim, 1997
Unterlagen zum Praktikum zur Vorlesung ' Grundlagen der Mikrosystemtechnik'

V	**Introduction to Microsystem Technology - Practical Course** 2143877, WS 24/25, 2 SWS, Language: German, Open in study portal	**Practical course (P)** **On-Site**

Literature
Menz, W., Mohr, J.: Mikrosystemtechnik für Ingenieure, VCH-Verlag, Weinheim, 1997
Unterlagen zum Praktikum zur Vorlesung ' Grundlagen der Mikrosystemtechnik'

T 11.374 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-102591 - Laboratory Course
M-MACH-102614 - Major Field: Mechatronics
M-MACH-104443 - Major Field: Vibration Theory

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

Events					
ST 2024	2162208	Schwingungstechnisches Praktikum		Practical course / ✕	Genda, 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 11.375 Course: Principles of Ceramic and Powder Metallurgy Processing [T-MACH-102111]

Responsible: apl. Prof. Dr. Günter Schell
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102597 - Compulsory Elective Module Mechanical Engineering
M-MACH-102611 - Major Field: Materials Science and Engineering
M-MACH-102619 - Major Field: Technical Ceramics and Powder Materials

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

Events					
WT 24/25	2193010	Basic principles of powder metallurgical and ceramic processing	2 SWS	Lecture /	Schell
Exams					
ST 2024	76-T-MACH-102111	Principles of Ceramic and Powder Metallurgy Processing			Schell
WT 24/25	76-T-MACH-102111	Principles of Ceramic and Powder Metallurgy Processing			Schell, Wagner

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 24/25, 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 11.376 Course: Principles of Medicine for Engineers [T-MACH-105235]

Responsible: apl. Prof. Dr. Christian Pylatiuk
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102597 - Compulsory Elective Module Mechanical Engineering
M-MACH-102615 - Major Field: Medical Technology
M-MACH-102642 - Major Field: Development of Innovative Appliances and Power Tools

Type	Credits	Grading scale	Recurrence	Version
Written examination	4	Grade to a third	Each winter term	1

Events					
WT 24/25	2105992	Principles of Medicine for Engineers	2 SWS	Lecture / 🗣	Pylatiuk
Exams					
ST 2024	76-T-MACH-105235	Principles of Medicine for Engineers			Pylatiuk

Legend: 🖥 Online, Blended (On-Site/Online), 🗣 On-Site, ✕ Cancelled

Competence Certificate
Written examination (Duration: 45min)

Prerequisites
none

Below you will find excerpts from events related to this course:

V Principles of Medicine for Engineers

2105992, WS 24/25, 2 SWS, Language: German, Open in study portal

Lecture (V)
On-Site

Content
Content:

- Introduction: Definitions of "health" and "disease". History of medicine and paradigm shift towards evidence based medicine and personalized medicine.
- Special topics: nervous system, saltatory conduction, musculoskeletal system, cardio-circulatory system, narcosis, pain, respiratory system, sensory organs, gynaecology, digestive organs, surgery, nephrology, orthopaedics, immune system, genetics.

Learning objectives:

Students have fundamental knowledge about functionality and anatomy of organs within different medical disciplines. The students further know about technical methods in diagnosis and therapy, common diseases, their relevance and costs. Finally the students are able to communicate with medical doctors in a way, in which they prevent misunderstandings and achieve a more realistic idea of each others expectations.

Literature

- Adolf Faller, Michael Schünke: Der Körper des Menschen. Thieme Verlag.
- Renate Huch, Klaus D. Jürgens: Mensch Körper Krankheit. Elsevier Verlag.

T 11.377 Course: Probability Theory and Statistics [T-MATH-109620]

Responsible: Prof. Dr. Nicole Bäuerle
Dr. rer. nat. Bruno Ebner
Prof. Dr. Vicky Fasen-Hartmann
Prof. Dr. Daniel Hug
PD Dr. Bernhard Klar
Prof. Dr. Günter Last
Prof. Dr. Mathias Trabs
PD Dr. Steffen Winter

Organisation: KIT Department of Mathematics

Part of: M-MACH-102594 - Mathematical Methods
M-MACH-102739 - Fundamentals and Methods of Automotive Engineering
M-MACH-102740 - Fundamentals and Methods of Mechatronics and Microsystem Technology
M-MACH-102743 - Fundamentals and Methods of Theoretical Foundations of Mechanical Engineering

Type	Credits	Grading scale	Recurrence	Version
Written examination	6	Grade to a third	Each term	2

Exams			
ST 2024	00007	Probability Theory and Statistics	Trabs, Ebner, Winter

Competence Certificate
Written exam (90 min.)

Prerequisites
None

T 11.378 Course: Process Simulation in Forming Operations [T-MACH-105348]

Responsible: Dr.-Ing. Dirk Helm
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102597 - Compulsory Elective Module Mechanical Engineering
M-MACH-102646 - Major Field: Applied Mechanics

Type	Credits	Grading scale	Recurrence	Version
Oral examination	4	Grade to a third	Each winter term	1

Competence Certificate
oral exam, 20 min.

Prerequisites
none

T 11.379 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-102597 - Compulsory Elective Module Mechanical Engineering
M-MACH-102607 - Major Field: Vehicle Technology
M-MACH-102618 - Major Field: Production Technology
M-MACH-102628 - Major Field: Lightweight Construction

Type	Credits	Grading scale	Recurrence	Version
Oral examination	4	Grade to a third	Each winter term	1

Events					
WT 24/25	2149670	Product- and Production-Concepts for modern Automobiles	2 SWS	Lecture /	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 24/25, 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.

Zur Vertiefung des im Rahmen der Lehrveranstaltung erworbenen Wissens werden die theoretischen Vorlesungseinheiten durch Praxiseinheiten im Umfeld der Karlsruher Forschungsfabrik (https://www.karlsruher-forschungsfabrik.de) unterstützt.

The lecture is a block course. An application in Ilias is mandatory.

The theoretical lectures are complemented by practical lectures in the Karlsruhe Research Factory (https://www.karlsruher-forschungsfabrik.de/en.html) to deepen the acquired knowledge.

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 11.380 Course: Product Development - Dimensioning of Components [T-MACH-105383]

Responsible: Dr.-Ing. Stefan Dietrich
Prof. Dr.-Ing. Volker Schulze

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102593 - Product Development - Dimensioning of Components

Type	Credits	Grading scale	Recurrence	Version
Written examination	7	Grade to a third	Each summer term	1

Events					
ST 2024	2150511	Product Development - Component Dimensioning		Lecture / Practice (/ 🗣	Schulze, Dietrich
Exams					
ST 2024	76-T-MACH-105383	Product Development - Dimensioning of Components			Schulze
WT 24/25	76-T-MACH-105383	Product Development - Dimensioning of Components			Schulze

Legend: 🖥 Online, 🧩 Blended (On-Site/Online), 🗣 On-Site, ✕ Cancelled

Competence Certificate
written exam (2 hours)

Prerequisites
none

Below you will find excerpts from events related to this course:

V Product Development - Component Dimensioning

2150511, SS 2024, SWS, Language: German, Open in study portal

Lecture / Practice (VÜ)
On-Site

Content
The aim of the lecture is to present the topics of the dimensioning and the material science in their connection and to learn how to deal with corresponding methods and the combination thereof.

For the prospective engineer the most important educational objective is to understand the interaction of these topics while the interplay of the individual material stresses in the component are clarified.

The topics in detail are

Structural dimensioning: basic stresses, superimposed stresses, notch influence, fatigue limit, fatigue strength, assessment of cracked components, operational strength, residual stresses, high temperature stress and corrosion

Material selection: Basics, material indices, material selection diagrams, Ashby procedure, multiple boundary conditions, target conflicts, shape and efficiency.

Learning target: The students…

are capable to design and dimension components according to their load.

can include mechanical material properties from the mechanical material test in the dimensioning process.

can identify superimposed total loads and critical loads on simple components and to compute them.

acquire the skill to select materials based on the application area of the components and respective loads.

Examination: written exam (2 hours)

Organizational issues
Freitags generell nach Vereinbarung

Literature
Vorlesungsskript

T 11.381 Course: Product Lifecycle Management [T-MACH-105147]

Responsible: Prof. Dr.-Ing. Jivka Ovtcharova
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102405 - Fundamentals and Methods of General Mechanical Engineering
M-MACH-102597 - Compulsory Elective Module Mechanical Engineering
M-MACH-102739 - Fundamentals and Methods of Automotive Engineering
M-MACH-102740 - Fundamentals and Methods of Mechatronics and Microsystem Technology
M-MACH-102741 - Fundamentals and Methods of Product Development and Construction
M-MACH-102742 - Fundamentals and Methods of Production Technology

Type	Credits	Grading scale	Recurrence	Version
Written examination	4	Grade to a third	Each winter term	2

Events					
WT 24/25	2121350	Product Lifecycle Management	2 SWS	Lecture / 🗣	Ovtcharova, Elstermann
Exams					
ST 2024	76-T-MACH-105147	Product Lifecycle Management			Ovtcharova, Elstermann
WT 24/25	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 24/25, 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 11.382 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-102597 - Compulsory Elective Module Mechanical Engineering
M-MACH-102607 - Major Field: Vehicle Technology

Type	Credits	Grading scale	Recurrence	Version
Oral examination	4	Grade to a third	Each summer term	2

Events					
ST 2024	2123364	Product, Process and Resource Integration in the Automotive Industry	2 SWS	Lecture / Practice (/ 🗣	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 2024, 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 11.383 Course: Production Techniques Laboratory [T-MACH-105346]

Responsible: Prof. Dr.-Ing. Barbara Deml
Prof. Dr.-Ing. Jürgen Fleischer
Prof. Dr.-Ing. Kai Furmans
Prof. Dr.-Ing. Jivka Ovtcharova

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102591 - Laboratory Course
M-MACH-102618 - Major Field: Production Technology
M-MACH-102629 - Major Field: Logistics and Material Flow Theory

Type	Credits	Grading scale	Recurrence	Version
Completed coursework	4	pass/fail	Each summer term	3

Events					
ST 2024	2110678	Production Techniques Laboratory	4 SWS	Practical course / Blended	Deml, Fleischer, Furmans, Meyer
Exams					
ST 2024	76-T-MACH-105346	Production Techniques Laboratory			Deml, Furmans, Ovtcharova, Schulze

Legend: Online, Blended (On-Site/Online), On-Site, × Cancelled

Competence Certificate
Advanced Internship: Participate in practicle exercise courses and complete the colloquia successfully.

Elective Subject: Participate in practicle exercise courses and complete the colloquia successfully and presentation of a specific topic.

Prerequisites
The course is limited in capacity, therefore the allocation of places is based on § 5 (4) in the Study and Examination Regulations

This results in the following selection criteria:

The selection is based

- on the study progress (here the study progress in credit points and not the study progress in semesters is taken as a basis),
- on the waiting period in the case of equal progress in studies
- by lot if the waiting period is the same.

The procedure is explained in more detail on ILIAS.

Successful participation requires active and continuous participation in the course.

Below you will find excerpts from events related to this course:

V Production Techniques Laboratory

2110678, SS 2024, 4 SWS, Language: German, Open in study portal

Practical course (P)
Blended (On-Site/Online)

Content

The production technique laboratory (PTL) is a collaboration of the institutes wbk, IFL, IMI and ifab.

1. Information management for I4.0 (IMI)
2. VR-supported product development (IMI)
3. Production of parts with CNC turning machines (wbk)
4. Controlling of production systems using PLCs (wbk)
5. Automated assembly systems (wbk)
6. Flexible material flow in the age of Industry 4.0 (IFL)
7. Identification in production and logistics (IFL)
8. Storage and order-picking systems (IFL)
9. Production Management (ifab)
10. Time study (ifab)
11. Accomplishment of workplace design (ifab)

Recommendations:

Participation in the following lectures:

- Informationssystems in logistics and supply chain management
- Material flow in logistic systems
- Manufacturing technology
- Human Factors Engineering

Learning Objects:

The students acquire in the lab profound knowledge about the scientific theories, principles and methods of Production Engineering. Afterwards they are able to evaluate and design complex production systems according to problems of manufacturing and process technologies, materials handling, handling techniques, information engineering as well as production organisation and management.

After completion this lab, the students are able

- to analyse and solve planning and layout problems of the discussed fields,
- to evaluate and configure the quality and efficiency of production, processes and products,
- to plan, control and evaluate the production of a production enterprise,
- to configure and evaluate the IT architecture of a production enterprise,
- to design and evaluate appropriate techniques for conveying, handling and picking within a production system,
- to design and evaluate the part production and the assembly by considering the work processes and the work places.

Organizational issues

Anwesenheitspflicht, Teilnehmerzahl begrenzt. Anmeldung über ILIAS

Arbeitsaufwand von 120 h (=4 LP).

Nachweis: **bestanden / nicht bestanden**

Regelmäßige Teilnahme an Praktikumsversuchen und erfolgreiche Eingangskolloquien.

Zur Vertiefung des im Rahmen der Lehrveranstaltung erworbenen Wissens werden die theoretischen Vorlesungseinheiten durch Praxiseinheiten unterstützt.

Literature

Das Skript und Literaturhinweise stehen auf ILIAS zum Download zur Verfügung.

T 11.384 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-102597 - Compulsory Elective Module Mechanical Engineering
M-MACH-102599 - Major Field: Powertrain Systems
M-MACH-102605 - Major Field: Engineering Design
M-MACH-102607 - Major Field: Vehicle Technology
M-MACH-102618 - Major Field: Production Technology
M-MACH-102623 - Major Field: Fundamentals of Energy Technology

Type	Credits	Grading scale	Recurrence	Version
Written examination	4	Grade to a third	Each summer term	2

Events					
ST 2024	2150605	Production Technology for E-Mobility	2 SWS	Lecture / 🗣	Fleischer
Exams					
ST 2024	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 2024, 2 SWS, Language: German, Open in study portal

Lecture (V)
On-Site

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

Organizational issues
Zur Vertiefung des im Rahmen der Lehrveranstaltung erworbenen Wissens werden die theoretischen Vorlesungseinheiten durch Praxiseinheiten im Umfeld der Karlsruher Forschungsfabrik (https://www.karlsruher-forschungsfabrik.de) unterstützt.

The theoretical lectures are complemented by practical lectures in the Karlsruhe Research Factory (https://www.karlsruher-forschungsfabrik.de/en.html) to deepen the acquired knowledge.

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 11.385 Course: Productivity Management in Production Systems [T-MACH-105523]

Responsible: Prof. Dr.-Ing. Sascha Stowasser
Organisation: KIT Department of Mechanical Engineering

Part of:
M-MACH-102597 - Compulsory Elective Module Mechanical Engineering
M-MACH-102600 - Major Field: Man - Technology - Organisation
M-MACH-102613 - Major Field: Lifecycle Engineering
M-MACH-102618 - Major Field: Production Technology
M-MACH-102629 - Major Field: Logistics and Material Flow Theory

Type	Credits	Grading scale	Recurrence	Version
Oral examination	4	Grade to a third	Each summer term	1

Events					
ST 2024	2110046	Productivity Management in Production Systems	3 SWS	/ 🗣	Stowasser
Exams					
ST 2024	76-T-MACH-105523	Productivity Management in Production Systems			Deml, Stowasser

Legend: 🖥 Online, ⚙ Blended (On-Site/Online), 🗣 On-Site, ✕ Cancelled

Competence Certificate
oral exam (approx. 30 min)

The exam is offered in German only!

Prerequisites
none

Annotation
The course is capacity-limited, therefore the **allocation of places** is based on § 5 para. 4 in the module handbook: **Registration and admission to module examinations and courses** . This results in the following selection criteria:

- Students of the degree program have priority over students from outside the degree program

- Among students within the degree program, a decision may be made based on academic progress (not just with subject semesters)
- In the case of equal academic progress according to waiting time
- In the case of equal waiting time by lot

The exact procedure is explained on **ILIAS**.

"Successful participation requires active and continuous participation in the course."

Below you will find excerpts from events related to this course:

V Productivity Management in Production Systems

2110046, SS 2024, 3 SWS, Language: German, Open in study portal **On-Site**

Content

1. Definition and terminology of process design and industrial engineering
2. Tasks of industrial engineering
3. Actual approaches of organisation of production (Holistic production systems, Guided group work et al.)
4. Methods and principles of industrial engineering and production systems
5. Case studies and exercises for process design
6. Industry 4.0

Requirements:

- Compact course (one week full-time)
- Limited number of participants; seats are assigned according the date of registration
- Registration via ILIAS is required
- Compulsory attendance during the whole lecture

Recommendations:

- Knowledge of work science is helpful

Learning objective:

- Ability to design work operations and processes effecitvely and efficiently
- Instruction in methods of time study (MTM, Data acquisition etc.)
- Instruction in methods and principles of process design
- The Students are able to apply methods for the design of workplaces, work operations and processes.
- The Students are able to apply actual approaches of process and production organisation.

Literature
Das Skript und Literaturhinweise stehen auf ILIAS zum Download zur Verfügung.

T 11.386 Course: Programming in CAE-Applications [T-MACH-111431]

Responsible: Prof. Dr.-Ing. Luise Kärger
Organisation: KIT Department of Mechanical Engineering
Lightweight Design
Part of: M-MACH-102605 - Major Field: Engineering Design
M-MACH-102611 - Major Field: Materials Science and Engineering
M-MACH-102628 - Major Field: Lightweight Construction
M-MACH-102632 - Major Field: Polymer Engineering

Type	Credits	Grading scale	Recurrence	Expansion	Version
Completed coursework	4	pass/fail	Each winter term	1 terms	2

Events					
WT 24/25	2113109	Programming in CAE-Applications	2 SWS	Practical course /	Kärger
Exams					
WT 24/25	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 24/25, 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 Veranstaltung findet immer dienstags um 15:45 Uhr am Campus Ost in Geb. 70.04, Raum 219 statt.

Aufgrund des gewünschten Betreuungsverhältnisses und der Institutsausstattung ist die maximale Anzahl der teilnehmenden Studierenden begrenzt. Die vorläufige Anmeldung erfolgt über das zugehören Formular auf der Instituts-Homepage (https://www.fast.kit.edu/lbt/1205.php), welches Mitte September dort zusammen mit weiteren Details veröffentlicht wird. Bei zu vielen Interessenten findet eine Auswahl unter allen Interessenten statt.

The event takes place every Tuesday at 3:45 p.m. on Campus East in building 70.04, room 219.

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 in the mid of September. If there are too many interested students, a selection will take place among all interested students.

T 11.387 Course: Project Internship Additive Manufacturing: Development and Production of an Additive Component [T-MACH-110960]

Responsible: Prof. Dr.-Ing. Frederik Zanger
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102605 - Major Field: Engineering Design
M-MACH-102611 - Major Field: Materials Science and Engineering
M-MACH-102615 - Major Field: Medical Technology
M-MACH-102618 - Major Field: Production Technology
M-MACH-102628 - Major Field: Lightweight Construction

Type	Credits	Grading scale	Recurrence	Version
Examination of another type	4	Grade to a third	Each winter term	2

Events					
WT 24/25	2149700	Project Internship Aditive Manufacturing: Development and Production of an Additive Component	2 SWS	Practical course / 🗣	Zanger, Frey

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

Modeled Conditions
The following conditions have to be fulfilled:

1. The course T-MACH-110983 - Project Internship Aditive Manufacturing: Development and Production of an Additive Component must not have been started.

Below you will find excerpts from events related to this course:

V Project Internship Aditive Manufacturing: Development and Production of an Additive Component

Practical course (P)
On-Site

2149700, WS 24/25, 2 SWS, Language: German, Open in study portal

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).
- 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
Die Veranstaltung beginnt mit einer Blockveranstaltung vor Semesterbeginn. Während des Semesters finden nur einzelne Pflichtveranstaltungen statt. Die genauen 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.

T 11.388 Course: Project Internship Aditive Manufacturing: Development and Production of an Additive Component [T-MACH-110983]

Responsible: Prof. Dr.-Ing. Frederik Zanger
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102591 - Laboratory Course

Type	Credits	Grading scale	Recurrence	Version
Completed coursework (oral)	4	pass/fail	Each winter term	2

Events					
WT 24/25	2149700	Project Internship Aditive Manufacturing: Development and Production of an Additive Component	2 SWS	Practical course / 🗣	Zanger, Frey

Legend: 🖥 Online, ⚙ Blended (On-Site/Online), 🗣 On-Site, ✕ Cancelled

Competence Certificate
Alternative Achievement (oral):

The competence certificate is a project work. 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

Modeled Conditions
The following conditions have to be fulfilled:

1. The course T-MACH-110960 - Project Internship Additive Manufacturing: Development and Production of an Additive Component must not have been started.

Below you will find excerpts from events related to this course:

V Project Internship Aditive Manufacturing: Development and Production of an Additive Component

Practical course (P)
On-Site

2149700, WS 24/25, 2 SWS, Language: German, Open in study portal

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).
- 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
Die Veranstaltung beginnt mit einer Blockveranstaltung vor Semesterbeginn. Während des Semesters finden nur einzelne Pflichtveranstaltungen statt. Die genauen 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.

T 11.389 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-102597 - Compulsory Elective Module Mechanical Engineering
M-MACH-102607 - Major Field: Vehicle Technology

Type	Credits	Grading scale	Recurrence	Version
Oral examination	6	Grade to a third	Each term	1

Events					
ST 2024	2115817	Project Workshop: Automotive Engineering	3 SWS	Lecture / 🗣	Gauterin, Gießler, Frey
WT 24/25	2115817	Project Workshop: Automotive Engineering	3 SWS	Lecture / 🗣	Gießler, Frey
Exams					
ST 2024	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 2024, 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:

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 24/25, 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 11.390 Course: ProVIL - Product Development in a Virtual Idea Laboratory [T-MACH-106738]

Responsible: Prof. Dr.-Ing. Albert Albers
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102591 - Laboratory Course

Type	Credits	Grading scale	Recurrence	Version
Completed coursework	4	pass/fail	Each summer term	1

Events					
ST 2024	2146210	ProVIL - Product Development in a Virtual Idea Laboratory	4 SWS	Lecture / 🖥	Albers, Düser
Exams					
ST 2024	76-T-MACH-106738	ProVIL - Product development in a Virtual Idea Laboratory			Albers, Düser

Legend: 🖥 Online, Blended (On-Site/Online), On-Site, × Cancelled

Competence Certificate
colloquia and presentations.

