Module Handbook
Bachelor's Program Mechatronics and Information Technology (B.Sc.)

SPO 2016

Summer term 2024

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KIT DEPARTMENT OF MECHANICAL ENGINEERING / KIT DEPARTMENT OF ELECTRICAL ENGINEERING AND INFORMATION TECHNOLOGY

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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).

2 General Information

2.1 Study program details

KIT-Department	KIT Department of Mechanical Engineering / KIT Department of Electrical Engineering and Information Technology
Academic Degree	Bachelor of Science (B.Sc.)
Examination Regulations Version	20161
Regular terms	6 terms
Maximum terms	10 terms
Credits	180
Language	
Grade calculation	Weighted by (Weight * CP)
Additional Information	Link to study program https://www.mach.kit.edu/4385.php

Karlsruher Institut für Technologie

Die Forschungsuniversität in der Helmholtz-Gemeinschaft

Amtliche Bekanntmachung

2016 **Ausgegeben Karlsruhe, den 10. Mai 2016** **Nr. 29**

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

vom 03. Mai 2016

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 3 des Gesetzes zur Verbesserung von Chancengerechtigkeit und Teilhabe in Baden-Württemberg vom 01. Dezember 2015 (GBl. S. 1047, 1052), hat der Senat des KIT am 18. April 2016 die folgende Studien- und Prüfungsordnung für den Bachelorstudiengang Mechatronik und Informationstechnik beschlossen.

Der Präsident hat seine Zustimmung gemäß § 20 Absatz 2 KITG i.V.m. § 32 Absatz 3 Satz 1 LHG am 03. Mai 2016 erteilt.

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Präambel

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

I. Allgemeine Bestimmungen

§ 1 Geltungsbereich

Diese Bachelorprüfungsordnung regelt Studienablauf, Prüfungen und den Abschluss des Studiums im Bachelorstudiengang Mechatronik und Informationstechnik am KIT. Dieser Studiengang wird gemeinsam von der KIT-Fakultät für Elektrotechnik und Informationstechnik sowie der KIT-Fakultät für Maschinenbau am KIT angeboten.

§ 2 Ziel des Studiums, akademischer Grad

(1) Im Bachelorstudium sollen die wissenschaftlichen Grundlagen und die Methodenkompetenz der Fachwissenschaften vermittelt werden. Ziel des Studiums ist die Fähigkeit, einen konsekutiven Masterstudiengang erfolgreich absolvieren zu können sowie das erworbene Wissen berufsfeldbezogen anwenden zu können.

(2) Aufgrund der bestandenen Bachelorprüfung wird der akademische Grad „Bachelor of Science (B.Sc.)“ für den Bachelorstudiengang Mechatronik und Informationstechnik verliehen.

§ 3 Regelstudienzeit, Studienaufbau, Leistungspunkte

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

(2) Die Regelstudienzeit beträgt sechs Semester. Bei einer qualifizierten Teilnahme am MINT-Kolleg bleiben bei der Anrechnung auf die Regelstudienzeit bis zu zwei Semester unberücksichtigt. Die konkrete Anzahl der Semester richtet sich nach § 8 Absatz 2 Satz 3 bis 5. Eine qualifizierte Teilnahme liegt vor, wenn die Studierenden Veranstaltungen des MINT-Kollegs für die Dauer von mindestens einem Semester im Umfang von mindestens zwei Fachkursen (Gesamtworkload 10 Semesterwochenstunden) belegt hat. Das MINT-Kolleg stellt hierüber eine Bescheinigung aus.

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

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

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

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

§ 4 Modulprüfungen, Studien- und Prüfungsleistungen

(1) Die Bachelorprüfung besteht aus Modulprüfungen. Modulprüfungen bestehen aus einer oder mehreren Erfolgskontrollen. Erfolgskontrollen gliedern sich in Studien- oder Prüfungsleistungen.

(2) Prüfungsleistungen sind:

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

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

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

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

§ 5 Anmeldung und Zulassung zu den Modulprüfungen und Lehrveranstaltungen

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

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

(3) Zu einer Erfolgskontrolle ist zuzulassen, wer

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

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

3. nachweist, dass er in dem Bachelorstudiengang Mechatronik und Informationstechnik den Prüfungsanspruch nicht verloren hat und

4. die in § 20 a genannte Voraussetzung erfüllt.

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

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

§ 6 Durchführung von Erfolgskontrollen

(1) Erfolgskontrollen werden studienbegleitend, in der Regel im Verlauf der Vermittlung der Lehrinhalte der einzelnen Module oder zeitnah danach, durchgeführt.