Prerequisites
none

Below you will find excerpts from events related to this course:

V ProVIL - Product Development in a Virtual Idea Laboratory

2146210, SS 2024, 4 SWS, Language: German, Open in study portal

Lecture (V)
Online

Content
Content

The course ProVIL is carried out as an innovation project with 4 phases and a reality-related task. Using state-of-the-art hardware and software, the students develop their own product concepts in a team and carry out the following activities:

- Analysis of the existing market and the environment of a product area
- Identification and analysis of customer requirements
- Modelling of customer and user benefits as product profiles
- Validation of product profiles for target customer markets
- Generation of solution ideas for the technical implementation of product profiles
- Evaluation and selection of the best ideas
- Implementation of the selected ideas in functional prototypes
- Evaluation of the functional prototypes through planning, implementation, evaluation and interpretation of appropriate

Experiments

- Presentation of the prototypes in a closing event

Prerequisites

none

T 11.391 Course: Public Law I & II [T-INFO-112672]

Responsible: N.N.
Organisation: KIT Department of Informatics
Part of: M-MACH-102596 - Compulsory Elective Subject Economics/Law

Type	Credits	Grading scale	Recurrence	Version
Completed coursework (written)	6	pass/fail	Each summer term	2

Events					
ST 2024	24520	Öffentliches Recht II - Öffentliches Wirtschaftsrecht	2 SWS	Lecture / 🗣	Zufall
WT 24/25	24016	Öffentliches Recht I - Grundlagen	2 SWS	Lecture / 🗣	Zufall
Exams					
ST 2024	7500298	Public Law I & II			Zufall
WT 24/25	7500138	Public Law I & II			Zufall

Legend: 🖥 Online, Blended (On-Site/Online), 🗣 On-Site, ✕ Cancelled

T 11.392 Course: Python Algorithm for Vehicle Technology [T-MACH-110796]

Responsible: Stephan Rhode
Organisation:
Part of: M-MACH-102607 - Major Field: Vehicle Technology

Type	Credits	Grading scale	Recurrence	Version
Written examination	4	Grade to a third	Each summer term	1

Events					
ST 2024	2114862	Python Algorithms for Automotive Engineering	2 SWS	Lecture / ✕	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 2024, 2 SWS, Language: German, Open in study portal

Lecture (V)
Cancelled

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
Die Vorlesung wird im erst wieder im Sommersemester 2025 stattfinden.

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 11.393 Course: Quality Management [T-MACH-102107]

Responsible: Prof. Dr.-Ing. Gisela Lanza
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102597 - Compulsory Elective Module Mechanical Engineering
M-MACH-102605 - Major Field: Engineering Design
M-MACH-102618 - Major Field: Production Technology
M-MACH-102640 - Major Field: Technical Logistics
M-MACH-102642 - Major Field: Development of Innovative Appliances and Power Tools

Type	Credits	Grading scale	Recurrence	Version
Written examination	4	Grade to a third	Each winter term	3

Events					
WT 24/25	2149667	Quality Management	2 SWS	Lecture / Blended	Lanza, Stamer
Exams					
ST 2024	76-T-MACH-102107	Quality Management			Lanza

Legend: Online, Blended (On-Site/Online), On-Site, Cancelled

Competence Certificate
Written Exam (60 min)

Prerequisites
It is not possible to combine this brick with brick Quality Management [T-MACH-112586].

Modeled Conditions
The following conditions have to be fulfilled:

1. The course T-MACH-112586 - Quality Management must not have been started.

Below you will find excerpts from events related to this course:

V Quality Management

2149667, WS 24/25, 2 SWS, Language: German, Open in study portal

Lecture (V)
Blended (On-Site/Online)

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
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 11.394 Course: Quality Management [T-MACH-112586]

Responsible: Prof. Dr.-Ing. Gisela Lanza
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102596 - Compulsory Elective Subject Economics/Law

Type	Credits	Grading scale	Recurrence	Version
Completed coursework	4	pass/fail	Each winter term	4

Events					
WT 24/25	2149667	Quality Management	2 SWS	Lecture / Blended	Lanza, Stamer
Exams					
ST 2024	76-T-MACH-112586	Quality Management			Lanza

Legend: Online, Blended (On-Site/Online), On-Site, Cancelled

Competence Certificate
Written Exam (60 min)

Prerequisites
It is not possible to combine this brick with brick quality management [T-MACH-102107].

Modeled Conditions
The following conditions have to be fulfilled:

1. The course T-MACH-102107 - Quality Management must not have been started.

Below you will find excerpts from events related to this course:

V Quality Management — **Lecture (V)** **Blended (On-Site/Online)**
2149667, WS 24/25, 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

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 11.395 Course: Quantum Machines I [T-MACH-113827]

Responsible: Prof. Dr. Marcel Utz
Organisation: KIT Department of Mechanical Engineering
Part of: M-MACH-102616 - Major Field: Microsystem Technology

Type	Credits	Grading scale	Recurrence	Expansion	Version
Written examination	4	Grade to a third	Each winter term	1 terms	1

Competence Certificate
Written exam, duration: 90 minutes

Prerequisites
none

Recommendation

- A standard BSc degree in mechanical, materials or electrical engineering
- Solid knowledge of engineering mechanics, including statics, dynamics and mechanics of materials.
- Basic knowledge of engineering thermodynamics.
- Proficiency in complex numbers, including their algebraic and polar forms.
- Understanding of linear algebra, including vector spaces, matrices, eigenvalues and eigenvectors.
- Familiarity with ordinary differential equations (ODEs) and their solutions, especially as they relate to physical systems.

T 11.396 Course: Quantum Machines II [T-MACH-113826]

Responsible: Prof. Dr. Marcel Utz
Organisation: KIT Department of Mechanical Engineering
Part of: M-MACH-102616 - Major Field: Microsystem Technology

Type	Credits	Grading scale	Recurrence	Expansion	Version
Written examination	4	Grade to a third	Each summer term	1 terms	1

Competence Certificate
Written exam, duration: 90 minutes

Prerequisites
none

Recommendation

- A standard BSc degree in mechanical, materials or electrical engineering
- Solid knowledge of engineering mechanics, including statics, dynamics and mechanics of materials.
- Basic knowledge of engineering thermodynamics.
- Foundations of quantum mechanics (Quantum Machines I is recommended).
- Proficiency in complex numbers, including their algebraic and polar forms.
- Understanding of linear algebra, including vector spaces, matrices, eigenvalues and eigenvectors.
- Familiarity with ordinary differential equations (ODEs) and their solutions, especially as they relate to physical systems.

T 11.397 Course: Rail System Technology [T-MACH-106424]

Responsible: Prof. Dr.-Ing. Martin Cichon
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102597 - Compulsory Elective Module Mechanical Engineering
M-MACH-102641 - Major Field: Rail System Technology

Type	Credits	Grading scale	Recurrence	Version
Oral examination	4	Grade to a third	Each term	3

Events					
ST 2024	2115919	Rail System Technology	2 SWS	Lecture / 🗣	Cichon
WT 24/25	2115919	Rail System Technology	2 SWS	Lecture / 🗣	Cichon
Exams					
ST 2024	76-T-MACH-106424	Rail System Technology			Cichon, Ziesel, Berthold
WT 24/25	76-T-MACH-106424	Rail System Technology			Cichon

Legend: 🖥 Online, ⚙ Blended (On-Site/Online), 🗣 On-Site, ✕ Cancelled

Competence Certificate
oral examination in German language
Duration: approx. 30 minutes
No tools or reference materials may be used during the exam except calculator and dictionary

Prerequisites
none

Below you will find excerpts from events related to this course:

V Rail System Technology

2115919, SS 2024, 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

Organizational issues
ab SS 2024 schriftliche Prüfung

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 24/25, 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 11.398 Course: Rail Vehicle Technology [T-MACH-105353]

Responsible: Prof. Dr.-Ing. Martin Cichon
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102597 - Compulsory Elective Module Mechanical Engineering
M-MACH-102641 - Major Field: Rail System Technology

Type	Credits	Grading scale	Recurrence	Version
Oral examination	4	Grade to a third	Each term	3

Events					
ST 2024	2115996	Rail Vehicle Technology	2 SWS	Lecture / 🗣	Cichon
WT 24/25	2115996	Rail Vehicle Technology	2 SWS	Lecture / 🗣	Cichon
Exams					
ST 2024	76-T-MACH-105353	Rail Vehicle Technology			Cichon, Ziesel, Berthold
WT 24/25	76-T-MACH-105353	Rail Vehicle Technology			Cichon

Legend: 🖥 Online, ⚙ Blended (On-Site/Online), 🗣 On-Site, ✕ Cancelled

Competence Certificate
oral examination in German language
Duration: approx 30 minutes
No tools or reference materials may be used during the exam except calculator and dictionary

Prerequisites
none

Below you will find excerpts from events related to this course:

V Rail Vehicle Technology
2115996, SS 2024, 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

Organizational issues
ab SS 2024 schriftliche Prüfung

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 24/25, 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).

T 11.399 Course: Railways in the Transportation Market [T-MACH-105540]

Responsible: Prof. Dr.-Ing. Martin Cichon
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102597 - Compulsory Elective Module Mechanical Engineering
M-MACH-102641 - Major Field: Rail System Technology

Type	Credits	Grading scale	Recurrence	Version
Oral examination	4	Grade to a third	Each summer term	1

Events					
ST 2024	2114914	Railways in the Transportation Market	2 SWS	Block / 🗣	Cichon
Exams					
ST 2024	76-T-MACH-105540	Railways in the Transportation Market			Cichon

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 2024, 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 **20.06./21.06./22.06.2024 von 9.00 bis 16.00 Uhr** am Campus Ost. Geb. 70.04, R 220 in Präsenz statt. Die Prüfung findet am 11.07.2024 in Präsenz statt.
Näheres siehe Homepage http://www.fast.kit.edu/bst/929.php

Literature
keine

T 11.400 Course: Rapid Industrialization of Immature Products using the Example of Electric Mobility [T-MACH-113031]

Responsible: Dr. Jörg Bauer
Organisation: KIT Department of Mechanical Engineering
Part of: M-MACH-102600 - Major Field: Man - Technology - Organisation
M-MACH-102601 - Major Field: Automation Technology
M-MACH-102618 - Major Field: Production Technology
M-MACH-102629 - Major Field: Logistics and Material Flow Theory
M-MACH-102640 - Major Field: Technical Logistics
M-MACH-102642 - Major Field: Development of Innovative Appliances and Power Tools

Type	Credits	Grading scale	Recurrence	Expansion	Version
Written examination	4	Grade to a third	Each winter term	1 terms	1

Events					
WT 24/25	2149621	Rapid Industrialization of Immature Products using the Example of Electric Mobility	2 SWS	Lecture / 🗣	Bauer
Exams					
ST 2024	76-T-MACH-113031	Rapid Industrialization of Immature Products using the Example of Electric Mobility			Bauer

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 Rapid Industrialization of Immature Products using the Example of Electric Mobility

Lecture (V)
On-Site

2149621, WS 24/25, 2 SWS, Language: German, Open in study portal

Content

The lecture "Rapid Industrialization of Immature Products using the Example of Electric Mobility" deals with production engineering methods for the robust and cost-effective production of technologically novel, so-called "immature" products. In this context, approaches for solving the central challenges resulting from the tension triangle of product development, industrialization and production are identified and discussed.

Based on the motivation for rapid market entry, the current approach involving stakeholders and other participants is explained. On this basis, key enablers for rapid and targeted industrialization are derived and discussed. For example, robust industrial processes based on flexible equipment are an essential core element for cost-effective production. Against this background, industry-relevant concepts for the automation and flexibilization of production processes are presented in the lecture in order to be able to deal efficiently and effectively with product-specific changes on the production side. Therefore, the main goal of an industrialization process is to develop production technologies and processes that enable robust, resource-efficient and cost-effective manufacturing of established and innovative products.

The lecture is structured as follows:

1. Motivation for rapid industrialization (complex market requirements, shortened development and product cycles, decreasing quantities per variant, ...).
2. Industrialization methods (simultaneous engineering, releases, frozen zones, high volumes, ...)
3. Key enablers to accelerate industrialization (simulation and digitalization, flexible and digital production equipment
4. Supply chains and suppliers
5. Testing and deployment
6. Ramp-up

Learning Outcomes:

- The students are familiar with the essential elements of simultaneous engineering and industrialization (motivation, processes, fields of action, challenges).
- The Students know the key enablers for the rapid industrialization of immature products (digitization, flexible production equipment, rapid manufacturing processes for primary production).
- The Students are familiar with the basic principles, methods and procedures of the main enablers. The understanding is deepened through theory, case and practical examples.
- The toolbox of key enablers described in the lecture allows students to select and independently apply the enablers in the context of future challenges.
- The Students are able to disseminate and to apply the knowledge acquired during the lecture in their future working lives.

Workload:

regular attendance: 21 hours
self-study: 99 hours

Organizational issues

Blockvorlesung im Januar/Februar 2025. Termine und Ort werden online bekannt gegeben. (http://www.wbk.kit.edu/studium-und-lehre.php).

Block course in January/February 2025. Timetable and location will be published online. (http://www.wbk.kit.edu/studium-und-lehre.php).

Literature

Foliensatz zur Veranstaltung wird über Ilias (https://ilias.studium.kit.edu/) bereitgestellt.

Lecture notes will be provided in Ilias (https://ilias.studium.kit.edu/).

T 11.401 Course: Re:Invent - Revolutionary Business Models as the Basis for Product Innovations [T-MACH-111888]

Responsible: Dr.-Ing. Thomas Schneider
Organisation: KIT Department of Mechanical Engineering
Part of: M-MACH-102597 - Compulsory Elective Module Mechanical Engineering
M-MACH-102600 - Major Field: Man - Technology - Organisation
M-MACH-102605 - Major Field: Engineering Design
M-MACH-102614 - Major Field: Mechatronics
M-MACH-102642 - Major Field: Development of Innovative Appliances and Power Tools
M-MACH-104323 - Major Field: Innovation and Entrepreneurship

Type	Credits	Grading scale	Recurrence	Expansion	Version
Oral examination	4	Grade to a third	Each summer term	1 terms	1

Events					
ST 2024	2147177	Re:Invent - Revolutionary Business Models as the Basis for Product Innovations (Lecture)	2 SWS	Lecture / 🗣	Schneider
Exams					
ST 2024	76-T-MACH-111888	Re:Invent - Revolutionary business models as the basis for product innovations			Schneider, Matthiesen

Legend: 🖥 Online, 🔀 Blended (On-Site/Online), 🗣 On-Site, ✕ Cancelled

Competence Certificate
Oral exam, duration: approx. 20 minutes

Prerequisites
None

T 11.402 Course: Reactor Safety I: Fundamentals [T-MACH-105405]

Responsible: Dr. Victor Hugo Sanchez-Espinoza
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102597 - Compulsory Elective Module Mechanical Engineering
M-MACH-102608 - Major Field: Nuclear Energy

Type	Credits	Grading scale	Recurrence	Version
Oral examination	4	Grade to a third	Each summer term	1

Events					
ST 2024	2189465	Reactor Safety I: Fundamentals	2 SWS	Lecture / 🗣	Sanchez-Espinoza, Zhang
Exams					
ST 2024	76-T-MACH-105405	Reactor Safety I: Fundamentals			Sanchez-Espinoza
WT 24/25	76-T-MACH-105405	Reactor Safety I: Fundamentals			Sanchez-Espinoza

Legend: 🖥 Online, ⚙ Blended (On-Site/Online), 🗣 On-Site, ✕ Cancelled

Competence Certificate
oral exam about 30 minutes

Prerequisites
none

Below you will find excerpts from events related to this course:

V Reactor Safety I: Fundamentals
2189465, SS 2024, 2 SWS, Language: German/English, Open in study portal

Lecture (V)
On-Site

Content
This lecture will be given in English, if required in German

The lecture discuss the fundamental principles and concepts of reactor safety including the methologies for safety assessment and major accidents.

In the lecture, the fundamental principles and concepts of reactor safety are discussed. They facilitate the assessment of the safety status of nuclear power plants and the interpretation of incidents or accidents as such as Chernobyl or Fukushima. Starting with the explanations of the technical safety features of reactor systems, the safety concepts of different reactor types are discussed. The initiation and progression of incidents/accidents as well as the methods for the safety evaluation are also treated in the lecture. Discussing the Fukushima accident, the radiological risk from nuclear power plants together with the counter measures to stop severe accident and to limit the consequences will be explained. Finally, new development to increase the safety or reactors of Generation III and IV will be presented.

Lecture Content:

- National and international nuclear regulations
- Fundamental principles of reactor safety
- Implementation of safety principles in nuclear power plants of generation 2
- Methods for safety analysis and safety assessment
- Key physical phenomena during severe accidents determining radiological impact
- How to analyse reactor accidents with numerical simulation tools
- Discussion severe accidents e.g. the Fukushima accident

Lernziele

Lecture Content:

- National and international nuclear regulations
- Fundamental principles of reactor safety
- Implementation of safety principles in nuclear power plants of generation 2
- Safety analysis and methods for safety assessment
- Nuclear events and accidents and its evaluation methods
- Discussion severe accidents

Knowledge in energy technology, nuclear power plants, reactor physics, thermal hydraulic of nuclear reactors is welcomed

regular attendance: 30 h
self-study: 60 h

Zielgruppe: Students of Mechanical Engineering,

oral examination, duration approximately 30 minutes

Organizational issues
Mündliche Prüfung (Oral examination)

Anmeldung im ILIAS (Registration through ILIAS)

Literature

- A. Ziegler, Lehrbuch der Reaktortechnik Band 1 und 2, Springer Verlag, 1986
- D. Smidt, Reaktorsicherheitstechnik. Springer-Verlag Berlin Heidelberg New York. 1979
- D. Smidt, Reaktortechnik, Band 2, Verlag G. Braun, Karlsruhe, 1976

- G. Kessler at al; Risks of Nuclear Energy Technology- Safety Concepts of Light Water Reactors. Springer Verlag 2014.
- B. R. Sehgal; Nuclear Safety in LWR: Severe Accident Phenomenology. Academic Press Elsevier. 2012.
- John C. Lee and Norman J. McCormick.July; Risk and Safety Analysis of Nuclear Systems. 2011
- G. Petrangeli; Nuclear Safety. Elsevier Butterworth-Heinemann. 2006
- J. N. Lillington; Light Water Reactor Safety: The Development of Advanced Models and Codes for Light Water Reactor Safety Analysis. Elsevier 1995.

T 11.403 Course: Reduction Methods for the Modeling and the Simulation of Combustion Processes [T-MACH-105421]

Responsible: Dr. Viatcheslav Bykov
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102597 - Compulsory Elective Module Mechanical Engineering
M-MACH-102612 - Major Field: Modeling and Simulation in Energy- and Fluid Engineering
M-MACH-102635 - Major Field: Engineering Thermodynamics

Type	Credits	Grading scale	Recurrence	Version
Oral examination	4	Grade to a third	Each summer term	1

Events					
ST 2024	2166543	Reduction methods for the modeling and the simulation of combustion processes	2 SWS	Lecture / 🗣	Bykov

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 Reduction methods for the modeling and the simulation of combustion processes

Lecture (V)
On-Site

2166543, SS 2024, 2 SWS, Language: German/English, Open in study portal

Content
The course will introduce the principles of model reduction of chemical kinetic models of combustion processes. The basic mathematical concepts and methods of analysis of chemical reaction mechanisms will be outlined in the context of model reduction. The detailed implementation scheme of model reduction will be introduced. The course will cover simplified and idealized models of combustion (e.g. auto-ignition, explosion, deflagration etc.), which will be analyzed and reduced. The main analytical methods and numerical tools will be presented, evaluated and illustrated by using these simple examples.

Organizational issues
Termin: Mi, 14:00-15:30. Für Änderungen siehe Aushang im ITT-Schaukasten und auf der Internetseite des Instituts.

Literature
N. Peters, B. Rogg: Reduced kinetic mechanisms for aplication in combustion systems, Lecture notes in physics, 15, Springer Verlag, 1993.

T 11.404 Course: Registration for Certificate Issuance - Supplementary Studies on Science, Technology and Society [T-FORUM-113587]

Responsible: Dr. Christine Mielke
Christine Myglas

Organisation:

Part of: M-FORUM-106753 - Supplementary Studies on Science, Technology and Society

Type	Credits	Grading scale	Recurrence	Version
Completed coursework	0	pass/fail	Each term	1

Prerequisites
In order to register, it is mandatory that the basic module and the advanced module have been completed and that the grades for the partial performances in the advanced module are available.

T 11.405 Course: Reliability and Test Engineering [T-MACH-111840]

Responsible: Dr.-Ing. Thomas Gwosch
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102597 - Compulsory Elective Module Mechanical Engineering
M-MACH-102642 - Major Field: Development of Innovative Appliances and Power Tools

Type	Credits	Grading scale	Recurrence	Expansion	Version
Examination of another type	5	Grade to a third	Each winter term	1 terms	2

Events					
WT 24/25	2145350	Reliability and Test Engineering (Lecture)	1 SWS	Lecture / 🧩	Gwosch
WT 24/25	2145351	Workshop Reliability and Test Engineering	2 SWS	Practical course / 🗣	Gwosch
Exams					
WT 24/25	76-T-MACH-111840	Reliability and Test Engineering			Gwosch

Legend: 🖥 Online, 🧩 Blended (On-Site/Online), 🗣 On-Site, ✕ Cancelled

Competence Certificate
The grade is composed of the evaluation of a final report following the practical part. The assessment criteria are as follows:

- Structure of the report
- Comprehensibility and comprehensibility
- Preparation of the tests
- Use of test and reliability methods
- Formulation and answering of test hypotheses
- Test evaluation, comprehensible results

Attendance and active participation in the lab is mandatory.

Prerequisites
none

Recommendation
None

Below you will find excerpts from events related to this course:

V Reliability and Test Engineering (Lecture)
2145350, WS 24/25, 1 SWS, Language: German, Open in study portal

Lecture (V)
Blended (On-Site/Online)

Content
The students know the methods of reliability and test engineering and the components used. They learn the methods to carry out test planning, test execution and test interpretation for a given problem on a test bench.

The following contents are taught in the lecture:

- Relevance of reliability and test engineering in the industry.
- Overview of test equipment
- Test strategies and statistical test planning
- Testing with hypotheses
- Modelling of drive trains
- Experimental controller parameterization
- Reliability models

The implementation of test planning, test execution and test interpretation are carried out on a demonstrator test bench using the example of vibration-based condition monitoring on a drive train. Students learn how to use test benches and the integrated control and regulation systems as well as measurement technology.

In addition, the participants use Matlab to evaluate measurement data from the test bench.

Organizational issues
Die Teilnehmerzahl des Praktikums ist grundsätzlich beschränkt, weshalb eine Anmeldung erforderlich ist. Nähere Informationen befinden sich auf der Website des IPEK unter dem Titel der Lehrveranstaltung: https://www.ipek.kit.edu/2976.php

Die Veranstaltung findet im Block zusammen mit dem Workshopteil (LVNr. 2145351) statt.

Im WS24/25 wird die LV vom 14.-18.10. im Block stattfinden.

Arbeitsmaterialien/Skripte werden über ILIAS bereitgestellt.

Bei Fragen kontaktieren Sie bitte LRT@ipek.kit.edu

Literature
O'Connor: Test Engineering

O'Connor: Practical Reliability Engineering

Birolini: Reliability Engineering

Bertsche: Zuverlässigkeit mechatronischer Systeme

VDI 4002: Zuverlässigkeitsingenieur

Matlab Vibration Analysis of Rotating Machinery

V	**Workshop Reliability and Test Engineering** 2145351, WS 24/25, 2 SWS, Language: German, Open in study portal	**Practical course (P)** **On-Site**

Content
The students learn how to handle test benches and the control systems integrated in them, as well as measurement technology.

Practical implementation of test planning, test execution and test interpretation take place on a demonstrator test bench using the example of vibration-based condition monitoring of a drivetrain.

Evaluation of measurement data with Matlab.

Preparation and giving of a final presentation of the practical part is carried out at the end.

Organizational issues
Ort und Zeit wird im Vorlesungsblock bekanntgegeben und wird auch auf der Homepage der Veranstaltung auf der ipek-website veröffentlicht (https://www.ipek.kit.edu/2976.php).

Die Veranstaltung findet im Block zusammen mit dem Theorieteil (LVNr. 2145350) statt.

Im WS24/25 wird die LV vom 14.-18.10. im Block stattfinden.

Die Teilnehmerzahl des Praktikums ist grundsätzlich beschränkt, weshalb eine Anmeldung erforderlich ist. Nähere Informationen befinden sich auf der Website des IPEK unter dem Titel der Lehrveranstaltung,

Arbeitsmaterialien/Skripte werden über ILIAS bereitgestellt.

Bei Fragen schreiben Sie bitte an: LRT@ipek.kit.edu

Literature
siehe Vorlesung

T 11.406 Course: Renewable Energy-Resources, Technologies and Economics [T-WIWI-100806]

Responsible: Prof. Dr. Patrick Jochem
Organisation: KIT Department of Economics and Management
Part of: M-MACH-104323 - Major Field: Innovation and Entrepreneurship

Type	Credits	Grading scale	Recurrence	Version
Written examination	4	Grade to a third	Each winter term	7

Events					
WT 24/25	2581012	Renewable Energy – Resources, Technologies and Economics	2 SWS	Lecture / 🗣	Jochem
Exams					
ST 2024	7981012	Renewable Energy-Resources, Technologies and Economics			Fichtner

Legend: 🖥 Online, ⚄ Blended (On-Site/Online), 🗣 On-Site, × Cancelled

Competence Certificate
The assessment consists of a written exam (60 minutes, in English, answers are possible in German or English) (following §4(2) of the examination regulation). The exam takes place in every semester. Re-examinations are offered at every ordinary examination date. Depending on the respective pandemic situation, the exam may be offered as an open book exam (alternative exam assessment, following §4(2), 3 of the examination regulation).

Prerequisites
None.

Below you will find excerpts from events related to this course:

V Renewable Energy – Resources, Technologies and Economics

Lecture (V)
On-Site

2581012, WS 24/25, 2 SWS, Language: English, Open in study portal

Content
1. General introduction: Motivation, Global situation
2. Basics of renewable energies: Energy balance of the earth, potential definition
3. Hydro
4. Wind
5. Solar
6. Biomass
7. Geothermal
8. Other renewable energies
9. Promotion of renewable energies
10. Interactions in systemic context
11. Excursion to the "Energieberg" in Mühlburg

Learning Goals:

The student

- understands the motivation and the global context of renewable energy resources.
- gains detailed knowledge about the different renewable resources and technologies as well as their potentials.
- understands the systemic context and interactions resulting from the increased share of renewable power generation.
- understands the important economic aspects of renewable energies, including electricity generation costs, political promotion and marketing of renewable electricity.
- is able to characterize and where required calculate these technologies.

Organizational issues
Blockveranstaltung, freitags 14:00-17:00 Uhr, 25.10., 08.11., 22.11., 06.12., 20.12., 17.01., 31.01. 14.02.

Literature
Weiterführende Literatur:

- Kaltschmitt, M., 2006, Erneuerbare Energien : Systemtechnik, Wirtschaftlichkeit, Umweltaspekte, aktualisierte, korrigierte und ergänzte Auflage Berlin, Heidelberg : Springer-Verlag Berlin Heidelberg.
- Kaltschmitt, M., Streicher, W., Wiese, A. (eds.), 2007, Renewable Energy: Technology, Economics and Environment, Springer, Heidelberg.
- Quaschning, V., 2010, Erneuerbare Energien und Klimaschutz : Hintergründe - Techniken - Anlagenplanung – Wirtschaftlichkeit München : Hanser, Ill.2., aktualis. Aufl.
- Harvey, D., 2010, Energy and the New Reality 2: Carbon-Free Energy Supply, Eathscan, London/Washington.
- Boyle, G. (ed.), 2004, Renewable Energy: Power for a Sustainable Future, 2nd Edition, Open University Press, Oxford.

T 11.407 Course: Robotics I - Introduction to Robotics [T-INFO-108014]

Responsible: Prof. Dr.-Ing. Tamim Asfour
Organisation: KIT Department of Informatics
Part of: M-MACH-102598 - Major Field: Advanced Mechatronics
M-MACH-102609 - Major Field: Cognitive Technical Systems
M-MACH-102615 - Major Field: Medical Technology
M-MACH-102633 - Major Field: Robotics
M-MACH-102647 - Major Field: Microactuators and Microsensors

Type	Credits	Grading scale	Recurrence	Version
Written examination	6	Grade to a third	Each winter term	2

Events					
WT 24/25	2424152	Robotics I - Introduction to Robotics		Lecture / 🗣	Asfour
Exams					
ST 2024	7500218	Robotik I - Einführung in die Robotik			Asfour
WT 24/25	7500106	Robotics I - Introduction to Robotics			Asfour

Legend: 🖥 Online, 🧩 Blended (On-Site/Online), 🗣 On-Site, ✕ Cancelled

Competence Certificate
The assessment is carried out as a written examination (§ 4 Abs. 2 No. 1 SPO) lasting 120 minutes.

Prerequisites
none.

Below you will find excerpts from events related to this course:

V Robotics I - Introduction to Robotics
2424152, WS 24/25, SWS, Language: English, Open in study portal

Lecture (V)
On-Site

Content
The lecture provides an overview of the fundamentals of robotics using the examples of industrial robots, service robots and autonomous humanoid robots. An insight into all relevant topics is given. This includes methods and algorithms for robot modeling, control and motion planning, image processing and robot programming. First, mathematical basics and methods for kinematic and dynamic robot modeling, trajectory planning and control as well as algorithms for collision-free motion planning and grasp planning are covered. Subsequently, basics of image processing, intuitive robot programming especially by human demonstration and symbolic planning are presented.

In the exercise, the theoretical contents of the lecture are further illustrated with examples. Students deepen their knowledge of the methods and algorithms by independently working on problems and discussing them in the exercise. In particular, students can gain practical programming experience with tools and software libraries commonly used in robotics.

Workload:

Lecture with 3 SWS + 1 SWS Tutorial, 6 LP

6 LP corresponds to 180 hours, including

15 * 3= 45 hours attendance time (lecture)

15 * 1= 15 hours attendance time (tutorial)

15 * 6= 90 hours self-study and exercise sheets

30 hours preparation for the exam

Competency Goals:

The students are able to apply the presented concepts to simple and realistic tasks from robotics. This includes mastering and deriving the mathematical concepts relevant for robot modeling. Furthermore, the students master the kinematic and dynamic modeling of robot systems, as well as the modeling and design of simple controllers. The students know the algorithmic basics of motion and grasp planning and can apply these algorithms to problems in robotics. They know algorithms from the field of image processing and are able to apply them to problems in robotics. They are able to model and solve tasks as a symbolic planning problem. The students have knowledge about intuitive programming procedures for robots and know procedures for programming and learning by demonstration.

Organizational issues
Die Erfolgskontrolle erfolgt in Form einer schriftlichen Prüfung im Umfang von i.d.R. 120 Minuten nach § 4 Abs. 2 Nr. 1 SPO.

Modul für Bachelor/Master Informatik, Maschinenbau, Mechatronik und Informationstechnik, Elektrotechnik und Informationstechnik

Literature
Weiterführende Literatur

Fu, Gonzalez, Lee: Robotics - Control, Sensing, Vision, and Intelligence

Russel, Norvig: Artificial Intelligence - A Modern Approach, 2nd. Ed.

11.408 Course: Robotics II - Humanoid Robotics [T-INFO-105723]

Responsible: Prof. Dr.-Ing. Tamim Asfour
Organisation: KIT Department of Informatics
Part of: M-MACH-102615 - Major Field: Medical Technology
M-MACH-102633 - Major Field: Robotics

Type	Credits	Grading scale	Recurrence	Version
Written examination	3	Grade to a third	Each summer term	4

Events					
ST 2024	2400074	Robotics II: Humanoid Robotics	2 SWS	Lecture / 🗣	Asfour
Exams					
ST 2024	7500086	Robotics II: Humanoid Robotics			Asfour
WT 24/25	7500211	Robotics II: Humanoid Robotics			Asfour

Legend: 🖥 Online, Blended (On-Site/Online), 🗣 On-Site, ✕ Cancelled

Competence Certificate
The assessment is carried out as a written examination (§ 4 Abs. 2 No. 1 SPO) lasting 60 minutes.

Recommendation
Having visited the lectures on Robotics I - Introduction to Robotics and Mechano-Informatics and Robotics is recommended.

Below you will find excerpts from events related to this course:

V Robotics II: Humanoid Robotics

2400074, SS 2024, 2 SWS, Language: English, Open in study portal

Lecture (V)
On-Site

Content
The lecture presents current work in the field of humanoid robotics that deals with the implementation of complex sensorimotor and cognitive abilities. In the individual topics different methods and algorithms, their advantages and disadvantages, as well as the current state of research are discussed.

The topics addressed are: Applications and real world examples of humanoid robots; biomechanical models of the human body, biologically inspired and data-driven methods of grasping, imitation learning and programming by demonstration; semantic representations of sensorimotor experience as well as cognitive software architectures of humanoid robots.

Learning Objectives:

The students have an overview of current research topics in autonomous learning robot systems using the example of humanoid robotics. They are able to classify and evaluate current developments in the field of cognitive humanoid robotics.

The students know the essential problems of humanoid robotics and are able to develop solutions on the basis of existing research.

Organizational issues
Die Erfolgskontrolle erfolgt in Form einer schriftlichen Prüfung im Umfang von i.d.R. 60 Minuten nach § 4 Abs. 2 Nr. 1 SPO.

Arbeitsaufwand: 90 h

Empfehlungen: Der Besuch der Vorlesungen *Robotik I – Einführung in die Robotik* und *Mechano-Informatik in der Robotik* wird empfohlen

Zielgruppe: **Modul für Master Informatik, Master Maschinenbau, Mechatronik und Informationstechnik, Elektrotechnik und Informationstechnik**

Literature
Weiterführende Literatur

Wissenschaftliche Veröffentlichungen zum Thema, werden auf der VL-Website bereitgestellt.

T 11.409 Course: Robotics III - Sensors and Perception in Robotics [T-INFO-109931]

Responsible: Prof. Dr.-Ing. Tamim Asfour
Organisation: KIT Department of Informatics
Part of: M-MACH-102633 - Major Field: Robotics

Type	Credits	Grading scale	Recurrence	Version
Written examination	3	Grade to a third	Each summer term	2

Events					
ST 2024	2400067	Robotics III - Sensors and Perception in Robotics	2 SWS	Lecture / 🗣	Asfour
Exams					
ST 2024	7500242	Robotics III - Sensors and Perception in Robotics			Asfour
WT 24/25	7500207	Robotics III - Sensors and Perception in Robotics			Asfour

Legend: 🖥 Online, 🔀 Blended (On-Site/Online), 🗣 On-Site, ✕ Cancelled

Competence Certificate
The assessment is carried out as a written examination (§ 4 Abs. 2 No. 1 SPO) lasting 60 minutes.

Prerequisites
none.

Modeled Conditions
The following conditions have to be fulfilled:

1. The course T-INFO-101352 - Robotics III - Sensors in Robotics must not have been started.

Recommendation
Attending the lecture Robotics I – Introduction to Robotics is recommended.

Below you will find excerpts from events related to this course:

V Robotics III - Sensors and Perception in Robotics

2400067, SS 2024, 2 SWS, Language: German/English, Open in study portal

Lecture (V)
On-Site

Content
The lecture supplements the lecture Robotics I with a broad overview of sensors used in robotics. The lecture focuses on visual perception, object recognition, semantic scene interpretation and (inter-)active perception. The lecture is divided into two parts:

In the first part a comprehensive overview of current sensor technologies is given. A basic distinction is made between sensors for the perception of the environment (exteroceptive) and sensors for the perception of the internal state (proprioceptive).

The second part of the lecture concentrates on the use of exteroceptive sensors in robotics. The topics covered include tactile exploration and visual data processing, including advanced topics such as feature extraction, object localization, semantic scene interpretation and (inter-)active perception.

Learning Obejctives:

Students know the main sensor principles used in robotics and understand the data flow from physical measurement through digitization to the use of the recorded data for feature extraction, state estimation and environmental modeling.

Students are able to propose and justify suitable sensor concepts for common tasks in robotics.

Organizational issues
Die Erfolgskontrolle erfolgt in Form einer schriftlichen Prüfung im Umfang von i.d.R. 60 Minuten nach § 4 Abs. 2 Nr. 1 SPO.

Modul für Master Maschinenbau, Mechatronik und Informationstechnik, Elektrotechnik und Informationstechnik

Empfehlungen: **Der Besuch der Vorlesung *Robotik I – Einführung in die Robotik* wird empfohlen**

Zielgruppe: Die Vorlesung richtet sich an Studierende der Informatik, der Elektrotechnik und des Maschinenbaus sowie an alle Interessenten an der Robotik.

Arbeitsaufwand: 90 h

Literature

Eine Foliensammlung wird im Laufe der Vorlesung angeboten.

Begleitende Literatur wird zu den einzelnen Themen in der Vorlesung bekannt gegeben.

T 11.410 Course: Robotics III - Sensors in Robotics [T-INFO-101352]

Responsible: Prof. Dr.-Ing. Tamim Asfour
Organisation: KIT Department of Informatics
Part of: M-MACH-102609 - Major Field: Cognitive Technical Systems
M-MACH-102615 - Major Field: Medical Technology

Type	Credits	Grading scale	Recurrence	Version
Written examination	3	Grade to a third	Each summer term	1

Events					
ST 2024	2400067	Robotics III - Sensors and Perception in Robotics	2 SWS	Lecture / 🗣	Asfour
Exams					
ST 2024	7500242	Robotics III - Sensors and Perception in Robotics			Asfour
WT 24/25	7500207	Robotics III - Sensors and Perception in Robotics			Asfour

Legend: 🖥 Online, ❖ Blended (On-Site/Online), 🗣 On-Site, ✕ Cancelled

Below you will find excerpts from events related to this course:

V Robotics III - Sensors and Perception in Robotics

2400067, SS 2024, 2 SWS, Language: German/English, Open in study portal

Lecture (V)
On-Site

Content
The lecture supplements the lecture Robotics I with a broad overview of sensors used in robotics. The lecture focuses on visual perception, object recognition, semantic scene interpretation and (inter-)active perception. The lecture is divided into two parts:

In the first part a comprehensive overview of current sensor technologies is given. A basic distinction is made between sensors for the perception of the environment (exteroceptive) and sensors for the perception of the internal state (proprioceptive).

The second part of the lecture concentrates on the use of exteroceptive sensors in robotics. The topics covered include tactile exploration and visual data processing, including advanced topics such as feature extraction, object localization, semantic scene interpretation and (inter-)active perception.

Learning Obejctives:

Students know the main sensor principles used in robotics and understand the data flow from physical measurement through digitization to the use of the recorded data for feature extraction, state estimation and environmental modeling.

Students are able to propose and justify suitable sensor concepts for common tasks in robotics.

Organizational issues
Die Erfolgskontrolle erfolgt in Form einer schriftlichen Prüfung im Umfang von i.d.R. 60 Minuten nach § 4 Abs. 2 Nr. 1 SPO.

Modul für Master Maschinenbau, Mechatronik und Informationstechnik, Elektrotechnik und Informationstechnik

Empfehlungen: **Der Besuch der Vorlesung *Robotik I – Einführung in die Robotik* wird empfohlen**

Zielgruppe: Die Vorlesung richtet sich an Studierende der Informatik, der Elektrotechnik und des Maschinenbaus sowie an alle Interessenten an der Robotik.

Arbeitsaufwand: 90 h

Literature
Eine Foliensammlung wird im Laufe der Vorlesung angeboten.

Begleitende Literatur wird zu den einzelnen Themen in der Vorlesung bekannt gegeben.

T 11.411 Course: Safe Human-Robot-Collaboration [T-INFO-109911]

Responsible: Dr.-Ing. Johannes Kurth
Organisation: KIT Department of Informatics
Part of: M-MACH-102597 - Compulsory Elective Module Mechanical Engineering

Type	Credits	Grading scale	Recurrence	Version
Oral examination	3	Grade to a third	Each winter term	1

T 11.412 Course: Safety Engineering [T-MACH-105171]

Responsible: Hans-Peter Kany
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102597 - Compulsory Elective Module Mechanical Engineering
M-MACH-102600 - Major Field: Man - Technology - Organisation
M-MACH-102605 - Major Field: Engineering Design
M-MACH-102613 - Major Field: Lifecycle Engineering
M-MACH-102629 - Major Field: Logistics and Material Flow Theory
M-MACH-102636 - Major Field: Thermal Turbomachines
M-MACH-102640 - Major Field: Technical Logistics

Type	Credits	Grading scale	Recurrence	Version
Oral examination	4	Grade to a third	Each winter term	2

Events					
WT 24/25	2117061	Safety Engineering	2 SWS	Lecture / 🗣	Kany
Exams					
ST 2024	76-T-MACH-105171	Safety Engineering			Furmans

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 24/25, 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 11.413 Course: Scaling in Fluid Dynamics [T-MACH-105400]

Responsible: apl. Prof. Dr. Leo Bühler
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102597 - Compulsory Elective Module Mechanical Engineering
M-MACH-102634 - Major Field: Fluid Mechanic

Type	Credits	Grading scale	Recurrence	Version
Oral examination	4	Grade to a third	Each summer term	1

Events					
ST 2024	2154044	Scaling in fluid dynamics	2 SWS	Lecture / 🗣	Bühler
Exams					
ST 2024	76-T-MACH-105400	Scaling in Fluid Dynamics			Bühler

Legend: 🖥 Online, ⚙ Blended (On-Site/Online), 🗣 On-Site, ✕ Cancelled

Competence Certificate
Oral exam

Duration: 20-30 minutes

No auxiliary means

Prerequisites
none

Recommendation
Fluid Mechanics (T-MACH-105207)

Below you will find excerpts from events related to this course:

V Scaling in fluid dynamics
2154044, SS 2024, 2 SWS, Language: German, Open in study portal

Lecture (V)
On-Site

Content

- Introduction
- Similarity rules (examples)
- Dimensional analysis (Pi-theorem)
- Scaling in differential equations
- Scaling in boundary layers
- Self-similar solutions
- Scaling in turbulent shear layers
- Rotating flows
- Magnetohydrodynamic flows

Educational objective: The student can extract non-dimensional number from the characteristic properties of flows. From the insights on scaling laws, the students are qualified to identify the influencing quantities from generic experiments and transfer these to real applications. The students can simplify the governing equations of fluid mechanic appropriately and can interpret the achieved results as a basis for efficient solution strategies.

Literature
G. I. Barenblatt, 1979, Similarity, Self-Similarity, and Intermediate Asymptotics, Plenum Publishing Corporation (Consultants Bureau)

J. Zierep, 1982, Ähnlichkeitsgesetze und Modellregeln der Strömungsmechanik, Braun

J. H. Spurk, 1992, Dimensionsanalyse in der Strömungslehre, Springer

T 11.414 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-102405 - Fundamentals and Methods of General Mechanical Engineering
M-MACH-102597 - Compulsory Elective Module Mechanical Engineering
M-MACH-102602 - Major Field: Reliability in Mechanical Engineering
M-MACH-102646 - Major Field: Applied Mechanics
M-MACH-102739 - Fundamentals and Methods of Automotive Engineering
M-MACH-102743 - Fundamentals and Methods of Theoretical Foundations of Mechanical Engineering
M-MACH-102744 - Fundamentals and Methods of Materials and Structures for High Performance Systems

Type	Credits	Grading scale	Recurrence	Version
Written examination	4	Grade to a third	Each winter term	3

Events					
WT 24/25	2181738	Scientific computing for Engineers	2 SWS	Lecture / 🗣	Weygand, Gumbsch
WT 24/25	2181739	Exercises for Scientific Computing for Engineers	2 SWS	Practice / 🗣	Weygand
Exams					
ST 2024	76-T-MACH-100532	Scientific Computing for Engineers			Weygand, Gumbsch
WT 24/25	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).

Modeled Conditions
The following conditions have to be fulfilled:

1. The course T-MACH-105390 - Application of Advanced Programming Languages in Mechanical Engineering must not have been started.

Below you will find excerpts from events related to this course:

V Scientific computing for Engineers

2181738, WS 24/25, 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 24/25, 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 11.415 Course: Selected Applications of Technical Logistics [T-MACH-102160]

Responsible: Viktor Milushev
Dr.-Ing. Martin Mittwollen

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102597 - Compulsory Elective Module Mechanical Engineering

Type	Credits	Grading scale	Recurrence	Version
Oral examination	4	Grade to a third	Each summer term	1

Competence Certificate
The assessment consists of an oral exam (20 min.) taking place in the recess period according to § 4 paragraph 2 Nr. 2 of the examination regulation.

Prerequisites
none

Recommendation
Knowledge out of Basics of Technical Logistics I (T-MACH-109919) / Elements and Systems of Technical Logistics (T-MACH-102159) preconditioned.

T 11.416 Course: Selected Chapters of the Combustion Fundamentals [T-MACH-105428]

Responsible: Prof. Dr. Ulrich Maas
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102597 - Compulsory Elective Module Mechanical Engineering
M-MACH-102635 - Major Field: Engineering Thermodynamics

Type	Credits	Grading scale	Recurrence	Version
Oral examination	4	Grade to a third	Each term	1

Events					
ST 2024	2167541	Selected chapters of the combustion fundamentals	2 SWS	Lecture / 🗣	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 Selected chapters of the combustion fundamentals

2167541, SS 2024, 2 SWS, Language: German, Open in study portal

Lecture (V)
On-Site

Content
Depending on the lecture: Fundamentals of chemical kinetics, of statistical modeling of turbulent flames or of droplet and spray combustion.