(2) Die Art der Erfolgskontrolle (§ 4 Abs. 2 Nr. 1 bis 3, Abs. 3) wird von der/dem Prüfenden der betreffenden Lehrveranstaltung in Bezug auf die Lerninhalte der Lehrveranstaltung und die Lernziele des Moduls festgelegt. Die Art der Erfolgskontrolle, ihre Häufigkeit, Reihenfolge und Gewichtung sowie gegebenenfalls die Bildung der Modulnote müssen mindestens sechs Wochen vor Vorlesungsbeginn im Modulhandbuch bekannt gemacht werden. Im Einvernehmen von Prüfendem und Studierender bzw. Studierendem können die Art der Prüfungsleistung sowie die Prüfungssprache auch nachträglich geändert werden; im ersten Fall ist jedoch § 4 Abs. 5 zu berücksichtigen. Bei der Prüfungsorganisation sind die Belange Studierender mit Behinderung oder chronischer Erkrankung gemäß § 13 Abs. 1 zu berücksichtigen. § 13 Abs. 1 Satz 3 und 4 gelten entsprechend.

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

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

(5) *Schriftliche Prüfungen* (§ 4 Abs. 2 Nr. 1) sind in der Regel von einer/einem Prüfenden nach § 18 Abs. 2 oder 3 zu bewerten. Sofern eine Bewertung durch mehrere Prüfende erfolgt, ergibt sich die Note aus dem arithmetischen Mittel der Einzelbewertungen. Entspricht das arithmetische Mittel keiner der in § 7 Abs. 2 Satz 2 definierten Notenstufen, so ist auf die nächstliegende Notenstufe auf- oder abzurunden. Bei gleichem Abstand ist auf die nächstbessere Notenstufe zu runden. Das Bewertungsverfahren soll sechs Wochen nicht überschreiten. Schriftliche Prüfungen dauern mindestens 60 und höchstens 300 Minuten.

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

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

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

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

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

Schriftliche Arbeiten im Rahmen einer *Prüfungsleistung anderer Art* haben dabei die folgende Erklärung zu tragen: „Ich versichere wahrheitsgemäß, die Arbeit selbstständig angefertigt, alle benutzten Hilfsmittel vollständig und genau angegeben und alles kenntlich gemacht zu haben, was aus Arbeiten anderer unverändert oder mit Abänderungen entnommen wurde.“ Trägt die Arbeit diese Erklärung nicht, wird sie nicht angenommen. Die wesentlichen Gegenstände und Ergebnisse der Erfolgskontrolle sind in einem Protokoll festzuhalten.

§ 6 a Erfolgskontrollen im Antwort-Wahl-Verfahren

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

§ 6 b Computergestützte Erfolgskontrollen

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

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

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

§ 7 Bewertung von Studien- und Prüfungsleistungen

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

(2) Folgende Noten sollen verwendet werden:

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

Zur differenzierten Bewertung einzelner Prüfungsleistungen sind nur folgende Noten zugelassen:

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

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

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

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

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

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

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

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

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

		bis	1,5	=	sehr gut
von	1,6	bis	2,5	=	gut
von	2,6	bis	3,5	=	befriedigend
von	3,6	bis	4,0	=	ausreichend

§ 8 Orientierungsprüfungen, Verlust des Prüfungsanspruchs

(1) Die Teilmodulprüfung „Höhere Mathematik I“ im Modul „Höhere Mathematik“, die Teilmodulprüfung „Technische Mechanik I“ im Modul „Technische Mechanik“ und die Modulprüfung im Modul „Digitaltechnik“ sind bis zum Ende des Prüfungszeitraums des zweiten Fachsemesters abzulegen (Orientierungsprüfungen).

(2) Wer die Orientierungsprüfungen einschließlich etwaiger Wiederholungen bis zum Ende des Prüfungszeitraums des dritten Fachsemesters nicht erfolgreich abgelegt hat, verliert den Prüfungsanspruch im Studiengang, es sei denn, dass die Fristüberschreitung nicht selbst zu vertreten ist; hierüber entscheidet der Prüfungsausschuss auf Antrag der oder des Studierenden. Eine zweite Wiederholung der Orientierungsprüfungen ist ausgeschlossen. Die Fristüberschreitung hat die/der Studierende insbesondere dann nicht zu vertreten, wenn eine qualifizierte Teilnahme am MINT-Kolleg im Sinne von § 3 Abs. 2 vorliegt. Ohne ausdrückliche Genehmigung des Vorsitzenden des Prüfungsausschusses gilt eine Fristüberschreitung von

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

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

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

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

§ 9 Wiederholung von Erfolgskontrollen, endgültiges Nichtbestehen

(1) Studierende können eine nicht bestandene schriftliche Prüfung (§ 4 Absatz 2 Nr. 1) einmal wiederholen. Wird eine schriftliche Wiederholungsprüfung mit „nicht ausreichend“ (5,0) bewertet, so findet eine mündliche Nachprüfung im zeitlichen Zusammenhang mit dem Termin der nicht bestandenen Prüfung statt. In diesem Falle kann die Note dieser Prüfung nicht besser als „ausreichend“ (4,0) sein.