Organizational issues
Blockveranstaltung. Termine siehe Schaukasten und Internetseite des Instituts.

Literature
Vorlesungsunterlagen

Verbrennung - Physikalisch-Chemische Grundlagen, Modellbildung, Schadstoffentstehung, Autoren: U. Maas, J. Warnatz, R.W. Dibble, Springer-Lehrbuch, Heidelberg 1996

T 11.417 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-102597 - Compulsory Elective Module Mechanical Engineering
M-MACH-102623 - 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 2024	2190411	Selected Problems of Applied Reactor Physics and Exercises	2 SWS	Lecture / 🗣	Dagan, Metz
Exams					
ST 2024	76-T-MACH-105462	Selected Problems of Applied Reactor Physics and Exercises			Dagan
WT 24/25	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 2024, 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 11.418 Course: Self-Booking-MSc-HOC-SPZ-ZAK-Graded [T-MACH-111687]

Responsible: Prof. Dr.-Ing. Martin Heilmaier
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102824 - Key Competencies

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
- Studium Generale. Forum Wissenschaft und Gesellschaft (FORUM) (ehem. ZAK)

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 11.419 Course: Self-Booking-MSc-HOC-SPZ-ZAK-Non-Graded [T-MACH-111686]

Responsible: Prof. Dr.-Ing. Martin Heilmaier
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102824 - Key Competencies

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
- Studium Generale. Forum Wissenschaft und Gesellschaft (FORUM) (ehem. ZAK)

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 11.420 Course: Seminar Application of Artificial Intelligence in Production [T-MACH-112121]

Responsible: Prof. Dr.-Ing. Jürgen Fleischer
Organisation: KIT Department of Mechanical Engineering

Part of:
M-MACH-102597 - Compulsory Elective Module Mechanical Engineering
M-MACH-102600 - Major Field: Man - Technology - Organisation
M-MACH-102601 - Major Field: Automation Technology
M-MACH-102609 - Major Field: Cognitive Technical Systems
M-MACH-102613 - Major Field: Lifecycle Engineering
M-MACH-102614 - Major Field: Mechatronics
M-MACH-102618 - Major Field: Production Technology
M-MACH-102624 - Major Field: Information Technology
M-MACH-102633 - Major Field: Robotics

Type	Credits	Grading scale	Recurrence	Version
Examination of another type	4	Grade to a third	Each summer term	5

Events					
ST 2024	2150910	Seminar Application of Artificial Intelligence in Production	2 SWS	Seminar / 🗣	Fleischer
Exams					
ST 2024	76-T-MACH-112121	Seminar Application of Artificial Intelligence in Production			Fleischer

Legend: 🖥 Online, ⚄ Blended (On-Site/Online), 🗣 On-Site, × Cancelled

Competence Certificate
Alternative test achievement (graded):

- Presentation of the results (approx. 20 min) followed by a colloquium (approx. 15 min) with weighting 25%
- Written processing of the results with weighting 75%

Prerequisites
none

Recommendation
Previous participation in the lecture 2149921 "Artificial Intelligence in Production" or advanced knowledge of Python.

Below you will find excerpts from events related to this course:

V Seminar Application of Artificial Intelligence in Production

Seminar (S)
On-Site

2150910, SS 2024, 2 SWS, Language: German, Open in study portal

Content

The module AI in Production is designed to teach students the practical, holistic integration of machine learning methods and the application of artificial intelligence in production. The course is oriented towards the phases of the CRISP-DM process with the aim of developing a deep understanding of the necessary steps and content-related aspects (methods) within the individual phases. In addition to teaching the practical aspects of integrating the most important machine learning methods, the focus here is primarily on the necessary steps for data generation and data preparation as well as the implementation and validation of the methods in an industrial environment.

The lecture "Seminar Application of Artificial Intelligence in Production" aims at the practical integration of current machine learning methods based on realistic industrial use cases. The content framework of the lecture results from the holistic, practical implementation of an AI project in production. First, the necessary Deep Learning programming basics are taught using the Keras software package. Subsequently, practice-relevant use cases are defined, which are to be implemented practically with the methods of machine learning and especially deep learning.

Learning Outcomes:

The Students

- are able to independently analyze a practical problem in production with regard to the application of machine learning methods.
- will be able to independently apply common deep learning algorithms to practical data sets, validate them, and analyze the results.
- understand the challenges of using deep learning methods in production.
- will know the main action areas and open research questions for the successful implementation of AI in production and for the implementation of autonomous machines.
- are able to evaluate the results of current deep learning methods and, based on these, to develop and practically apply proposed solutions (from the field of machine learning).

Workload:

regular attendance: 21 hours
self-study: 99 hours

Organizational issues

Zur Vertiefung des im Rahmen der Lehrveranstaltung erworbenen Wissens werden die theoretischen Vorlesungseinheiten durch Praxiseinheiten im Umfeld der Karlsruher Forschungsfabrik (https://www.karlsruher-forschungsfabrik.de) unterstützt.

The theoretical lectures are complemented by practical lectures in the Karlsruhe Research Factory (https://www.karlsruher-forschungsfabrik.de/en.html) to deepen the acquired knowledge.

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 11.421 Course: Seminar Data-Mining in Production [T-MACH-108737]

Responsible: Prof. Dr.-Ing. Gisela Lanza
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102618 - Major Field: Production Technology

Type	Credits	Grading scale	Recurrence	Version
Examination of another type	3	Grade to a third	Each term	1

Events					
ST 2024	2151643	Seminar Data Mining in Production	2 SWS	Seminar / On-Site	Lanza
WT 24/25	2151643	Seminar Data Mining in Production	2 SWS	Seminar / On-Site	Lanza
Exams					
ST 2024	76-T-MACH-108737	Seminar Data-Mining in Production			Lanza

Legend: Online, Blended (On-Site/Online), On-Site, × Cancelled

Competence Certificate
alternative test achievement (graded):

- written elaboration (workload of at least 80 h)
- oral presentation (approx. 30 min)

Prerequisites
none

Annotation
The number of students is limited to twelve. Dates and deadlines for the seminar will be announced at https://www.wbk.kit.edu/studium-und-lehre.php.

Below you will find excerpts from events related to this course:

V Seminar Data Mining in Production

2151643, SS 2024, 2 SWS, Language: German, Open in study portal

Seminar (S)
On-Site

Content
In the age of Industry 4.0, large amounts of production data are generated by the global production networks and value chains. Their analysis enables valuable conclusions about production and lead to an increasing process efficiency. The aim of the seminar is to get to know production data analysis as an important component of future industrial projects. The students get to know the data mining tool KNIME and use it for analyses. A specific industrial use case with real production data enables practical work and offers direct references to industrial applications. The participants learn selected methods of data mining and apply them to the production data. The work within the seminar takes place in small groups on the computer. Subsequently, presentations on specific data mining methods have to be prepared.

Learning Outcomes:

The students …

- can name, describe and distinguish between different methods, procedures and techniques of production data analysis.
- can perform basic data analyses with the data mining tool KNIME.
- can analyze and evaluate the results of data analyses in the production environment.
- are able to derive suitable recommendations for action.
- are able to explain and apply the CRISP-DM model.

Workload:

regular attendance: 10 hours
self-study: 80 hours

Organizational issues
Die Teilnehmerzahl ist auf zwölf Studierende begrenzt. Termine und Fristen zur Veranstaltung werden unter https://www.wbk.kit.edu/studium-und-lehre.php bekanntgegeben.

The number of students is limited to twelve. Dates and deadlines for the seminar will be announced at https://www.wbk.kit.edu/studium-und-lehre.php.

Literature
Medien:
KNIME Analytics Platform

Media:
KNIME Analytics Platform

V	**Seminar Data Mining in Production** 2151643, WS 24/25, 2 SWS, Language: German, Open in study portal	**Seminar (S) On-Site**

Content
In the age of Industry 4.0, large amounts of production data are generated by the global production networks and value chains. Their analysis enables valuable conclusions about production and lead to an increasing process efficiency. The aim of the seminar is to get to know production data analysis as an important component of future industrial projects. The students get to know the data mining tool KNIME and use it for analyses. A specific industrial use case with real production data enables practical work and offers direct references to industrial applications. The participants learn selected methods of data mining and apply them to the production data. The work within the seminar takes place in small groups on the computer. Subsequently, presentations on specific data mining methods have to be prepared.

Learning Outcomes:

The students …

- can name, describe and distinguish between different methods, procedures and techniques of production data analysis.
- can perform basic data analyses with the data mining tool KNIME.
- can analyze and evaluate the results of data analyses in the production environment.
- are able to derive suitable recommendations for action.
- are able to explain and apply the CRISP-DM model.

Workload:

regular attendance: 10 hours
self-study: 80 hours

Organizational issues
Die Teilnehmerzahl ist auf zwölf Studierende begrenzt. Termine und Fristen zur Veranstaltung werden unter https://www.wbk.kit.edu/studium-und-lehre.php bekanntgegeben.

The number of students is limited to twelve. Dates and deadlines for the seminar will be announced at https://www.wbk.kit.edu/studium-und-lehre.php.

Literature
Medien:
KNIME Analytics Platform

Media:
KNIME Analytics Platform

T 11.422 Course: Seminar for Rail System Technology [T-MACH-108692]

Responsible: Prof. Dr.-Ing. Martin Cichon
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102641 - 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 2024	2115009	Seminar for Rail System Technology	2 SWS	Seminar / 🗣	Cichon, Ziesel
WT 24/25	2115009	Seminar for Rail System Technology	2 SWS	Seminar / 🗣	Cichon, Ziesel
Exams					
ST 2024	76-T-MACH-2115009	Seminar for Rail System Technology			Cichon
WT 24/25	76-T-MACH-2115009	Seminar for Rail System Technology			Cichon, Ziesel

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 2024, 2 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 Einführungsveranstaltung findet am 08.05.2024 13.00-16.00 Uhr am Campus Ost, 70.04, R 008 statt. Die Prüfung besteht aus einer schriftlichen Ausarbeitung (Seminararbeit - ca. 20 Seiten Inhalt) 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 (ca. 20 pages content), 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 24/25, 2 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 Einführungsveranstaltung findet am 13.11.2024 13.00-15.30 Uhr am Campus Ost, 70.04, R 008 statt. Die Prüfung besteht aus einer schriftlichen Ausarbeitung (Seminararbeit - ca. 20 Seiten Inhalt) 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 (ca. 20 pages content), 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 11.423 Course: Seminar: Energy Informatics [T-INFO-106270]

Responsible: Prof. Dr. Veit Hagenmeyer
Organisation: KIT Department of Informatics
Part of: M-MACH-102601 - Major Field: Automation Technology

Type	Credits	Grading scale	Recurrence	Version
Examination of another type	4	Grade to a third	Irregular	1

Events					
WT 24/25	2400013	Seminar: Energy Informatics	2 SWS	Seminar / 🗣	Hagenmeyer, Bläsius, Süß, Bauer, Geiges

Legend: 🖥 Online, ⚙ Blended (On-Site/Online), 🗣 On-Site, ✕ Cancelled

Below you will find excerpts from events related to this course:

V Seminar: Energy Informatics

2400013, WS 24/25, 2 SWS, Language: German/English, Open in study portal

Seminar (S)
On-Site

Content
Energy informatics is a young field of research at the interface of electrical engineering, computer science, economics and law, in which questions about energy systems are dealt with. Issues arising from climate change and the increasing use of renewable energy sources are of particular interest.

In the "Energy Informatics" seminar, we look at selected issues arising from current research. These questions consider, for example, modeling, algorithms or simulations in the context of energy systems.

This seminar is aimed at Master's students in subjects that overlap with energy informatics, for example computer science, mechanical engineering, information systems, economathematics, business engineering or economics engineering. If you have any questions regarding credit transfer, please contact your study program service.
Ideally, students should have an in-depth insight into the subject areas of energy informatics and have basic knowledge of modeling, simulation and algorithms.

Other participants: Prof. Dr. Veit Hagenmeyer, T.T.-Prof. Dr. Thomas Bläsius

Workload: 4 CP corresponds to approx. 120 hours, approx. 21 hours attending the seminar, approx. 45 hours analyzing and working on the topic, approx. 27 hours preparing and creating the presentation and approx. 27 hours writing the paper.

Learning objectives: Based on a given topic, participants identify, collect and evaluate relevant literature. They classify the topic within the subject area of "energy informatics".
Participants prepare a seminar paper and take format specifications into account. Students critically examine other seminar papers and write reviews of the seminar papers of others.
In presentations, the participants present the most important content of their seminar paper in an auditorium-friendly manner and discuss it with the audience.

T 11.424 Course: Sensors [T-ETIT-101911]

Responsible: Dr. Wolfgang Menesklou
Organisation: KIT Department of Electrical Engineering and Information Technology
Part of: M-MACH-102595 - Compulsory Elective Module Natural Science/Computer Science/Electrical Engineering

Type	Credits	Grading scale	Recurrence	Version
Written examination	3	Grade to a third	Each summer term	2

Events					
ST 2024	2304231	Sensors	2 SWS	Lecture / 🗣	Menesklou
Exams					
ST 2024	7304231	Sensors			Menesklou
WT 24/25	7304231	Sensors			Menesklou

Legend: 🖥 Online, 🧩 Blended (On-Site/Online), 🗣 On-Site, ✕ Cancelled

T 11.425 Course: Signal Processing Methods [T-ETIT-113837]

Responsible: Prof. Dr.-Ing. Sander Wahls
Organisation: KIT Department of Electrical Engineering and Information Technology
Part of: M-MACH-102595 - Compulsory Elective Module Natural Science/Computer Science/Electrical Engineering

Type	Credits	Grading scale	Recurrence	Version
Written examination	6	Grade to a third	Each winter term	1

Events					
WT 24/25	2302113	Signal Processing Methods	2 SWS	Lecture / Blended	Wahls
WT 24/25	2302115	Tutorial to 2302113 Signal Processing Methods	2 SWS	Practice / On-Site	Wahls, Al-Hammadi

Legend: Online, Blended (On-Site/Online), On-Site, Cancelled

Competence Certificate
Written exam, approx. 120 minutes.
The module grade is the grade of the written exam.

Prerequisites
none

Recommendation
Familiarity with signals and systems (in particular, Fourier transforms) and probability theory at the Bachelor level is assumed.

T 11.426 Course: Signals and Systems [T-ETIT-112860]

Responsible: Dr.-Ing. Mathias Kluwe
Prof. Dr.-Ing. Sander Wahls

Organisation: KIT Department of Electrical Engineering and Information Technology

Part of: M-MACH-102595 - Compulsory Elective Module Natural Science/Computer Science/Electrical Engineering
M-MACH-102598 - Major Field: Advanced Mechatronics

Type	Credits	Grading scale	Recurrence	Expansion	Version
Written examination	7	Grade to a third	Each winter term	1 terms	1

Events					
WT 24/25	2302109	Signals and Systems	3 SWS	Lecture / Blended	Wahls, Kluwe
WT 24/25	2302111	Signals and Systems (Tutorial to 2302109)	2 SWS	Practice / On-Site	Wahls, Leven, Illerhaus

Legend: Online, Blended (On-Site/Online), On-Site, Cancelled

Competence Certificate
The assessment of success takes place in the form of a written examination lasting 180 minutes. The module grade is the grade of the written examination.

Prerequisites
none

T 11.427 Course: Simulation of Coupled Systems [T-MACH-105172]

Responsible: Prof. Dr.-Ing. Marcus Geimer
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102597 - Compulsory Elective Module Mechanical Engineering
M-MACH-102630 - Major Field: Mobile Machines
M-MACH-104434 - 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 2024	2114095	Simulation of Coupled Systems	2 SWS	Lecture / 🗣	Geimer, Breitfuß
Exams					
ST 2024	76T-MACH-105172	Simulation of Coupled Systems			Geimer
WT 24/25	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 2024, 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 11.428 Course: Simulation of Coupled Systems - Advance [T-MACH-108888]

Responsible: Prof. Dr.-Ing. Marcus Geimer
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102597 - Compulsory Elective Module Mechanical Engineering
M-MACH-102630 - Major Field: Mobile Machines
M-MACH-104434 - Major Field: Modeling and Simulation in Dynamics

Type	Credits	Grading scale	Recurrence	Version
Completed coursework	0	pass/fail	Each summer term	1

Exams			
ST 2024	76-T-MACH-108888	Simulation of Coupled Systems - Advance	Geimer

Competence Certificate
Preparation of semester report

Prerequisites
none

T 11.429 Course: Simulation of Optical Systems [T-MACH-105990]

Responsible: apl. Prof. Dr. Ingo Sieber
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102598 - Major Field: Advanced Mechatronics
M-MACH-102601 - Major Field: Automation Technology
M-MACH-102614 - Major Field: Mechatronics
M-MACH-102615 - Major Field: Medical Technology
M-MACH-102633 - Major Field: Robotics

Type	Credits	Grading scale	Recurrence	Version
Oral examination	4	Grade to a third	Each winter term	1

Events					
WT 24/25	2105018	Simulation of Optical Systems	2 SWS	Lecture / 🗣	Sieber
Exams					
ST 2024	76-T-MACH-105990	Simulation of Optical Systems			Sieber

Legend: 📱 Online, 🔀 Blended (On-Site/Online), 🗣 On-Site, ✕ Cancelled

Competence Certificate
oral exam (Duration: appr. 30min)

Prerequisites
none

Below you will find excerpts from events related to this course:

V Simulation of Optical Systems
2105018, WS 24/25, 2 SWS, Language: German, Open in study portal

Lecture (V)
On-Site

Content
This lecture gives an introduction into optical system’s design. The focus is on the system concept: design for manufacture, reliability in operation, as well as interactions between optical and non-optical system components are considered. Practical aspects of optical systems design like e.g. the consideration of design rules to ensure
manufacturability, tolerancing of the optical system to ensure a reliable operation, and the coupling of optical and mechanical simulation tools will also be presented. Application of the acquired techniques will be deepened with the help of three case studies.

Content:

- Introduction
- Modeling, simulation, and systems design
- Basics of optics
- Properties of optical materials
- Optical imaging
- Ray tracing
- The optical design process
- Basics of the Finite-Element Method (FEM)
- The FEM design process
- Coupling of simulation tools
- Microoptical sub-systems

Learning objectives:

The students…

- know the basics of optical modeling and simulation.
- know the basics of modeling and simulation by means of the Finite-Element Method.
- know the basics of the optical and mechanical design process.
- are able to understand the specifications of optical systems and can use them in optical modeling.
- are able to use design rules.
- are able to conduct basic tolerance analysis.
- are able to assess the need of an inter-domain simulation.

Literature

- Averill M. Law, W. David Kelton, „Simulation, Modeling & Analysis“, McGraw-Hill, New York (1991)
- R.E. Fischer, „Optical System Design“, SPIE Press, New York (2008)
- G. Pahl, W. Beitz, „Engineering Design“, Springer, Heidelberg (1995Optik, E. Hecht (Oldenbourg, 2005)
- Optical System Design, R. E. Fischer, B. Tadic-Galeb, P. R. Yoder (Mc Graw Hill, 2008)
- Practical Computer-Aided Lens Design, G. H. Smith (Willman-Bell, 1998)
- M. Mayr, U. Thalhofer, „Numerische Lösungsverfahren in der Praxis“, Hanser Verlag München (1993)
- M. Weck, C. Brecher, „Werkzeugmaschinen – Konstruktion und Berechnung“, Springer Heidelberg (2006)

T 11.430 Course: Simulation of the Process Chain of Continuously Fiber Reinforced Composite Structure [T-MACH-105971]

Responsible: Prof. Dr.-Ing. Luise Kärger

Organisation: KIT Department of Mechanical Engineering
Lightweight Design

Part of: M-MACH-102597 - Compulsory Elective Module Mechanical Engineering
M-MACH-102602 - Major Field: Reliability in Mechanical Engineering
M-MACH-102613 - Major Field: Lifecycle Engineering
M-MACH-102628 - Major Field: Lightweight Construction
M-MACH-102632 - Major Field: Polymer Engineering
M-MACH-102646 - Major Field: Applied Mechanics

Type	Credits	Grading scale	Recurrence	Version
Oral examination	4	Grade to a third	Each summer term	1

Events					
ST 2024	2114107	Simulation der Prozesskette kontinuierlich verstärkter Faserverbundbauteile	2 SWS	Lecture / Practice (/ 🗣	Kärger
Exams					
ST 2024	76-T-MACH-105971	Simulation of the process chain of continuously fiber reinforced composite structure			Kärger

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 Simulation der Prozesskette kontinuierlich verstärkter Faserverbundbauteile

2114107, SS 2024, 2 SWS, Language: German, Open in study portal

Lecture / Practice (VÜ)
On-Site

Content

The lecture deals with methods for the calculation of FRP components with continuous fiber reinforcement and provides the necessary understanding of materials and processes. The material behavior of fiber composites is largely determined by the fiber structure. This must be suitably modeled in the single layer and in the multilayer composite in order to be able to reliably predict the deformation and damage behavior of FRP components. In the case of curved components, the fiber structure is only created during the manufacturing process, specifically during the forming (draping) of the two-dimensional semi-finished products into a three-dimensional structure (preform). In addition, there is the mold filling process, in which the preform is infiltrated with a reactive resin system, as well as the curing process, which can lead to distortion and residual stresses. In addition to the simulation of structural behavior, process simulation is therefore an essential building block for the holistic development of fiber composite components. The main contents are:

- Virtual Process Chain
- Draping simulation: draping behavior of textiles
  draping process, kinematic draping simulation, FE draping simulation
- Molding simulation: Principles of fluid mechanics, viscosity and permeability, molding simulation within the CAE chain
- Curing simulation and distortion: process of crosslinking, resin kinetics, thermomechanics, internal stresses, part distortion
- Structural simulation: Modelling of multilayer laminate,
  influence of manufacturing effects

Study goals:

The students understand that the microstructure of fibre reinforces plastics (FRP) and the resulting material behavior is mainly influenced by the manufacturing process. They know the simulation steps needed to virtually describe the process chain of RTM (resin transfer molding) parts. They are able to explain the principal mechanical processes of draping, molding and curing and can name their influences on the structural behavior.

Workload:

lectures: 21h, preparation of examination: 63h

Literature

Altenbach, J. Altenbach, and R. Rikards: Einführung in die Mechanik der Laminat- und Sandwichtragwerke. Deutscher Verlag für Grundstoffindustrie, Stuttgart, 1. edition, 1996.

Altenbach, J. Altenbach, W. Kissing; Mechanics of Composite Structural Elements . ISBN 978-3-642-07411-0 Springer-Verlag Berlin Heidelberg, 2004.

Barbero, J.: Introduction to Composite Materials Design. CRC Press, Boca Raton, FL, 2. edition, 2011.

Bickerton, S.; Sozer, E.M. Simacek, P. and Advani, S.G.: “Fabric structure and mold curvature effects on preform permeability and mold filling in the RTM process. Part II. Predictions and comparisons with experiments”. Composites Part A 31: 439–458, 2000.

Henning, F.; Moeller, E.: Handbuch Leichtbau: Methoden, Werkstoffe, Fertigung. Carl Hanser Verlag GmbH & Co. KG, 2011.

Kärger, L.; Bernath, A.; Fritz, F.; Galkin, S.; Magagnato, D.; Oeckerath, A.; Schön, A.; Henning, F.: Development and validation of a CAE chain for unidirectional fibre reinforced composite components. Composite Structures 132: 350–358, 2015.

Puck A: Festigkeitsanalyse von Faser-Matrix-Laminaten, Modelle für die Praxis. Carl Hanser Verlag, München, Wien, 1. edition, 1996.

Schürmann H: Konstruieren mit Faserverbundwerkstoffen. ISBN 3-540-40283-7 . Springer Verlag, 2005.

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 11.431 Course: Simulator Exercises Combined Cycle Power Plants [T-MACH-105445]

Responsible:	Prof. Dr.-Ing. Daniel Banuti Hon.-Prof. Dr. Thomas Schulenberg
Organisation:	KIT Department of Mechanical Engineering
Part of:	M-MACH-102610 - Major Field: Power Plant Technology M-MACH-102636 - Major Field: Thermal Turbomachines

Type	Credits	Grading scale	Recurrence	Version
Oral examination	2	Grade to a third	Each summer term	1

Events					
ST 2024	2170491	Simulator Exercises Combined Cycle Power Plants	2 SWS	Practical course / 🗣	Banuti, Schulenberg
Exams					
ST 2024	76-T-MACH-105445	Simulator Exercises Combined Cycle Power Plants			Banuti, Schulenberg

Legend: 🖥 Online, ⚙ Blended (On-Site/Online), 🗣 On-Site, ✕ Cancelled

Competence Certificate
oral exam (ca. 15 min)

Prerequisites
none

Recommendation
Participation at LV-No. 2170490 "Combined Cycle Power Plants" (T-MACH-105444) is recommended.

Below you will find excerpts from events related to this course:

V Simulator Exercises Combined Cycle Power Plants

2170491, SS 2024, 2 SWS, Language: English, Open in study portal

Practical course (P)
On-Site

Content
The training objective of the course is the qualification for a research-related professional activity in power plant engineering. On the basis of the learned fundamentals in thermodynamics, in instrumentation and control engineering, as well as on the basis of the acquired knowledge of design of combined cycle plants, the participants can operate a real combined cycle power plant. This application creates a deeper understanding of the dynamic processes of the power plant, the specific importance of the plant components and the limits of the load capacity of the components. Participants can optimize normal operation and analyze incidents. They can work self-organized and reflexive. They have communicative and organizational skills in teamwork, even under major technical challenges.

Start-up of the power plant from scratch; load changes and shut down; dynamic response of the power plant in case of malfuctions and of sudden load changes; manual operation of selected components.

Organizational issues
Termine zum Simulatorpraktikum werden in der Vorlesung und per ILIAS am Semesterbeginn mit den Studenten vereinbart.

Appointments for the simulator internship are arranged with the students in the lecture and via ILIAS at the beginning of the semester.

Literature
Vorlesungsskript und weitere Unterlagen der Vorlesung Gas- und Dampfkraftwerke.

Slides and other documents of the lecture Combined Cycle Power Plants.

T 11.432 Course: Solar Thermal Energy Systems [T-MACH-106493]

Responsible: apl. Prof. Dr. Ron Dagan
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102597 - Compulsory Elective Module Mechanical Engineering
M-MACH-102610 - Major Field: Power Plant Technology
M-MACH-102623 - Major Field: Fundamentals of Energy Technology
M-MACH-102648 - Major Field: Energy Technology for Buildings

Type	Credits	Grading scale	Recurrence	Version
Oral examination	4	Grade to a third	Each winter term	4

Events					
WT 24/25	2189400	Solar Thermal Energy Systems	2 SWS	Lecture / 🗣	Dagan
Exams					
ST 2024	76106493	Repetition: Solar Thermal Energy Systems			Dagan
ST 2024	76-T-MACH-106493	Solar Thermal Energy Systems			Dagan
WT 24/25	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

Modeled Conditions
The following conditions have to be fulfilled:

1. The course T-MACH-105225 - Thermal Solar Energy must not have been started.

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 24/25, 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 Vorlesung "Thermische Solarenergie" findet ab dem WS 2024/25 nicht mehr statt. Sie wurde zusammengelegt mit der engl. Version "Solar Thermal Energy Systems"

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 11.433 Course: Solid State Reactions and Kinetics of Phase [T-MACH-107667]

Responsible: Dr. Peter Franke
Prof. Dr. Hans Jürgen Seifert

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102597 - Compulsory Elective Module Mechanical Engineering
M-MACH-102611 - Major Field: Materials Science and Engineering

Type	Credits	Grading scale	Recurrence	Version
Oral examination	4	Grade to a third	Each winter term	4

Events					
WT 24/25	2193003	Solid State Reactions and Kinetics of Phase Transformations	2 SWS	Lecture / 🗣	Franke
Exams					
ST 2024	76-T-MACH-107667	Solid State Reactions and Kinetics of Phase			Seifert, Franke

Legend: 🖥 Online, 🧩 Blended (On-Site/Online), 🗣 On-Site, ✕ Cancelled

Competence Certificate
oral examination (about 30 min)

Prerequisites
The successful participation in Übungen zu Festkörperreaktionen / Kinetik von Phasenumwandlungen, Korrosion is the condition for the admittance to the oral exam in Festkörperreaktionen / Kinetik von Phasenumwandlungen, Korrosion.

T-MACH-110926 – Exercises for Solid State Reactions and Kinetics of Phase Transformations has not been started.

T-MACH-110927 – Solid State Reactions and Kinetics of Phase has not been started.

Modeled Conditions
The following conditions have to be fulfilled:

1. The course T-MACH-107632 - Exercises for Solid State Reactions and Kinetics of Phase Transformations must have been passed.

Recommendation
Bacic course in materials science and engineering

Basic course in mathematics

physical chemistry

Below you will find excerpts from events related to this course:

V **Solid State Reactions and Kinetics of Phase Transformations** — **Lecture (V) On-Site**
2193003, WS 24/25, 2 SWS, Language: German, Open in study portal

Content
Oral examination (about 30 min)

Teaching Content:

1. Crystal Defects and Mechanisms of Diffusion
2. Microscopic Description of Diffusion
3. Phenomenological Treatment
4. Diffusion Coefficients
5. Diffusion Problems; Analytical Solutions
6. Diffusion with Phase Transformation
7. Kinetics of Microstructural Transformations
8. Diffusion at Surfaces, Grain Boundaries and Dislocations
9. Numerical treatment of diffusion controlled phase transformations

Recommendations:

knowledge of the course "Fundamentals in Materials Thermodynamics and Heterogeneous Equilibria" (Seifert); Bacic course in materials science and Engineering; Basic course in mathematics; physical chemistry

regular attendance: 22 hours

self-study: 98 hours

The students acquire knowledge about:

- diffusion mechanisms
- Fick's laws
- basic solutions of the diffusion equation
- evaluation of diffusion experiments
- interdiffusion processes
- the thermodynamic factor
- parabolic growth of layers
- formation of pearlite
- microstructural transformations according to the models of Avrami and Johnson-Mehl
- TTT diagrams

Literature
1. J. Crank, "The Mathematics of Diffusion", 2nd Ed., Clarendon Press, Oxford, 1975.
2. J. Philibert, "Atom Movements", Les Éditions de Physique, Les Ulis, 1991.
3. D.A. Porter, K.E. Easterling, M.Y. Sherif, "Phase Transformations in Metals and Alloys", 3rd edition, CRS Press, 2009.
4. H. Mehrer, "Diffusion in Solids", Springer, Berlin, 2007.

T 11.434 Course: Stability: from Order to Chaos [T-MACH-108846]

Responsible: apl. Prof. Dr. Andreas Class
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102595 - Compulsory Elective Module Natural Science/Computer Science/Electrical Engineering

Type	Credits	Grading scale	Recurrence	Version
Completed coursework (oral)	6	pass/fail	Each summer term	1

Events					
ST 2024	2154437	Hydrodynamic Stability: From Order to Chaos	2 SWS	Lecture / 🔀	Class
Exams					
ST 2024	76-T-MACH-105425	Hydrodynamic Stability: From Order to Chaos			Class

Legend: 🖥 Online, 🔀 Blended (On-Site/Online), 🗣 On-Site, ✕ Cancelled

Competence Certificate
The study performance is considered to have been passed if all exercise assignments have been successfully processed and the final colloquium (30 minutes) has been successfully passed.

no auxiliary

Prerequisites
The partial performance number T-MACH-105425 "Hydrodynamic Stability: From Order to Chaos" must not be startet or completed. The partial services T-MACH-108846 "Stability: from order to chaos" (Nat/Inf/Etit) and T-MACH-105425 "Hydrodynamic Stability: From Order to Chaos" are mutually exclusive.

Modeled Conditions
The following conditions have to be fulfilled:

1. The course T-MACH-105425 - Hydrodynamic Stability: From Order to Chaos must not have been started.

Recommendation
Fluid Mechanics (T-MACH-105207)

Mathematical Methods in Fluid Mechanics (T-MACH-105295)

Below you will find excerpts from events related to this course:

V Hydrodynamic Stability: From Order to Chaos

2154437, SS 2024, 2 SWS, Language: German/English, Open in study portal

Lecture (V)
Blended (On-Site/Online)

Content
The studends can apply the analytic and numerical methods for an evaluation of stability properties of hydrodynamic systems. The are qualified to discuss the characteristic influence of parameter changes (e.g. Renolds number) on the calculated results with respect to the flow character and properties (e.g. transition laminar/turbulent flow).

Increasing a control parameter of a thermohydraulic system, e.g. the Reynolds number, the initial flow pattern (e.g. stationary flow) can be replaced by a different pattern (e.g. turbulent flow).

Typical hydrodynamic instabilities are summarized in the lecture.
The systematic analysis of thermohydraulic stability problems is developed for the case of Rayleigh-Bernard convection (fluid layer heated from below) and selected examples from fluid dynamics.

Covered is:

- linear stability analysis: determine limiting control parameter value up to which the basic flow pattern is stable against small perturbations.
- nonlinear reduced order modeling, capable to characterize more complex flow patterns
- Lorenz system: a generic system exhibiting chaotic behavior

Literature
Vorlesungsskript

T 11.435 Course: Steering of a Global Operating Company - The Robert BOSCH GmbH as an Example [T-MACH-110961]

Responsible: Bernd Grube
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102824 - Key Competencies

Type	Credits	Grading scale	Recurrence	Version
Completed coursework	2	pass/fail	Each winter term	1

Events					
WT 24/25	2149663	Steering of a Global Operating Company - The Robert BOSCH GmbH as an Example	2 SWS	Seminar / 🗣	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 24/25, 2 SWS, Language: German, Open in study portal

Content

The lecture series provides an insight into the main functional areas of a global company and is based on close interaction with the students. Top managers from Bosch explain the technical and business processes of a company using examples from their business areas. The tasks of the engineer working at an innovative and globally active automotive supplier is addressed. These range from technical competence and an understanding of economic aspects to questions of personnel responsibility.

In addition, insights are provided into the careers of the Bosch managers giving the lectures. The focus of the course is therefore not only on business processes but also on first-hand accounts of challenges, successes, failures and product and process innovations.

The topics in detail are:

- Introduction, Strategy, Innovation
- R&D, Product Development Process
- Production
- Quality Assurance
- 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

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 11.436 Course: Strategic Decision-Making in Global Production Network Design: A Seminar on Optimization and Simulation [T-MACH-113372]

Responsible: Martin Benfer
Prof. Dr.-Ing. Gisela Lanza

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102618 - Major Field: Production Technology

Type	Credits	Grading scale	Recurrence	Version
Examination of another type	4	Grade to a third	Each summer term	2

Events					
ST 2024	2150658	Strategic Decision-Making in Global Production Network Design: A Seminar on Optimization and Simulation	2 SWS	Seminar / 🗣	Lanza, Benfer
Exams					
ST 2024	76-T-MACH-113372	Strategic Decision-Making in Global Production Network Design: A Seminar on Optimization and Simulation			Lanza

Legend: 🖥 Online, 🧩 Blended (On-Site/Online), 🗣 On-Site, ✕ Cancelled

Competence Certificate

The assessment takes the form of an examination with a different type of success check (in accordance with §4(2), 3 SPO). Here, the project work, the milestone-based presentation of the results in presentation form and a final presentation are included in the assessment

Modeled Conditions

You have to fulfill one of 4 conditions:

1. The course T-MACH-110991 - Global Production must have been passed.
2. The course T-MACH-105158 - Global Production and Logistics - Part 1: Global Production must have been passed.
3. The course T-MACH-108848 - Global Production and Logistics - Part 1: Global Production must have been passed.
4. The course T-MACH-110337 - Global Production and Logistics must have been passed.

Recommendation

Participation in the following lectures:
Integrated Production Planning in the Age of Industry 4.0 [2150660]
Introduction to Operations Research I [2550040] + II [2530043]

Below you will find excerpts from events related to this course:

V Strategic Decision-Making in Global Production Network Design: A Seminar on Optimization and Simulation

Seminar (S)
On-Site

2150658, SS 2024, 2 SWS, Language: English, Open in study portal

Content

The lecture "Strategic Decision Making in the Design of Global Production Networks: A Seminar in Optimization and Simulation" offers students a comprehensive insight into the application of quantitative models from operations research in global production networks. The course places special emphasis on practical applications and allows students to deepen their skills through a real-world use case during the semester.

The classroom sessions serve to convey important basics and to introduce and present the practice-relevant cases. In the self-study phase, the topics covered are worked on in greater depth. The curriculum covers various phases. Optimization techniques for network design are covered first, followed by simulation methods for network management. Subsequently, open questions are dealt with, e.g. from the consideration of uncertainty, sustainability aspects or the search for the overall optimum in the production network.

The students are divided into small groups to work together on the questions. The methods taught in the course are implemented in python. In order to strengthen the students' presentation skills, regular presentations of interim results are planned. The progress made is supported by feedback and interaction with an internationally operating consulting firm.

The practical orientation of the course, combined with the application of quantitative models and the use of Python, enables students to prepare holistically for complex challenges in global production.

Learning Outcomes:

The Students are able to

1. **put concepts of global production into practice:**
   • Understand how global production networks can be implemented in real business scenarios.
   • Develop and implement strategies for adapting global production networks to specific business requirements.
2. **in-depth knowledge and use of optimization in global production:**
   • Develop an in-depth understanding of various optimization techniques in global production processes.
   • Apply optimization models to complex production networks and continuously improve them.
3. **approach to improving network configuration, site selection and transportation routes:**
   • Understand methods to evaluate and optimize production networks.
   • Effectively plan and improve site selection decisions and transportation routes.
4. **deepen knowledge and use of simulations in global production:**
   • Understand how simulations can be used as a tool to analyze and optimize global production processes.
   • Gain experience in the application of simulation techniques for modeling and analyzing production processes.
5. **approach to improving delivery reliability:**
   • Develop and implement strategies to improve delivery reliability.
   • Optimize processes that can affect delivery reliability.
6. **consider uncertainties, aspects of sustainability and multidimensionality:**
   • Recognize and manage uncertainties in global production environments.
   • Consider sustainability aspects and multidimensional challenges when making decisions in global production.
7. **linking results and models:**
   • Link models and analytical results to create holistic solutions to complex problems in global production.
   • Strengthen the ability to iteratively improve models based on real-world results.
8. **presentations to management:**
   • Present complex global manufacturing concepts to management in an understandable and persuasive manner.
   • Build confidence in the use of visual aids and effective communication techniques in front of management levels.

Workload:

regular attendance: ~ 30 hours
self-study: ~ 99 hours

Organizational issues

Aus organisatorischen Gründen ist die Teilnehmerzahl für die Lehrveranstaltung auf 20 Studierende begrenzt. Termine und Fristen zur Veranstaltung werden über die Homepage des wbk (https://www.wbk.kit.edu/studium-und-lehre.php) bekannt gegeben.

For organizational reasons the number of students is limited to 20. Dates and deadlines for the seminar will be announced via the homepage of wbk (https://www.wbk.kit.edu/studium-und-lehre.php).

Literature

Vorlesungsskript der Lehrveranstaltungen / Lecture notes of the courses:
Abele et al. (2008): Global Production [978-3-540-71652-5]
Domschke et al. (2015): Einführung in das Operations Research [Einführung in Operations Research]
Friedli et al. (2021): Global Manufacturing Management: From Excellent Plants Toward Network Optimization [978-3-030-72739-0]

T 11.437 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-102597 - Compulsory Elective Module Mechanical Engineering
M-MACH-102599 - Major Field: Powertrain Systems
M-MACH-102605 - Major Field: Engineering Design
M-MACH-102607 - Major Field: Vehicle Technology
M-MACH-102642 - Major Field: Development of Innovative Appliances and Power Tools

Type	Credits	Grading scale	Recurrence	Version
Oral examination	3	Grade to a third	Each summer term	2

Events					
ST 2024	2146198	Strategic product development - identification of potentials of innovative products	2 SWS	Lecture / Blended	Siebe
Exams					
ST 2024	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 2024, 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 11.438 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-102597 - Compulsory Elective Module Mechanical Engineering
M-MACH-102599 - Major Field: Powertrain Systems
M-MACH-102605 - Major Field: Engineering Design
M-MACH-102607 - Major Field: Vehicle Technology
M-MACH-102642 - Major Field: Development of Innovative Appliances and Power Tools

Type	Credits	Grading scale	Recurrence	Version
Examination of another type	1	Grade to a third	Each summer term	2

Events					
ST 2024	2146198	Strategic product development - identification of potentials of innovative products	2 SWS	Lecture / Blended	Siebe
Exams					
ST 2024	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

2146198, SS 2024, 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 11.439 Course: Structural Analysis of Composite Laminates [T-MACH-105970]

Responsible: Prof. Dr.-Ing. Luise Kärger

Organisation: KIT Department of Mechanical Engineering
Lightweight Design

Part of: M-MACH-102597 - Compulsory Elective Module Mechanical Engineering
M-MACH-102602 - Major Field: Reliability in Mechanical Engineering
M-MACH-102611 - Major Field: Materials Science and Engineering
M-MACH-102613 - Major Field: Lifecycle Engineering
M-MACH-102628 - Major Field: Lightweight Construction
M-MACH-102632 - Major Field: Polymer Engineering
M-MACH-102646 - Major Field: Applied Mechanics

Type	Credits	Grading scale	Recurrence	Version
Oral examination	4	Grade to a third	Each winter term	1

Events					
WT 24/25	2113106	Structural Analysis of Composite Laminates	2 SWS	Lecture / Practice (/ 🗣	Kärger
Exams					
ST 2024	76-T-MACH-105970	Structural Analysis of Composite Laminates			Kärger
WT 24/25	76-T-MACH 105970	Structural Analysis of Composite Laminates			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 24/25, 2 SWS, Language: German, Open in study portal

Lecture / Practice (VÜ)
On-Site

Content
To reduce fuel consumption and CO2 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 can explain the mechanical correlation between fibre-matrix-configuration and macroscopic material behavior. They are able to 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 can name, evaluate, and apply failure criteria and approaches to model damage progression. They can name and explain simple dimension strategies to design FRP components.

Literature

H. Altenbach, J. Altenbach, and R. Rikards: Einführung in die Mechanik der Laminat- und Sandwichtragwerke. Deutscher Verlag für Grundstoffindustrie, Stuttgart, 1. edition, 1996.

Henning, F.; Moeller, E.: Handbuch Leichtbau: Methoden, Werkstoffe, Fertigung. Carl Hanser Verlag GmbH & Co. KG, 2011

A. Puck: Festigkeitsanalyse von Faser-Matrix-Laminaten, Modelle für die Praxis. Carl Hanser Verlag, München, Wien, 1. edition, 1996.

H. Schürmann: Konstruieren mit Faserverbundwerkstoffen. ISBN 3-540-40283-7. Springer Verlag, 2005.

englischsprachige Literatur:

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 11.440 Course: Structural and Phase Analysis [T-MACH-102170]

Responsible: Dr.-Ing. Susanne Wagner
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102597 - Compulsory Elective Module Mechanical Engineering
M-MACH-102619 - Major Field: Technical Ceramics and Powder Materials

Type	Credits	Grading scale	Recurrence	Version
Oral examination	4	Grade to a third	Each winter term	1

Exams			
ST 2024	76-T-MACH-102170	Structural and Phase Analysis	Wagner
WT 24/25	76-T-MACH-102170	Structural and Phase Analysis	Wagner, Hinterstein

Competence Certificate
Oral examination

Prerequisites
none

T 11.441 Course: Structural Materials [T-MACH-100293]

Responsible: Dr.-Ing. Stefan Guth
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102597 - Compulsory Elective Module Mechanical Engineering

Type	Credits	Grading scale	Recurrence	Version
Oral examination	6	Grade to a third	Each winter term	3

Events					
WT 24/25	2174580	Structural Materials	4 SWS	Lecture / Practice (/	Guth
Exams					
ST 2024	76-T-MACH-100293	Structural Materials			Guth
WT 24/25	76-T-MACH-100293	Structural Materials			Guth

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 Structural Materials

2174580, WS 24/25, 4 SWS, Language: German, Open in study portal

Lecture / Practice (VÜ)
On-Site

Content
The lectures will be held online. Further information will be available on ILIAS.

Lectures and tutorialy on the topics:

- basic loading types and superimposed loadings
- high-temperature loading
- influence of notches
- uniaxial, multiaxial and superimposed cyclic loading
- notch fatigue
- structural durability
- impact of residual stresses
- basic principles of materials selection
- dimensioning of components

learning objectives:
The students are able to select materials for mechanical design and to dimension structural components according to the state of the art. They are familiar with the most important engineering materials. They can assess these materials on base of their characteristic properties and and they can match property profiles and requirement profiles. The dimensioning includes complex situations, such as multiaxial loading, notched components, static and dynamic loading, componetns with residual stresses and loading at high homologous temperatures.
requirements:
none
workload:

Precence: 42h

Self study: 138h

T 11.442 Course: Superconductors for Energy Applications [T-ETIT-110788]

Responsible: apl. Prof. Dr. Francesco Grilli
Organisation: KIT Department of Electrical Engineering and Information Technology
Part of: M-MACH-102595 - Compulsory Elective Module Natural Science/Computer Science/Electrical Engineering

Type	Credits	Grading scale	Recurrence	Expansion	Version
Oral examination	5	Grade to a third	Each winter term	1 terms	2

Events					
WT 24/25	2312704	Superconductors for Energy Applications	2 SWS	Lecture / 🗣	Grilli
WT 24/25	2312705	Übungen zu 2312704 Superconductors for Energy Applications	1 SWS	Practice / 🗣	Grilli
Exams					
ST 2024	7312682	Superconductors for Energy Applications			Grilli

Legend: 🖥 Online, ❖ Blended (On-Site/Online), 🗣 On-Site, ✕ Cancelled

Competence Certificate
oral exam approx. 30 minutes.