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

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

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

(5) Studienleistungen können mehrfach wiederholt werden.

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

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

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

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

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

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

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

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§ 10 Abmeldung; Versäumnis, Rücktritt

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

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

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

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

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

§ 11 Täuschung, Ordnungsverstoß

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

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

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

§ 12 Mutterschutz, Elternzeit, Wahrnehmung von Familienpflichten

(1) Auf Antrag sind die Mutterschutzfristen, wie sie im jeweils gültigen Gesetz zum Schutz der erwerbstätigen Mutter (Mutterschutzgesetz - MuSchG) festgelegt sind, entsprechend zu berücksichtigen. Dem Antrag sind die erforderlichen Nachweise beizufügen. Die Mutterschutzfristen unterbrechen jede Frist nach dieser Prüfungsordnung. Die Dauer des Mutterschutzes wird nicht in die Frist eingerechnet.

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

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

§ 13 Studierende mit Behinderung oder chronischer Erkrankung

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

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

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

§ 14 Modul Bachelorarbeit

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

(1 a) Dem Modul Bachelorarbeit sind 12 LP zugeordnet. Es besteht aus der Bachelorarbeit und einer Präsentation. Die Präsentation hat innerhalb der maximalen Bearbeitungsdauer gemäß Absatz 4 Satz 2, jedoch spätestens sechs Wochen nach Abgabe der Bachelorarbeit zu erfolgen.

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

Die Ausgabe des Themas erfolgt in diesem Fall über die/den Vorsitzende/n des Prüfungsausschusses.

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

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

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

(6) Der Zeitpunkt der Ausgabe des Themas der Bachelorarbeit ist durch die Betreuerin/den Betreuer und die/den Studierenden festzuhalten und dies beim Prüfungsausschuss aktenkundig zu machen. Der Zeitpunkt der Abgabe der Bachelorarbeit ist durch den/die Prüfende/n beim Prüfungsausschuss aktenkundig zu machen. Das Thema kann nur einmal und nur innerhalb des ersten Monats der Bearbeitungszeit zurückgegeben werden. Macht der oder die Studierende einen triftigen Grund geltend, kann der Prüfungsausschuss die in Absatz 4 festgelegte Bearbeitungszeit auf Antrag der oder des Studierenden um höchstens einen Monat verlängern. Wird die Bachelorarbeit nicht fristgerecht abgeliefert, gilt sie als mit „nicht ausreichend" (5,0) bewertet, es sei denn, dass die Studierenden dieses Versäumnis nicht zu vertreten haben.

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

§ 14 a Berufspraktikum

(1) Während des Bachelorstudiums ist ein mindestens dreizehnwöchiges Berufspraktikum abzuleisten, welches geeignet ist, den Studierenden eine Anschauung von berufspraktischer Tätigkeit auf dem Gebiet der Mechatronik und Informationstechnik zu vermitteln. Dem Berufspraktikum sind 15 Leistungspunkte zugeordnet.

(2) Die Studierenden setzen sich in eigener Verantwortung mit geeigneten privaten oder öffentlichen Einrichtungen in Verbindung, an denen das Praktikum abgeleistet werden kann. Das Nähere regelt das Modulhandbuch.

§ 15 Zusatzleistungen

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

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

§ 15 a Mastervorzug

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

§ 16 Überfachliche Qualifikationen

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

§ 17 Prüfungsausschuss

(1) Für den Bachelorstudiengang Mechatronik und Informationstechnik 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 aus den nach § 1 Satz 2 beteiligten KIT-Fakultäten und zwei Studierenden mit beratender Stimme. Im Falle der Einrichtung eines gemeinsamen Prüfungsausschusses für den Bachelor- und den Masterstudiengang Mechatronik und Informationstechnikerhöht sich die Anzahl der Studierenden auf vier Mitglieder mit beratender Stimme, wobei je zwei dieser vier aus dem Bachelor- und aus dem Masterstudiengang stammen. Die Amtszeit der nichtstudentischen Mitglieder beträgt zwei Jahre, die des studentischen Mitglieds ein Jahr. Jede gemäß § 1 Satz 2 beteiligte KIT-Fakultät muss stimmberechtigt vertreten sein.

(2) Die/der Vorsitzende, ihre/sein Stellvertreter/in, die weiteren Mitglieder des Prüfungsausschusses sowie deren Stellvertreter/innen werden von den KIT-Fakultätsräten der gemäß § 1 Satz 2 beteiligten KIT-Fakultäten 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.