Prerequisites
A basic knowledge of electromagnetism and thermodynamics is the only requirement. Previous knowledge of superconductivity is not necessary.

"T-ETIT-106970 - Superconducting Materials for Energy Applications" must not be taken.

T 11.443 Course: Superhard Thin Film Materials [T-MACH-102103]

Responsible: Prof. Sven Ulrich
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102597 - Compulsory Elective Module Mechanical Engineering
M-MACH-102637 - Major Field: Tribology

Type	Credits	Grading scale	Recurrence	Version
Oral examination	4	Grade to a third	Each winter term	3

Events					
WT 24/25	2177618	Superhard Thin Film Materials	2 SWS	Lecture / 🗣	Ulrich
Exams					
ST 2024	76-T-MACH-102103	Superhard Thin Film Materials			Ulrich

Legend: 🖥 Online, ⚙ Blended (On-Site/Online), 🗣 On-Site, ✕ Cancelled

Competence Certificate
oral examination (ca. 30 Minuten)

Prerequisites
none

Below you will find excerpts from events related to this course:

V Superhard Thin Film Materials
2177618, WS 24/25, 2 SWS, Language: German, Open in study portal

Lecture (V)
On-Site

Content
oral examination (about 30 min), no tools or reference materials

Teaching Content:

Introduction

Basics

Plasma diagnostics

Particle flux analysis

Sputtering and ion implantation

Computer simulations

Properties of materials, thin film deposition technology,
thin film analysis and modelling of superhard materials

Amorphous hydrogenated carbon

Diamond like carbon

Diamond

Cubic Boronnitride

Materials of the system metall-boron-carbon-nitrogen-silicon

regular attendance: 22 hours
self-study: 98 hours

Superhard materials are solids with a hardness higher than 4000 HV 0,05. The main topics of this lecture are modelling, deposition, characterization and application of superhard thin film materials.

Recommendations: none

Organizational issues
Falls die Vorlesung online stattfinden muss, bitte um Anmeldung unter sven.ulrich@kit.edu bis zum 22.10.24.

Den entsprechenden MS Teams Link erhalten Sie dann per E-Mail am 23.10.24.

Literature
G. Kienel (Herausgeber): Vakuumbeschichtung 1 - 5, VDI Verlag, Düsseldorf, 1994

Abbildungen und Tabellen werden verteilt; Copies with figures and tables will be distributed

T 11.444 Course: Sustainable Product Engineering [T-MACH-105358]

Responsible: Prof. Dr.-Ing. Albert Albers
Prof. Dr.-Ing. Sven Matthiesen
Dr.-Ing. Karl-Friedrich Ziegahn

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102597 - Compulsory Elective Module Mechanical Engineering
M-MACH-102599 - Major Field: Powertrain Systems
M-MACH-102605 - Major Field: Engineering Design
M-MACH-102607 - Major Field: Vehicle Technology
M-MACH-102613 - Major Field: Lifecycle Engineering
M-MACH-102614 - Major Field: Mechatronics
M-MACH-102623 - Major Field: Fundamentals of Energy Technology
M-MACH-102633 - Major Field: Robotics
M-MACH-102650 - Major Field: Combustion Engines Based Powertrains

Type	Credits	Grading scale	Recurrence	Version
Written examination	4	Grade to a third	Each summer term	2

Events					
ST 2024	2146192	Sustainable Product Engineering	2 SWS	Lecture / 🗣	Ziegahn
Exams					
ST 2024	76-T-MACH-105358	Sustainable Product Engineering			Ziegahn, Albers

Legend: 🖥 Online, ⚙ Blended (On-Site/Online), 🗣 On-Site, ✕ Cancelled

Competence Certificate
written exam (90 min)

Prerequisites
none

Recommendation
None

Below you will find excerpts from events related to this course:

V Sustainable Product Engineering
2146192, SS 2024, 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 11.445 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-102597 - Compulsory Elective Module Mechanical Engineering
M-MACH-102607 - Major Field: Vehicle Technology
M-MACH-102627 - Major Field: Energy Converting Engines
M-MACH-102650 - Major Field: Combustion Engines Based Powertrains

Type	Credits	Grading scale	Recurrence	Version
Oral examination	4	Grade to a third	Each winter term	1

Events					
WT 24/25	2133132	Sustainable Vehicle Drivetrains	2 SWS	Lecture / 🗣	Toedter

Legend: 🖥 Online, 🔀 Blended (On-Site/Online), 🗣 On-Site, ✕ Cancelled

Competence Certificate
oral exam (approx. 20 minutes)

Prerequisites
none

Annotation
Starting in winter term 25/26, the course consists of a lecture (2h / week) and a tutorial (1 h / week).

Below you will find excerpts from events related to this course:

V Sustainable Vehicle Drivetrains

Lecture (V)
On-Site

2133132, WS 24/25, 2 SWS, Language: German, Open in study portal

Content
Sustainability

Environmental balance

Legislation

Alternative fuels

BEV

Fuel cell

Hybrid drives

T 11.446 Course: System Integration in Micro- and Nanotechnology [T-MACH-105555]

Responsible: apl. Prof. Dr. Ulrich Gengenbach
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102597 - Compulsory Elective Module Mechanical Engineering
M-MACH-102598 - Major Field: Advanced Mechatronics
M-MACH-102601 - Major Field: Automation Technology
M-MACH-102614 - Major Field: Mechatronics
M-MACH-102615 - Major Field: Medical Technology
M-MACH-102633 - Major Field: Robotics
M-MACH-102647 - Major Field: Microactuators and Microsensors

Type	Credits	Grading scale	Recurrence	Version
Oral examination	4	Grade to a third	Each summer term	1

Events					
ST 2024	2106033	System Integration in Micro- and Nanotechnology I	2 SWS	Lecture / 🗣	Gengenbach
Exams					
ST 2024	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 2024, 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

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 11.447 Course: System Integration in Micro- and Nanotechnology 2 [T-MACH-110272]

Responsible: apl. Prof. Dr. Ulrich Gengenbach
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102597 - Compulsory Elective Module Mechanical Engineering
M-MACH-102598 - Major Field: Advanced Mechatronics
M-MACH-102601 - Major Field: Automation Technology
M-MACH-102614 - Major Field: Mechatronics
M-MACH-102615 - Major Field: Medical Technology
M-MACH-102633 - Major Field: Robotics
M-MACH-102647 - Major Field: Microactuators and Microsensors

Type	Credits	Grading scale	Recurrence	Version
Oral examination	4	Grade to a third	Each winter term	1

Events					
WT 24/25	2105040	System Integration in Micro- and Nanotechnology 2	2 SWS	Lecture / 🗣	Gengenbach
Exams					
ST 2024	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

Below you will find excerpts from events related to this course:

V System Integration in Micro- and Nanotechnology 2

2105040, WS 24/25, 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:

- 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 11.448 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-102405 - Fundamentals and Methods of General Mechanical Engineering
M-MACH-102575 - Fundamentals and Methods of Energy and Environmental Engineering
M-MACH-102739 - Fundamentals and Methods of Automotive Engineering
M-MACH-102740 - Fundamentals and Methods of Mechatronics and Microsystem Technology
M-MACH-102741 - Fundamentals and Methods of Product Development and Construction
M-MACH-102742 - Fundamentals and Methods of Production Technology
M-MACH-102743 - Fundamentals and Methods of Theoretical Foundations of Mechanical Engineering
M-MACH-102744 - Fundamentals and Methods of Materials and Structures for High Performance Systems

Type	Credits	Grading scale	Recurrence	Version
Written examination	4	Grade to a third	Each summer term	5

Events					
ST 2024	2174576	Systematic Materials Selection	3 SWS	Lecture / 🗣	Dietrich
ST 2024	2174577	Excercises in Systematic Materials Selection	1 SWS	Practice / 🗣	Dietrich
Exams					
ST 2024	76-T-MACH-100531	Systematic Materials Selection			Dietrich
WT 24/25	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
none

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

Lecture (V)
On-Site

2174576, SS 2024, 3 SWS, Language: German, Open in study portal

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 11.449 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-102597 - Compulsory Elective Module Mechanical Engineering
M-MACH-102605 - Major Field: Engineering Design
M-MACH-102610 - Major Field: Power Plant Technology
M-MACH-102623 - Major Field: Fundamentals of Energy Technology
M-MACH-102642 - Major Field: Development of Innovative Appliances and Power Tools

Type	Credits	Grading scale	Recurrence	Version
Oral examination	4	Grade to a third	Each term	1

Events					
ST 2024	2158107	Technical Acoustics	2 SWS	Lecture / 🗣	Walter, Pantle
Exams					
ST 2024	76-T-MACH-111382	Technical Acoustics			Pantle, Walter
WT 24/25	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 2024, 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 14-tägigem Rhythmus statt. 1. Termin in 1. Vorlesungswoche.

Literature

1. Vorlesungsskript (über ILIAS erreichbar).
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 11.450 Course: Technical and Environmental Historical Perspectives on Current Innovation Processes [T-GEISTSOZ-110845]

Responsible: Prof. Dr. Marcus Popplow
Organisation: KIT Department of Humanities and Social Sciences
Part of: M-MACH-102596 - Compulsory Elective Subject Economics/Law

Type	Credits	Grading scale	Recurrence	Version
Completed coursework	4	pass/fail	Each term	2

Events					
ST 2024	5012014	Innovation processes: Perspectives from the history of technology and environmental history (seminar for students in mechanical engineering)	2 SWS	Seminar / 🗣	Popplow
WT 24/25	5012045	Perspectives on current innovation processes from the history of technology and the environment (seminar for mechanical engineering students, maximum number of participants: 25)	2 SWS	Seminar / 🗣	Popplow
Exams					
ST 2024	7400565	Technical and environmental historical perspectives on current innovation processes			Popplow
WT 24/25	7400466	Technical and environmental historical perspectives on current innovation processes			Popplow

Legend: 🖥 Online, ❖ Blended (On-Site/Online), 🗣 On-Site, ✕ Cancelled

Prerequisites
none

T 11.451 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-102597 - Compulsory Elective Module Mechanical Engineering
M-MACH-102600 - Major Field: Man - Technology - Organisation
M-MACH-102605 - Major Field: Engineering Design

Type	Credits	Grading scale	Recurrence	Version
Written examination	4	Grade to a third	Each summer term	1

Events					
ST 2024	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 2024, 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** 2024 **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 11.452 Course: Technical Energy Systems for Buildings 1: Processes & Components [T-MACH-105559]

Responsible: Dr. Ferdinand Schmidt
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102648 - Major Field: Energy Technology for Buildings

Type	Credits	Grading scale	Recurrence	Version
Oral examination	4	Grade to a third	Each winter term	1

Events					
WT 24/25	2157200	Technical energy systems for buildings 1: Processes & components	2 SWS	Lecture / 🗣	Schmidt
Exams					
ST 2024	76-T-MACH-105559	Technical Energy Systems for Buildings 1: Processes & Components			Schmidt
WT 24/25	76-T-MACH-105559	Technical Energy Systems for Buildings 1: Processes & Components			Schmidt

Legend: 🖥 Online, 🧩 Blended (On-Site/Online), 🗣 On-Site, ✕ Cancelled

Competence Certificate
oral exam, approx. 30 minutes

Prerequisites
none

Below you will find excerpts from events related to this course:

V Technical energy systems for buildings 1: Processes & components

Lecture (V)
On-Site

2157200, WS 24/25, 2 SWS, Language: German, Open in study portal

Content
Introduction to heating and cooling technologies for buildings, solar energy utilization in buildings (solar radiation, solar thermal energy, photovoltaics) and to energy storage in buildings (thermal and electric storage technologies). Topics covered:

- Burners, condensing and non-condensing boilers
- Cogeneration units for use in buildings
- Heat transformation: Fundamentals, vapor compression, absorption, adsorption
- Solar energy: Radiation, solar thermal collectors, photovoltaics
- energy storage in buildings: thermal and electric storage

Learning objectives:

Students know relevant technical components of energy supply systems in buildings (heating and cooling, dehumidification). They know the energy conversion processes associated with these components and can estimate their energy efficiencies as well as the most important factors influencing efficiency.

Students are familiar with the underlying physics (mostly thermodynamics) of the relevant processes. They can derive relevant figures of merit from these principles. They know the degree of technological development for the various processes and components and are aware of current research and development objectives in this field.

Oral exam: about 25 min.
No tools

T 11.453 Course: Technical Energy Systems for Buildings 2: System Concept [T-MACH-105560]

Responsible: Dr. Ferdinand Schmidt
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102648 - Major Field: Energy Technology for Buildings

Type	Credits	Grading scale	Recurrence	Version
Oral examination	4	Grade to a third	Each summer term	1

Events					
ST 2024	2158201	Technical energy systems for buildings 2: System concepts	2 SWS	Lecture / 🗣	Schmidt
Exams					
ST 2024	76-T-MACH-105560	Technical Energy Systems for Buildings 2: System Concept			Schmidt
WT 24/25	76-T-MACH-105560	Technical Energy Systems for Buildings 2: System Concept			Schmidt

Legend: 🖥 Online, 🧩 Blended (On-Site/Online), 🗣 On-Site, ✕ Cancelled

Competence Certificate
oral exam, approx. 30 minutes

Prerequisites
none

Below you will find excerpts from events related to this course:

V Technical energy systems for buildings 2: System concepts

2158201, SS 2024, 2 SWS, Language: German, Open in study portal

Lecture (V)
On-Site

Content
Introduction of relevant figures of merit for technical energy systems in buildings. Description of different system concepts for energy supply of buildings (heating, cooling, dehumidification) and evaluation according to figures of merit. Systems covered include

- Heat pumps and heat pump systems including combination with solar thermal energy
- cogeneration and trigeneration system (heating, cooling, power)
- Solar thermal systems: Domestic hot water, heating support, cooling and dehumidification
- District heating systems including solar thermal heat
- Photovoltaics and heat pump systems including thermal and battery storage
- Grid-reactive building technology: Smart-Metering, Smart Home, Smart Grid

Learning outcomes:

Students are able to develop system concepts for technical energy systems in buildings and to rationally design such systems. They know the relevant figures of merit for an energy-related as well as an economical or combined evaluation of systems, and know how to employ these figures of merit in sizing systems and components. Students are able to employ plausibility checks and to give rough estimates on building energy concepts and they know which technologies can be combined for highly efficient system combinations.

Workload: 30 hours course attendance, 90 hours self-study

Oral exam appr. 25 minutes

T 11.454 Course: Technology of Steel Components [T-MACH-105362]

Responsible: Prof. Dr.-Ing. Volker Schulze
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102597 - Compulsory Elective Module Mechanical Engineering
M-MACH-102611 - Major Field: Materials Science and Engineering
M-MACH-102618 - Major Field: Production Technology

Type	Credits	Grading scale	Recurrence	Version
Oral examination	4	Grade to a third	Each summer term	2

Events					
ST 2024	2174579	Technology of steel components	2 SWS	Lecture / 🗣	Schulze
Exams					
ST 2024	76-T-MACH-105362	Technology of Steel Components			Schulze
WT 24/25	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
none

Below you will find excerpts from events related to this course:

V Technology of steel components

2174579, SS 2024, 2 SWS, Language: German, Open in study portal

Lecture (V)
On-Site

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 11.455 Course: Ten Lectures on Turbulence [T-MACH-105456]

Responsible: Dr. Ivan Otic
Organisation: KIT Department of Mechanical Engineering

Part of:
M-MACH-102597 - Compulsory Elective Module Mechanical Engineering
M-MACH-102608 - Major Field: Nuclear Energy
M-MACH-102612 - Major Field: Modeling and Simulation in Energy- and Fluid Engineering
M-MACH-102643 - Major Field: Fusion Technology

Type	Credits	Grading scale	Recurrence	Version
Oral examination	4	Grade to a third	Each winter term	1

Events					
WT 24/25	2189904	Ten lectures on turbulence	2 SWS	Lecture /	Otic

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 Ten lectures on turbulence

2189904, WS 24/25, 2 SWS, Language: English, Open in study portal

Lecture (V)
Blended (On-Site/Online)

Content
Contents:

The course is aimed of giving the fundamentals of turbelence theory, modelling and simulation. Governing equations and statistical description of turbulence are introduced. Reynolds equations, Kolmogorov's theory and scales of turbulent ows are discussed. Homogeneous and isotropic turbulence. Turbulent free-shear ows and wall-bounded turbulent ows are discussed. Turbulence modelling approaches and simulation methods are introduced.

1 Introduction
2 Turbulent transport of momentum and heat
3 Statistical description of turbulence
4 Scales of turbulent flows
5 Homogeneous turbulent shear flows
6 Free turbulent shear flows
7 Wall-Bounded turbulent flows
8 Turbulence Modelling
9 Reynolds Averaged Navier-Stokes (RANS) Simulation Approach
10 Large Eddy Simulation (LES) Approach

Objectives:

At the completion of this course, students
- are able to understand fundamentals of statistical fluid mechanics, turbulence theory and turbulence modelling
- are able to derive RANS and LES transport equations
- get working knowledge of modelling techniques that can be used for solving engineering heat and mass transfer problems.

- able to formulate an own turbulence model and implement it into the opensource computational fluid dynamics software OpenFOAM.

Literature
Reference texts:
- Lecture Notes
- Presentation slides

Recommended Books:
- Pope, S. B.: Turbulent Flows. Cambridge University Press, 2003.
- Hinze J. O.: Turbulence. McGraw-Hill, 1975.

T 11.456 Course: Theory of Stability [T-MACH-105372]

Responsible: Prof. Dr.-Ing. Alexander Fidlin
Organisation: KIT Department of Mechanical Engineering

Part of:
M-MACH-102597 - Compulsory Elective Module Mechanical Engineering
M-MACH-102598 - Major Field: Advanced Mechatronics
M-MACH-102614 - Major Field: Mechatronics
M-MACH-102646 - Major Field: Applied Mechanics
M-MACH-104443 - Major Field: Vibration Theory

Type	Credits	Grading scale	Recurrence	Version
Oral examination	6	Grade to a third	Each summer term	1

Events					
ST 2024	2163113	Theory of Stability	2 SWS	Lecture / ✕	Fidlin
ST 2024	2163114	Übungen zu Stabilitätstheorie	2 SWS	Practice / ✕	Fidlin, Yüzbasioglu
Exams					
ST 2024	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 2024, 2 SWS, Language: German, Open in study portal

Lecture (V)
Cancelled

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

Organizational issues
Die Vorlesung Stabilitätstheorie wird im Sommersemester 2024 nicht angeboten.

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 11.457 Course: Thermal Solar Energy [T-MACH-105225]

Responsible: apl. Prof. Dr. Ron Dagan
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102623 - 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 24/25	2189400	Solar Thermal Energy Systems	2 SWS	Lecture / 🗣	Dagan
Exams					
ST 2024	76-T-MACH-105225	Thermal Solar Energy			Dagan
WT 24/25	76-T-MACH-106493	Solar Thermal Energy Systems			Dagan

Legend: 🖥 Online, ❋ Blended (On-Site/Online), 🗣 On-Site, × Cancelled

Competence Certificate
Oral examination of about 30 minutes

Prerequisites
none

Modeled Conditions
The following conditions have to be fulfilled:

1. The course T-MACH-106493 - Solar Thermal Energy Systems must not have been started.

Below you will find excerpts from events related to this course:

V Solar Thermal Energy Systems

2189400, WS 24/25, 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 Vorlesung "Thermische Solarenergie" findet ab dem WS 2024/25 nicht mehr statt. Sie wurde zusammengelegt mit der engl. Version "Solar Thermal Energy Systems"

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

11.458 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-102597 - Compulsory Elective Module Mechanical Engineering
M-MACH-102610 - Major Field: Power Plant Technology
M-MACH-102623 - Major Field: Fundamentals of Energy Technology
M-MACH-102627 - Major Field: Energy Converting Engines
M-MACH-102635 - Major Field: Engineering Thermodynamics
M-MACH-102636 - Major Field: Thermal Turbomachines

Type	Credits	Grading scale	Recurrence	Version
Oral examination	6	Grade to a third	Each winter term	1

Events					
WT 24/25	2169453	Thermal Turbomachines I	3 SWS	Lecture / 🗣	Bauer
WT 24/25	2169454	Tutorial - Thermal Turbo Machines I	2 SWS	Practice / 🗣	Bauer
Exams					
ST 2024	76-T-MACH-105363	Thermal Turbomachines I			Bauer
ST 2024	76T-Mach-105363-Wdh	Thermal Turbomachines I (for repeater)			Bauer
WT 24/25	76-T-MACH-105363	Thermal Turbomachines I			Bauer
WT 24/25	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 24/25, 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

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

Organizational issues
Vorlesung wird nur noch in Englisch gehalten ab WS 2023/24.

Aufzeichnungen in Deutsch aus früheren Vorlesungen werden weiter zur Verfügung gestellt.

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 11.459 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-102597 - Compulsory Elective Module Mechanical Engineering
M-MACH-102610 - Major Field: Power Plant Technology
M-MACH-102627 - Major Field: Energy Converting Engines
M-MACH-102635 - Major Field: Engineering Thermodynamics
M-MACH-102636 - Major Field: Thermal Turbomachines

Type	Credits	Grading scale	Recurrence	Version
Oral examination	6	Grade to a third	Each summer term	2

Events					
ST 2024	2170477	Tutorial - Thermal Turbomachines II (Übung - Thermische Turbomaschinen II)	2 SWS	Practice / 🗣	Bauer, Mitarbeiter
ST 2024	2170553	Thermal Turbomachines II (in English)	3 SWS	Lecture / 🗣	Bauer
Exams					
ST 2024	76-T-MACH-105364	Thermal Turbomachines II			Bauer
ST 2024	76T-Mach-105364-Wdh	Thermal Turbomachines II (for repeaters)			Bauer
WT 24/25	76-T-MACH-105364	Thermal Turbomachines II			Bauer
WT 24/25	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 (in English)

2170553, SS 2024, 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'.

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 11.460 Course: Thermal-Fluid-Dynamics [T-MACH-106372]

Responsible: Dr. Sebastian Ruck
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102597 - Compulsory Elective Module Mechanical Engineering
M-MACH-102610 - Major Field: Power Plant Technology
M-MACH-102612 - Major Field: Modeling and Simulation in Energy- and Fluid Engineering
M-MACH-102634 - Major Field: Fluid Mechanic
M-MACH-102643 - Major Field: Fusion Technology
M-MACH-102648 - Major Field: Energy Technology for Buildings

Type	Credits	Grading scale	Recurrence	Version
Oral examination	4	Grade to a third	Each winter term	1

Events					
WT 24/25	2189423	Thermal-Fluid-Dynamics	2 SWS	Lecture / 🗣	Ruck
Exams					
ST 2024	76-T-MACH-106372	Thermal-Fluid-Dynamics			Ruck
WT 24/25	76-T-MACH-106372	Thermal-Fluid-Dynamics			Ruck

Legend: 🖥 Online, ⚙ Blended (On-Site/Online), 🗣 On-Site, ✕ Cancelled

Competence Certificate
oral exam of about 30 minutes

Prerequisites
none

Below you will find excerpts from events related to this course:

V Thermal-Fluid-Dynamics

2189423, WS 24/25, 2 SWS, Language: German, Open in study portal

Lecture (V)
On-Site

Content
Content

- Fundamentals of flows and heat transfer
- Dimensionless parameters of thermal fluid dynamics
- Velocity and temperature laws in boundary layers
- Convective heat transfer of external and internal flows
- Heat transfer analogies (Prandtl-, von Kárman, Martinelli,…)
- Methods for enhancing heat transfer
- Strategies and methods for investigation of thermal-hydraulics in R&D

The lecture provides an overview of momentum and energy transport as occurring in power engineering components and heat exchangers. On the basis of the conservation equations and the fundamentals of thermal-hydraulics, dimensionless parameters for forced and free convection are evolved. Flows close to walls play a crucial role for the convective heat transfer and for heat exchanger components. Thus, with scaling rules the laminar and turbulent thermal boundary layer equations are introduced. In the following, velocity and temperature laws of the wall as a basis for analogies and models of computational tools are discussed and the influence of roughness and surface design are shown. Concepts of state-of-the-art turbulence modelling and their applicability for different conditions or different heat transfer fluids (e.g. liquid metals, gas, oil) are described. Analogies and correlations for internal and external forced convection are developed by means of approximation concepts. Design options to enhance the efficiency and effectiveness of heat exchangers are discussed.

The objectives of the lecture are the fundamentals of thermal-hydraulics for describing and modelling convective fluid flow as occurring in power engineering components. A major objective is the description of the convective heat transfer for external and internal flows. A key issue is the transfer of analytic models and empirical results into “state of the art” computational tools and their validation by advanced experimental methods. Within the scope of the course, the students learn (a) to develop differential equation for thermal-hydraulic problems and to describe the thermal flow field by means of dimensionless parameters, (b) to transfer a real problem to an experiment or computational model, (c) to develop analogies and correlations for heat transfer processes of forced convection, (d) to select adequate computational methods/models, (e) to evaluate and select experiments including measurement techniques with adequate instrumentation for thermal-hydraulic problems and (f) to know design option for an efficient and effective heat exchange.

Attendance time: 21 h
Preparation/follow-up time of lectures, exam preparation: 90h

Oral exam of about 30 min.

Literature
Literaturlisten und Angabe von Fachliteratur werden jeweils in den Vorlesungen genannt. Unterlagen zur Lehrveranstaltung werden online unter http://ilias.studium.kit.edu zu Verfügung gestellt. Handout mit Übungsaufgaben für ausgewählte Themengebiete in den jeweiligen Vorlesungen.

T 11.461 Course: Thermodynamics of the energy transition [T-MACH-113145]

Responsible: Prof. Dr.-Ing. Daniel Banuti
Organisation: KIT Department of Mechanical Engineering
Part of: M-MACH-102610 - Major Field: Power Plant Technology

Type	Credits	Grading scale	Recurrence	Version
Oral examination	4	Grade to a third	Each winter term	1

Events					
WT 24/25	2153450	Thermodynamics of the energy transition	2 SWS	Lecture / 🗣	Banuti
Exams					
ST 2024	76-T-MACH-113145	Thermodynamics of the energy transition			Banuti

Legend: 🖥 Online, ⚙ Blended (On-Site/Online), 🗣 On-Site, ✕ Cancelled

Competence Certificate
Oral exam, duration: approximately 30 minutes

no tools of reference materials may be used during the exam

Prerequisites
none

Below you will find excerpts from events related to this course:

V Thermodynamics of the energy transition

2153450, WS 24/25, 2 SWS, Language: English, Open in study portal

Lecture (V)
On-Site

Content
(i) Climate change and consequences (welt bulb temperature and human limits, cooling water heating and influence on power plants, water loading in warmer air and weather)

(ii) Power cycles (Efficiency of "classical" processes at higher pressures, Organic Rankine cycles for low-temperature heat sources, supercritical cycle processes (MoNiKa), carbon-capture cycles (Allam-cycle), heat pumps

(iii) Hydrogen as an energy carrier for sector coupling (basic principles of production, use, safety)

(iv) Properties and behaviour of fluids at high pressures (high-pressure processes and hydrogen: phase diagrams, supercritical pseudo-evaporation processes and phase interfaces, Widom line, material models (ideal gas, incompressible, real gas state equations and their solution, etc.).

T 11.462 Course: Thin Film and Small-scale Mechanical Behavior [T-MACH-105554]

Responsible: Dr. Patric Gruber
Prof. Dr. Christoph Kirchlechner
Dr. Daniel Weygand

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-105904 - Major Field: Advanced Materials Modelling and Data Management

Type	Credits	Grading scale	Recurrence	Version
Oral examination	4	Grade to a third	Each summer term	1

Events					
ST 2024	2178123	Thin film and small-scale mechanical behavior	2 SWS	Lecture / 🗣	Kirchlechner, Gruber, Weygand
Exams					
ST 2024	76-T-MACH-105554	Thin Film and Small-scale Mechanical Behavior			Kirchlechner, Gruber, Weygand

Legend: 🖥 Online, 🧩 Blended (On-Site/Online), 🗣 On-Site, ✕ Cancelled

Competence Certificate
oral exam 30 minutes

Prerequisites
none

Recommendation
preliminary knowlegde in materials science, physics and mathematics

Below you will find excerpts from events related to this course:

V Thin film and small-scale mechanical behavior

2178123, SS 2024, 2 SWS, Language: English, Open in study portal

Lecture (V)
On-Site

Content
1. Introduction: Application and properties of micro- and nanosystems; Overview on size effects

2. Fundamentals: Dislocation plasticity (definition of a dislocation; dislocation density, mobility, dislocation sources, statistical aspects incl. SSDs and GNDs).

3. Single crystal plasticity: mechanical and microstructure characterization, mechanisms and their size dependence.

4. Interface plasticity: Compatibility, slip transfer mechanisms, expected size effects.

5. Modelling of mechanisms causing size effects in crystals and at grain boundaries, e.g. dislocation dynamics.
6. Thin film materials: synthesis, characterization and mechanical properties.

7. Nanocrystalline materials: Synthesis, outstanding mechanical properties

The students know and understand size and scaling effects in micro- and nanosystems based on the fundamental microstructure mechanisms at play. They can describe the mechanical behavior of nano- and microstructured materials and analyze and explain the origin for the differences compared to classical material behavior. They are able to explain suitable processing routes, experimental characterization techniques and adequate modelling schemes for nano- and microstructured materials.

regular attendance: 22,5 hours

self-study: 97,5 hours

oral exam ca. 30 minutes

Literature
1. M. Ohring: „The Materials Science of Thin Films“, Academic Press, 1992
2. L.B. Freund and S. Suresh: „Thin Film Materials

T 11.463 Course: Thin Films – Preparation, Structure, Thermodynamics [T-MACH-112158]

Responsible: Dr. rer. nat. Stefan Wagner
Organisation: KIT Department of Mechanical Engineering
Part of: M-MACH-102611 - Major Field: Materials Science and Engineering

Type	Credits	Grading scale	Recurrence	Expansion	Version
Oral examination	4	Grade to a third	Each winter term	1 terms	1

Events					
WT 24/25	2173573	Thin Films – Preparation, Structure, Thermodynamics	2 SWS	Lecture / 🗣	Wagner
Exams					
ST 2024	76-T-MACH-112158	Thin Films – Preparation, Structure, Thermodynamics			Wagner
WT 24/25	76-T-MACH-112158	Thin Films – Preparation, Structure, Thermodynamics			Wagner

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 Thin Films – Preparation, Structure, Thermodynamics
2173573, WS 24/25, 2 SWS, Language: English, Open in study portal

Lecture (V)
On-Site

Content
This lecture addresses the foundations of thin film preparation, microstructure and specific thermodynamic properties. The students know basics of UHV (Ultra-High-Vacuum) techniques and basic methods to characterize physical and mechanical properties of thin films. They know different methods of thin film preparation und can denominate their respective pros and cons. The students are familiar with the different nucleation and growth modi and with the epitaxy of thin films with the substrate, and they can denominate and classify the resulting microstructures of the films. The students can describe and motivate principal differences in the physical properties of bulk materials and thin films. They know how these differences affect the stability of thermodynamic phases of alloys and how this can be utilized to tune thin film properties.

T 11.464 Course: Tires and Wheel Development for Passenger Cars [T-MACH-102207]

Responsible: Prof. Dr.-Ing. Günter Leister
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102597 - Compulsory Elective Module Mechanical Engineering
M-MACH-102607 - Major Field: Vehicle Technology

Type	Credits	Grading scale	Recurrence	Version
Oral examination	4	Grade to a third	Each summer term	1

Events					
ST 2024	2114845	Tires and Wheel Development for Passenger Cars	2 SWS	Lecture / 🗣	Leister
Exams					
ST 2024	76-T-MACH-102207	Tires and Wheel Development for Passenger Cars			Leister
WT 24/25	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 2024, 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 11.465 Course: Tools for HPC and AI in Engineering [T-MACH-113265]

Responsible: Dr.-Ing. Samuel Braun
Organisation: KIT Department of Mechanical Engineering
Part of: M-MACH-102650 - Major Field: Combustion Engines Based Powertrains

Type	Credits	Grading scale	Recurrence	Version
Oral examination	4	Grade to a third	Each winter term	1

Events					
WT 24/25	2133120	Tools for HPC and AI in Engineering	2 SWS	Lecture / 🗣	Braun
Exams					
ST 2024	76-T-MACH-113265	Tools for HPC and AI in Engineering			Koch
WT 24/25	76-T-MACH-113265	Tools for HPC and AI in Engineering			Braun

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 Tools for HPC and AI in Engineering

Lecture (V)
On-Site

2133120, WS 24/25, 2 SWS, Language: German, Open in study portal

Content
The lecture covers the basics of the tools necessary to work in the fields of artificial intelligence and high performance computing.

In particular, the framework conditions and the infrastructure provided by KIT will also be addressed.

The following topics and issues will be covered:

- Hardware and operating system
  Which (relevant) components does a computer have? How can AI applications be executed with different operating systems (Windows, MacOS, Linux)? How can supercomputers be accessed from different operating systems?
- Command line
  What is the command line and why does it (still) exist? What possibilities do the different operating systems offer to access the command line? Which shells exist and which are typical on HPC facilities? What are the basic commands to get around on a supercomputer?
- Remote Access
  How to access a supercomputer, what are the types of authentication? How do you set up SSH keys and what forms of 2-factor authentication are common? How does a file transfer between supercomputer and local computer work?
- Supercomputers and HPC
  How is a supercomputer different from regular PCs? Which HPC resources does KIT offer? How are they accessed and what are the special features of the KIT infrastructure compared to other systems? What infrastructure is available statewide and nationally, for what purposes? How must software be designed to be compatible with supercomputers?
- Version Control
  What is it and why is it needed? What code hosting services exist? How does one access the Gitlab instance operated by KIT? What CI/CD capabilities exist at KIT?
- Editors
  How to edit program code, locally or remotely? What are the possibilities of Visual Studio Code to debug AI applications or HPC workflows on KIT supercomputers? How to develop code with code-server on compute nodes? How can documentation be done? What is the current state of pair programming with AI?
- Python and Jupyter
  Which Python distributions exist? Which ones are suitable for KIT HPC resources? How can Python packages be installed and used? What are Virtual Environments and what are they needed for? How can machine learning applications be developed with Jupyter, locally and remotely?
- Machine Learning
  What are the typical software packages needed for AI applications? How are they installed and used? What is a typical workflow to develop/use ML applications? What are accelerators, what specialized hardware does KIT infrastructure have?
- Remote Visualization
  How to use graphical applications on remote computers? What are the possibilities of remote visualization? Using Paraview as an example, how can a flow simulation be graphically evaluated interactively/non-interactively?
- Special topics
  What are containers and virtual machines? What are the benefits of containers especially for Machine Learning applications? Which container solutions can be used on KIT supercomputers? What is WSL 2? Which (commercial) cloud services exist for HPC and AI? Which cloud services are available at KIT for free?

Learning objectives
A major learning goal of the lecture is to provide an overview of available and suitable software tools (editors, access options, version management, infrastructure (at KIT)) for HPC and AI. Any existing fear of contact with the Linux operating system and the seemingly complex use of supercomputers will be eliminated. After successful attendance of the lecture, the students will be able to work on theses that touch on the topics of Artificial Intelligence or High Performance Computing.

Performance assessment
Oral exam: 30 min

T 11.466 Course: Tractors [T-MACH-105423]

Responsible: Prof. Dr.-Ing. Marcus Geimer
Hon.-Prof. Dr. Martin Kremmer

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102597 - Compulsory Elective Module Mechanical Engineering
M-MACH-102630 - Major Field: Mobile Machines

Type	Credits	Grading scale	Recurrence	Version
Written examination	4	Grade to a third	Each winter term	1

Events					
WT 24/25	2113080	Tractors	2 SWS	/ 🗣	Kremmer

Legend: 🖥 Online, ⚙ Blended (On-Site/Online), 🗣 On-Site, ✕ Cancelled

Competence Certificate
The assessment consists of an written exam taking place in the recess period (90 min).

Prerequisites
none

Recommendation
Basic knowledge in mechanical engineering.

Annotation
Learning Outcomes
After completion of the course the Students know:

- important problems in agritechnological developments
- Customer requirements and their implementation in tractors
- Tractor technology in width and depth

Content
Tractors are one of the most underestimated vehicles in regard to performance und technics. Almost none vehicle is as multifunctional and fulfilled with high-tech as a tractor. Automatic guidance, special chassis suspension or special concepts of power trains are one of the topics where tractors are in leading position in technologies
During the lecture an overview about the design and construction and application area is given. A close look will be taken on the historical background, legal requirements, ways of development, agricultural organizations and the process of development itself.
In detail the following topics will be dealt with:

- agricultural organization / legal requirements
- history of tractors
- tractor engineering
- tractor mechanics
- chassis suspension
- combustion engine
- transmission
- interfaces
- hydraulics
- wheels and tyres
- cabin
- electrics and electronics

Literature

- K.T. Renius: Traktoren - Technik und ihre Anwendung; DLG Verlag (Frankfurt), 1985
- E. Schilling: Landmaschinen - Lehr- und Handbuch für den Landmaschinenbau; Schilling-Verlag (Köln), 1960

Below you will find excerpts from events related to this course:

V **Tractors**
2113080, WS 24/25, 2 SWS, Language: German, Open in study portal **On-Site**

Content
Tractors are one of the most underestimated vehicles in regard to performance und technics. Almost none vehicle is as multifunctional and fullfilled with high-tec as a tractor. Automatic guidance, special chassis suspension or special concepts of power trains are one of the topics where tractors are in leading position in technologies

During the lecture an overview about the design and construction and application area is given. A close look will be taken on the historical backround, legal requirements, ways of development, agricultural organizations and the proces of development itself.

In detail the following topics will be dealt with:

- agricultural organization / legal requirements
- history of tractors
- tractor engineering
- tractor mechanics
- chassis suspension
- combustion engine
- transmission
- interfaces
- hydraulics
- wheels and tyres
- cabin
- electrics and electronics

basic knowledge in mechanical engineering

- regular attendance: 21 hours
- self-study: 92 hours

Organizational issues
Ort/Zeit siehe Institutshomepage

Literature

- K.T. Renius: Traktoren - Technik und ihre Anwendung; DLG Verlag (Frankfurt), 1985
- E. Schilling: Landmaschinen - Lehr- und Handbuch für den Landmaschinenbau; Schilling-Verlag (Köln), 1960

T 11.467 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-102599 - Major Field: Powertrain Systems
M-MACH-102637 - Major Field: Tribology
M-MACH-102650 - Major Field: Combustion Engines Based Powertrains

Type	Credits	Grading scale	Recurrence	Version
Oral examination	8	Grade to a third	Each winter term	2

Events					
WT 24/25	2181114	Tribology	5 SWS	Lecture / Practice (/ 🗣	Dienwiebel, Scherge
Exams					
WT 24/25	76-T-MACH-105531	Tribology			Dienwiebel

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

2181114, WS 24/25, 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 11.468 Course: Turbine and Compressor Design [T-MACH-105365]

Responsible: Prof. Dr.-Ing. Hans-Jörg Bauer
Organisation: KIT Department of Mechanical Engineering
Institute of Thermal Turbomachinery
Part of: M-MACH-102627 - Major Field: Energy Converting Engines

Type	Credits	Grading scale	Recurrence	Version
Oral examination	4	Grade to a third	Each winter term	1

Exams			
ST 2024	76-T-MACH-105365	Turbine and Compressor Design	Bauer
WT 24/25	76-T-MACH-105365	Turbine and Compressor Design	Bauer

Competence Certificate
oral exam, duration: 20 min.

Prerequisites
Exams Thermal Turbomachinery I & II successfully passed.

Modeled Conditions
The following conditions have to be fulfilled:

1. The course T-MACH-105363 - Thermal Turbomachines I must have been passed.
2. The course T-MACH-105364 - Thermal Turbomachines II must have been passed.

T 11.469 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-102597 - Compulsory Elective Module Mechanical Engineering
M-MACH-102627 - Major Field: Energy Converting Engines
M-MACH-102650 - Major Field: Combustion Engines Based Powertrains

Type	Credits	Grading scale	Recurrence	Version
Oral examination	4	Grade to a third	Each summer term	1

Exams			
ST 2024	76-T-MACH-105649	Boosting of Combustion Engines	Koch

Competence Certificate
oral exam, appr. 20 min

Prerequisites
none

T 11.470 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-102597 - Compulsory Elective Module Mechanical Engineering
M-MACH-102627 - Major Field: Energy Converting Engines
M-MACH-102636 - Major Field: Thermal Turbomachines

Type	Credits	Grading scale	Recurrence	Version
Oral examination	4	Grade to a third	Each summer term	1

Events					
ST 2024	2170478	Turbo Jet Engines	2 SWS	Lecture / 🗣	Bauer
Exams					
ST 2024	76-T-MACH-105366	Turbo Jet Engines			Bauer
WT 24/25	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 2024, 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 11.471 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-102597 - Compulsory Elective Module Mechanical Engineering
M-MACH-102628 - Major Field: Lightweight Construction
M-MACH-102743 - Fundamentals and Methods of Theoretical Foundations of Mechanical Engineering

Type	Credits	Grading scale	Recurrence	Version
Completed coursework	1	pass/fail	Each winter term	1

Events					
WT 24/25	2161253	Tutorial Continuum mechanics of solids and fluids	2 SWS	Practice / 🗣	Gisy, Speichinger, Böhlke

Legend: 🖥 Online, ⚙ Blended (On-Site/Online), 🗣 On-Site, ✕ 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 24/25, 2 SWS, Language: German, Open in study portal

Practice (Ü)
On-Site

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 11.472 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-102597 - Compulsory Elective Module Mechanical Engineering
M-MACH-102628 - Major Field: Lightweight Construction

Type	Credits	Grading scale	Recurrence	Version
Completed coursework	1	pass/fail	Each summer term	1

Events					
ST 2024	2162257	Tutorial Introduction to the Finite Element Method	1 SWS	Practice / 🗣	Lauff, Langhoff, Böhlke, Klein
Exams					
ST 2024	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 2024, 1 SWS, Language: German, Open in study portal

Practice (Ü)
On-Site

Content
See lecture "Introduction to the Finite Element Method"

Literature
siehe Vorlesung "Einführung in die Finite-Elemente-Methode"

T 11.473 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-102405 - Fundamentals and Methods of General Mechanical Engineering
M-MACH-102594 - Mathematical Methods
M-MACH-102597 - Compulsory Elective Module Mechanical Engineering
M-MACH-102742 - Fundamentals and Methods of Production Technology
M-MACH-102743 - Fundamentals and Methods of Theoretical Foundations of Mechanical Engineering
M-MACH-102744 - Fundamentals and Methods of Materials and Structures for High Performance Systems

Type	Credits	Grading scale	Recurrence	Expansion	Version
Completed coursework	2	pass/fail	Each winter term	1 terms	2

Events					
WT 24/25	2161255	Tutorial Mathematical Methods in Confinuum Mechanics	2 SWS	Practice / 🗣	Lauff, Klein, 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

Practice (Ü)
On-Site

2161255, WS 24/25, 2 SWS, Language: German, Open in study portal

Content
See "Mathematical Methods in Continuum Mechanics"

Literature
Siehe "Mathematische Methoden der Kontinuumsmechanik"

T 11.474 Course: Tutorial Mathematical Methods in Micromechanics [T-MACH-110379]

Responsible: Prof. Dr.-Ing. Thomas Böhlke
Organisation: KIT Department of Mechanical Engineering
Part of: M-MACH-102594 - Mathematical Methods
M-MACH-102602 - Major Field: Reliability in Mechanical Engineering
M-MACH-102611 - Major Field: Materials Science and Engineering
M-MACH-102646 - Major Field: Applied Mechanics
M-MACH-102743 - Fundamentals and Methods of Theoretical Foundations of Mechanical Engineering
M-MACH-102744 - Fundamentals and Methods of Materials and Structures for High Performance Systems

Type	Credits	Grading scale	Recurrence	Version
Completed coursework	1	pass/fail	Each summer term	1

Exams			
ST 2024	76-T-MACH-110379	Tutorial Mathematical Methods in Micromechanics	Böhlke

Competence Certificate
Successfully solving the homework sheets. Details are given in the first lecture.

T 11.475 Course: Tutorial Mathematical Methods in Structural Mechanics [T-MACH-106831]

Responsible: Prof. Dr.-Ing. Thomas Böhlke
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102405 - Fundamentals and Methods of General Mechanical Engineering
M-MACH-102741 - Fundamentals and Methods of Product Development and Construction

Type	Credits	Grading scale	Recurrence	Version
Completed coursework	1	pass/fail	Each summer term	2

Events					
ST 2024	2162281	Tutorial Mathematical Methods in Micromechanics	1 SWS	Practice / 🗣	Karl, Krause, Böhlke

Legend: 🖥 Online, Blended (On-Site/Online), 🗣 On-Site, ✕ Cancelled

Competence Certificate
Successfully solving the homework sheets. Details are given in the first lecture.

Prerequisites
none

Below you will find excerpts from events related to this course:

V Tutorial Mathematical Methods in Micromechanics

2162281, SS 2024, 1 SWS, Language: German, Open in study portal

Practice (Ü)
On-Site

Content
see lecture "Mathematical Methods in Micromechanics"

T 11.476 Course: Tutorial Nonlinear Continuum Mechanics [T-MACH-111027]

Responsible: Prof. Dr.-Ing. Thomas Böhlke
Organisation:
Part of: M-MACH-102597 - Compulsory Elective Module Mechanical Engineering
M-MACH-102611 - Major Field: Materials Science and Engineering
M-MACH-102646 - Major Field: Applied Mechanics
M-MACH-102743 - Fundamentals and Methods of Theoretical Foundations of Mechanical Engineering

Type	Credits	Grading scale	Recurrence	Expansion	Version
Completed coursework	1	pass/fail	Each summer term	1 terms	1

Competence Certificate
Written homework problems

Successful participation in this course allows for registration to the Exam "Nonlinear Continuum Mechanics" (see 76-T-MACH-111026)

Prerequisites
none

T 11.477 Course: Two-Phase Flow and Heat Transfer [T-MACH-105406]

Responsible: Hon.-Prof. Dr. Thomas Schulenberg
Dr. Martin Wörner

Organisation: KIT Department of Chemical and Process Engineering
KIT Department of Mechanical Engineering

Part of: M-MACH-102597 - Compulsory Elective Module Mechanical Engineering
M-MACH-102608 - Major Field: Nuclear Energy
M-MACH-102610 - Major Field: Power Plant Technology
M-MACH-102634 - Major Field: Fluid Mechanic
M-MACH-102643 - Major Field: Fusion Technology

Type	Credits	Grading scale	Version
Oral examination	4	Grade to a third	1

Competence Certificate
oral exam, duration: approximately 30 minutes

no tools or reference materials may be used during the exam

Prerequisites
none

T 11.478 Course: Vacuum and Tritium Technology in Nuclear Fusion [T-MACH-108784]

Responsible: Dr.-Ing. Thomas Giegerich
Dr. Robin Größle

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102643 - Major Field: Fusion Technology

Type	Credits	Grading scale	Recurrence	Version
Oral examination	4	Grade to a third	Each summer term	1

Events					
ST 2024	2190499	Vacuum and Tritium Technology in Nuclear Fusion	2 SWS	/ 🗣	Größle, Giegerich
Exams					
ST 2024	76-T-MACH-108784	Vacuum and Tritium Technology in Nuclear Fusion			Giegerich, Größle

Legend: 🖥 Online, ⚙ Blended (On-Site/Online), 🗣 On-Site, ✕ Cancelled

Competence Certificate
oral examination, approx. 20 Minutes, any time in the year

Prerequisites
none

Recommendation
Knowledge in ´Fusion Technology A´

Below you will find excerpts from events related to this course:

V Vacuum and Tritium Technology in Nuclear Fusion

2190499, SS 2024, 2 SWS, Language: German/English, Open in study portal

On-Site

Content
Introduction

Tritium Handling

Tritium Plant Technologies

Tritium and Breeding

Fundamentals of Vacuum Science and Technology

Fusion Vacuum systems

Matter Injection into the Plasma Chamber

Fuel Cycle of ITER and DEMO

The students have acquired the necessary understanding in order to design and size facilities for tritium operation. They understand the process steps in the tritium plant of a fusion reactor for tritium removal and tritium recovery from tritiated exhaust gas. Furthermore, the students have understood the fundamentals of vacuum physics and are able to design and choose vacuum pumps properly.

recommended is Knowledge in "Fusion Technology A"

oral exam of about 20 min

Organizational issues
Anmeldung bis 20. April via E-Mail an: christian.day@kit.edu

Raum wird bekanntgegeben.

T 11.479 Course: Vehicle Ergonomics [T-MACH-108374]

Responsible: Sofie Ehrhardt
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102600 - Major Field: Man - Technology - Organisation
M-MACH-102605 - Major Field: Engineering Design
M-MACH-102607 - Major Field: Vehicle Technology
M-MACH-102609 - Major Field: Cognitive Technical Systems
M-MACH-102630 - Major Field: Mobile Machines

Type	Credits	Grading scale	Recurrence	Version
Written examination	4	Grade to a third	Each summer term	1

Events					
ST 2024	2110050	Vehicle Ergonomics	3 SWS	Lecture / 🗣	Ehrhardt
Exams					
ST 2024	76-T-MACH-108374	Vehicle Ergonomics			Ehrhardt

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 2024, 3 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).

Im SS 2024 sind es noch 2 SWS.
Ab dem SS 2025 sind es 3 SWS.

Literature
Die Literaturliste wird in der Vorlesung ausgegeben. Die Folien zur Vorlesung stehen auf ILIAS zum Download zur Verfügung.

T 11.480 Course: Vehicle Lightweight Design - Strategies, Concepts, Materials [T-MACH-105237]

Responsible: Prof. Dr.-Ing. Frank Henning
Organisation: KIT Department of Mechanical Engineering

Lightweight Design

Part of:
M-MACH-102597 - Compulsory Elective Module Mechanical Engineering
M-MACH-102607 - Major Field: Vehicle Technology
M-MACH-102628 - Major Field: Lightweight Construction
M-MACH-102632 - Major Field: Polymer Engineering
M-MACH-102641 - Major Field: Rail System Technology

Type	Credits	Grading scale	Recurrence	Version
Written examination	4	Grade to a third	Each winter term	1

Events					
WT 24/25	2113102	Vehicle Lightweight design – Strategies, Concepts, Materials	2 SWS	Lecture /	Henning
Exams					
ST 2024	76-T-MACH-105237	Vehicle Lightweight Design - Strategies, Concepts, Materials			Henning
WT 24/25	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 24/25, 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 11.481 Course: Vehicle Systems for Urban Mobility [T-MACH-113069]

Responsible: Prof. Dr.-Ing. Martin Cichon
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102597 - Compulsory Elective Module Mechanical Engineering
M-MACH-102641 - Major Field: Rail System Technology

Type	Credits	Grading scale	Version
Oral examination	4	Grade to a third	3

Events					
ST 2024	2115922	Vehicle Systems for Urban Mobility	2 SWS	Lecture / 🗣	Cichon, Berthold
WT 24/25	2115922	Vehicle Systems for Urban Mobility	2 SWS	Lecture / 🗣	Cichon, Ziesel
Exams					
ST 2024	76-T-MACH-106428	Vehicle Systems for Urban Mobility			Cichon, Berthold
WT 24/25	76-T-MACH-106428	Vehicle Systems for Urban Mobility			Ziesel, Cichon

Legend: 🖥 Online, ✲ Blended (On-Site/Online), 🗣 On-Site, × Cancelled

Competence Certificate
Oral examination
Duration: approx. 20 minutes
No tools or reference material may be used during the exam.

T 11.482 Course: Vibration Theory [T-MACH-105290]

Responsible: Prof. Dr.-Ing. Alexander Fidlin
Organisation: KIT Department of Mechanical Engineering

Part of:
M-MACH-102405 - Fundamentals and Methods of General Mechanical Engineering
M-MACH-102575 - Fundamentals and Methods of Energy and Environmental Engineering
M-MACH-102598 - Major Field: Advanced Mechatronics
M-MACH-102614 - Major Field: Mechatronics
M-MACH-102636 - Major Field: Thermal Turbomachines
M-MACH-102646 - Major Field: Applied Mechanics
M-MACH-102739 - Fundamentals and Methods of Automotive Engineering
M-MACH-102740 - Fundamentals and Methods of Mechatronics and Microsystem Technology
M-MACH-102741 - Fundamentals and Methods of Product Development and Construction
M-MACH-102742 - Fundamentals and Methods of Production Technology
M-MACH-102743 - Fundamentals and Methods of Theoretical Foundations of Mechanical Engineering
M-MACH-102744 - Fundamentals and Methods of Materials and Structures for High Performance Systems
M-MACH-104434 - Major Field: Modeling and Simulation in Dynamics
M-MACH-104443 - Major Field: Vibration Theory

Type	Credits	Grading scale	Recurrence	Version
Written examination	5	Grade to a third	Each winter term	3

Events					
WT 24/25	2161212	Vibration Theory	2 SWS	Lecture	Römer, Genda
WT 24/25	2161213	Übungen zu Technische Schwingungslehre	2 SWS	Practice	Römer, Keller
Exams					
ST 2024	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

Lecture (V)

2161212, WS 24/25, 2 SWS, Language: German, Open in study portal

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** **Practice (Ü)**
2161213, WS 24/25, 2 SWS, Language: German, Open in study portal

Content
Exercises related to the lecture

T 11.483 Course: Virtual Engineering (Specific Topics) [T-MACH-105381]

Responsible: Prof. Dr.-Ing. Jivka Ovtcharova
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102597 - Compulsory Elective Module Mechanical Engineering

Type	Credits	Grading scale	Recurrence	Version
Oral examination	4	Grade to a third	Each summer term	1

Events					
ST 2024	3122031	Virtual Engineering (Specific Topics)	2 SWS	Lecture / 🗣	Ovtcharova, Maier
Exams					
ST 2024	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 2024, 2 SWS, Language: English, Open in study portal

Lecture (V)
On-Site

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
Zeit und Ort der Lehrveranstaltung siehe ILIAS / Time and place of the course see ILIAS.

Literature
Lecture slides / Vorlesungsfolien

T 11.484 Course: Virtual Engineering I [T-MACH-102123]

Responsible: Prof. Dr.-Ing. Jivka Ovtcharova
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102597 - Compulsory Elective Module Mechanical Engineering
M-MACH-102613 - Major Field: Lifecycle Engineering

Type	Credits	Grading scale	Recurrence	Version
Written examination	4	Grade to a third	Each winter term	3

Events					
WT 24/25	2121352	Virtual Engineering I	2 SWS	Lecture / 🗣	Ovtcharova
WT 24/25	2121353	Exercises Virtual Engineering I	2 SWS	Practice / 🗣	Ovtcharova, Mitarbeiter
Exams					
ST 2024	76-T-MACH-102123	Virtual Engineering I			Ovtcharova
WT 24/25	76-T-MACH-102123	Virtual Engineering I			Ovtcharova

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 Virtual Engineering I

Lecture (V)
On-Site

2121352, WS 24/25, 2 SWS, Language: English, Open in study portal

Content
The course includes:

- Conception of the product (system approaches, requirements, definitions, structure)
- Generation of domain-specific product data (CAD, ECAD, software, ...) and AI methods
- Validation of product properties and production processes through simulation
- Digital twin for optimization of products and processes using AI methods

After successful attendance of the course, students can:

- conceptualize complex systems with the methods of virtual engineering and continue the product development in different domains
- model the digital product with regard to planning, design, manufacturing, assembly and maintenance.
- use validation systems to validate product and production in an exemplary manner.
- Describe AI methods along the product creation process.

Literature
Vorlesungsfolien / Lecture slides

V Exercises Virtual Engineering I

Practice (Ü)
On-Site

2121353, WS 24/25, 2 SWS, Language: English, Open in study portal

Content
The theoretical Konzepts and contents of the lecture will be trained within practical relevance by basic functionalities of VE System solutions.

Organizational issues
Practice dates will probably be offered on different afternoons (14:00 - 17:15) in two-week intervals at IMI / Übungstermine werden voraussichtlich an unterschiedlichen Nachmittagen (14:00 - 17:15) in zweiwöchigem Rhythmus am IMI angeboten.

Literature
Exercise script / Übungsskript

T 11.485 Course: Virtual Engineering II [T-MACH-102124]

Responsible: Prof. Dr.-Ing. Jivka Ovtcharova
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102597 - Compulsory Elective Module Mechanical Engineering
M-MACH-102613 - Major Field: Lifecycle Engineering

Type	Credits	Grading scale	Recurrence	Version
Written examination	4	Grade to a third	Each summer term	3

Events					
ST 2024	2122378	Virtual Engineering II		Lecture / Practice (/ 🗣	Häfner, Ovtcharova
Exams					
ST 2024	76-T-MACH-102124	Virtual Engineering II			Ovtcharova, Häfner
ST 2024	76-T-MACH-102124-mdl	Virtual Engineering II			Häfner, Ovtcharova
WT 24/25	76-T-MACH-102124	Virtual Engineering II			Ovtcharova, Häfner

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 Virtual Engineering II

2122378, SS 2024, SWS, Language: English, Open in study portal

Lecture / Practice (VÜ)
On-Site

Content
The course includes:

- Fundamentals (Computer Graphics, VR, AR, MR)
- Hardware and Software Solutions
- Virtual Twin, Validation and application

After successful attendance of the course, students can:

- describe Virtual Reality concepts, as well as explaining and comparing the underlying technologies
- discuss the modeling and computer-internal picture of a VR scene and explain the operation of the pipeline to visualize the scene
- designate different systems to interact with a VR scene and assess the pros and cons of manipulation and tracking devices
- differentiate between static, dynamic and functional Virtual Twins
- describe applications and validation studies with Virtual Twins in the area of building and production

Organizational issues
Zusätzliche Übungszeiten (1 SWS) werden zu Vorlesungsbegin bekannt gegeben / Additional practice times (1 SWS) will be announced at the beginning of the lecture.

Literature
Vorlesungsfolien / Lecture slides

T 11.486 Course: Virtual Engineering Lab [T-MACH-106740]

Responsible: Prof. Dr.-Ing. Jivka Ovtcharova
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102613 - Major Field: Lifecycle Engineering

Type	Credits	Grading scale	Recurrence	Version
Examination of another type	4	Grade to a third	Each term	1

Events					
ST 2024	2123350	Virtual Engineering Lab	3 SWS	Project (P / 🗣	Häfner, Ovtcharova
WT 24/25	2123350	Virtual Engineering Lab	3 SWS	Project (P / 🗣	Ovtcharova, Häfner
Exams					
ST 2024	76-T-MACH-106740	Virtual Engineering Lab			Ovtcharova, Häfner

Legend: Online, Blended (On-Site/Online), On-Site, ✕ Cancelled

Competence Certificate
Assessment of another type (graded), Group project to create a VR application (project task, implementation and presentation of the project work)

Below you will find excerpts from events related to this course:

V Virtual Engineering Lab
2123350, SS 2024, 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 Webseite zur Lehrveranstaltung / see web page of the lecture

Literature
Keine / None

V Virtual Engineering Lab
2123350, WS 24/25, 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
Zeit. Ort und organisatorisches siehe ILIAS / Time, place and organizational details see ILIAS

Literature
Keine / None

T 11.487 Course: Virtual Reality Practical Course [T-MACH-102149]

Responsible: Prof. Dr.-Ing. Jivka Ovtcharova
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102601 - Major Field: Automation Technology
M-MACH-102612 - Major Field: Modeling and Simulation in Energy- and Fluid Engineering
M-MACH-102614 - Major Field: Mechatronics
M-MACH-102633 - Major Field: Robotics

Type	Credits	Grading scale	Recurrence	Version
Examination of another type	4	Grade to a third	Each term	2

Events					
WT 24/25	2123375	Virtual Reality Practical Course	3 SWS	Project (P / 🗣	Ovtcharova, Häfner
Exams					
ST 2024	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 24/25, 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
Zeit. Ort und organisatorisches siehe ILIAS / Time, place and organizational details see ILIAS

Literature
Keine / None

T 11.488 Course: Vortex Dynamics [T-MACH-105784]

Responsible: Dr. Jochen Kriegseis
Dr.-Ing. Robin Leister

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102627 - Major Field: Energy Converting Engines
M-MACH-102634 - Major Field: Fluid Mechanic
M-MACH-102636 - Major Field: Thermal Turbomachines

Type	Credits	Grading scale	Recurrence	Version
Oral examination	4	Grade to a third	Each winter term	1

Events					
WT 24/25	2153438	Vortex Dynamics	3 SWS	Lecture / Blended	Kriegseis, Leister
Exams					
ST 2024	76-T-MACH-105784	Vortex Dynamics			Kriegseis
ST 2024	76-T-MACH-105784 W	Vortex Dynamics			Kriegseis

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 Vortex Dynamics
2153438, WS 24/25, 3 SWS, Language: German, Open in study portal

Lecture (V)
Blended (On-Site/Online)

Content
The students are familiar with the physical basics and the mathematical description possibilities of turbulent flows and can deal with the basic concepts of turbulent flows such as rotation and circulation. They are able to describe planar and spatial turbulent flows in a stationary and time-dependent form with regard to structure and time behavior. The students can implement the common vortex identification criteria, apply them to sample flows and interpret the characteristic properties of the flows under investigation.

Content of lecture:

- Definition of a vortex
- Theoretical description of vortex flow
- Steady and time-dependent solutions of vortex flows
- Helmholtz's vortex theorems
- Vorticity equation
- Properties of various vortical structures
- Introduction of various vortec identification approaches

A practice:

Implementation of selected identification criteria in Matlab Matlab-based evaluation of selected flows

Literature
Literaturhinweise:
Spurk, J.H.: Strömungslehre, Springer, 1996
Green, S.I.: Fluid Vortices, Kluwer Academic Publishers, 1995
Wu, J.-Z. et al.: Vorticity and Vortex Dynamics, Springer, 2006
Saffman, P.G.: Vortex Dynamics, Cambrigde University Press, 1992

T 11.489 Course: Warehousing and Distribution Systems [T-MACH-105174]

Responsible: Prof. Dr.-Ing. Kai Furmans
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102618 - Major Field: Production Technology
M-MACH-102625 - Major Field: Information Technology of Logistic Systems
M-MACH-102629 - Major Field: Logistics and Material Flow Theory
M-MACH-102640 - Major Field: Technical Logistics

Type	Credits	Grading scale	Recurrence	Version
Written examination	3	Grade to a third	Each summer term	2

Events					
ST 2024	2118097	Warehousing and distribution systems	2 SWS	Lecture / 🗣	Furmans
Exams					
ST 2024	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 2024, 2 SWS, Language: German, Open in study portal

Lecture (V)
On-Site

Organizational issues
Die Vorlesung wird in diesem Semester als **Blockveranstaltung** angeboten. Die Veranstaltungstermine sind:

- Mi., 24. April
- Do., 25. April
- Fr., 26. April

Die Vorlesung startet jeweils um 08:00 Uhr und findet im **Selmayr-HS (Geb. 50.38)** statt. Bitte beachten Sie für mögliche kurzfristige Raumänderungen die Informationen im ILIAS-Kurs.

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 11.490 Course: Welding Technology [T-MACH-105170]

Responsible: Dr. Majid Farajian
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102611 - Major Field: Materials Science and Engineering
M-MACH-102618 - Major Field: Production Technology

Type	Credits	Grading scale	Recurrence	Version
Oral examination	4	Grade to a third	Each winter term	1

Events					
WT 24/25	2173571	Welding Technology	2 SWS	Block / 🗣	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 24/25, 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 11.491 Course: Windpower [T-MACH-105234]

Responsible: Norbert Lewald
Organisation: KIT Department of Mechanical Engineering
Institute of Thermal Turbomachinery
Part of: M-MACH-102610 - Major Field: Power Plant Technology
M-MACH-102623 - Major Field: Fundamentals of Energy Technology
M-MACH-102627 - Major Field: Energy Converting Engines
M-MACH-102648 - Major Field: Energy Technology for Buildings

Type	Credits	Grading scale	Recurrence	Version
Written examination	4	Grade to a third	Each winter term	2

Events					
WT 24/25	2157381	Windpower	2 SWS	Lecture / 🗣	Lewald
Exams					
ST 2024	76-T-MACH-105234	Windpower			Lewald
WT 24/25	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 24/25, 2 SWS, Language: German, Open in study portal

Lecture (V)
On-Site

T 11.492 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-102591 - Laboratory Course
M-MACH-102610 - Major Field: Power Plant Technology
M-MACH-102623 - Major Field: Fundamentals of Energy Technology
M-MACH-102636 - Major Field: Thermal Turbomachines

Type	Credits	Grading scale	Recurrence	Version
Completed coursework	4	pass/fail	Each term	1

Events					
ST 2024	2171488	Workshop on computer-based flow measurement techniques	3 SWS	Practical course / 🗣	Bauer, Mitarbeiter
WT 24/25	2171488	Workshop on computer-based flow measurement techniques	3 SWS	Practical course / 🗣	Bauer, Mitarbeiter

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 2024, 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)**
2171488, WS 24/25, 3 SWS, Language: German, Open in study portal **On-Site**

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

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- Design of a computer aided data acquisition system for pressure, temperature and derived parameters
- frequency analysis
-

regular attendance: 52,5
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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

T 11.493 Course: X-ray Optics [T-MACH-109122]

Responsible: Dr. Arndt Last
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102597 - Compulsory Elective Module Mechanical Engineering
M-MACH-102616 - Major Field: Microsystem Technology

Type	Credits	Grading scale	Recurrence	Version
Oral examination	4	Grade to a third	Each term	1

Events					
ST 2024	2141007	X-ray optics	2 SWS	Lecture / 🗣	Last
WT 24/25	2141007	X-ray Optics	2 SWS	Lecture / 🗣	Last
Exams					
ST 2024	76-T-MACH-109122	X-ray Optics			Last
WT 24/25	76-T-MACH-109122	X-ray Optics			Last

Legend: Online, Blended (On-Site/Online), 🗣 On-Site, ✕ Cancelled

Competence Certificate
oral exam (about 20 min)

Prerequisites
none

Below you will find excerpts from events related to this course:

V X-ray optics

2141007, SS 2024, 2 SWS, Language: English, Open in study portal

Lecture (V)
On-Site

Content
see Institute homepage

If you are interested, please contact arndt.last@kit.edu by 30.5.2023 to make an appointment.

Organizational issues
Viertägiger Blockkurs im Juni oder Juli 2024. Interessenten melden sich bitte zur Terminabsprache bis zum 30.5.2024 bei arndt.last@kit.edu

V X-ray Optics

2141007, WS 24/25, 2 SWS, Language: English, Open in study portal

Lecture (V)
On-Site

Organizational issues
Termin und Ort nach Absprache mit den Angemeldeten

Literature
M. Born und E. Wolf
Principles of Optics, 7th (expanded) edition
Cambridge University Press, 2010

A. Erko, M. Idir, T. Krist und A. G. Michette
Modern Developments in X-Ray and Neutron Optics
Springer Series in Optical Sciences, Vol. 137
Springer-Verlag Berlin Heidelberg, 2008

D. Attwood
Soft X-Rays and Extreme Ultraviolet Radiation: Principles and Applications
Cambridge University Press, 1999