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(3) Der Prüfungsausschuss achtet auf die Einhaltung der Bestimmungen dieser Studien- und Prüfungsordnung sowie deren Umsetzung in den gemäß § 1 Satz 2 beteiligten KIT-Fakultäten und fällt die Entscheidungen in Prüfungsangelegenheiten. Er entscheidet über die Anerkennung von Studienzeiten sowie Studien- und Prüfungsleistungen und trifft die Feststellung gemäß § 19 Absatz 1 Satz 1. Er berichtet der den gemäß § 1 Satz 2 beteiligten KIT-Fakultäten regelmäßig über die Entwicklung der Prüfungs- und Studienzeiten, einschließlich der Bearbeitungszeiten für die Bachelorarbeiten und die Verteilung der Modul- und Gesamtnoten. Er ist zuständig für Anregungen zur Reform der Studien- und Prüfungsordnung und zu Modulbeschreibungen. Der Prüfungsausschuss entscheidet mit der Mehrheit seiner Stimmen. Bei Stimmengleichheit entscheidet der Vorsitzende des Prüfungsausschusses.

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

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

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

(7) Belastende Entscheidungen des Prüfungsausschusses sind schriftlich mitzuteilen. Sie sind zu begründen und mit einer Rechtsbehelfsbelehrung zu versehen. Vor einer Entscheidung ist Gelegenheit zur Äußerung zu geben. Widersprüche gegen Entscheidungen des Prüfungsausschusses sind innerhalb eines Monats nach Zugang der Entscheidung schriftlich oder zur Niederschrift bei diesem einzulegen. Über Widersprüche entscheidet das für Lehre zuständig Mitglied des Präsidiums.

§ 18 Prüfende und Beisitzende

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

(2) Prüfende sind Hochschullehr/innen sowie leitende Wissenschaftler/innen gemäß § 14 Abs. 3 Ziff. 1 KITG, habilitierte Mitglieder und akademische Mitarbeiter/innen gemäß § 52 LHG, welche einer der gemäß § 1 Satz 2 beteiligten KIT-Fakultäten 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 eine der gemäß § 1 Satz 2 beteiligten KIT-Fakultäten eine Prüfungsbefugnis erteilt hat und sie die gemäß Absatz 2 Satz 2 vorausgesetzte Qualifikation nachweisen können.

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

§ 19 Anerkennung von Studien- und Prüfungsleistungen, Studienzeiten

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

(2) Die Studierenden haben die für die Anerkennung erforderlichen Unterlagen vorzulegen. Studierende, die neu in den Studiengang Mechatronik und Informationstechnik 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. Bachelorprüfung

§ 20 Umfang und Art der Bachelorprüfung

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

(2) Es sind Modulprüfungen in folgenden Pflichtfächern abzulegen:

1. Ingenieurwissenschaftliche Grundlagen: Modul(e) im Umfang von 110 LP,
2. Vertiefung in der Mechatronik: Modul(e) im Umfang von 37 LP,
3. Überfachliche Qualifikationen im Umfang von 6 LP gemäß § 16.

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

§ 20 a Leistungsnachweise für die Bachelorprüfung

Voraussetzung für die Anmeldung zur letzten Modulprüfung der Bachelorprüfung ist die Bescheinigung über das erfolgreich abgeleistete Berufspraktikum nach § 14 a. In Ausnahmefällen, die die Studierenden nicht zu vertreten haben, kann der Prüfungsausschuss die nachträgliche Vorlage dieses Leistungsnachweises genehmigen.

§ 21 Bestehen der Bachelorprüfung, Bildung der Gesamtnote

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

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

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

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

(1) Über die Bachelorprüfung werden nach Bewertung der letzten Prüfungsleistung eine Bachelorurkunde und ein Zeugnis erstellt. Die Ausfertigung von Bachelorurkunde und Zeugnis soll nicht später als drei Monate nach Ablegen der letzten Prüfungsleistung erfolgen. Bachelorurkunde und Bachelorzeugnis werden in deutscher und englischer Sprache ausgestellt. Bachelorurkunde und Zeugnis tragen das Datum der erfolgreichen Erbringung der letzten Prüfungsleistung. Diese Dokumente werden den Studierenden zusammen ausgehändigt. In der Bachelorurkunde wird die Verleihung des akademischen Bachelorgrades beurkundet. Die Bachelorurkunde wird von dem Präsidenten und den KIT-Dekaninnen/ den KIT-Dekanen der gemäß § 1 Satz 2 beteiligten KIT-Fakultäten 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 den KIT-Dekaninnen/den KIT-Dekanen der gemäß § 1 Satz 2 beteiligten KIT-Fakultäten 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 Bachelorurkunde, das Bachelorzeugnis und das Diploma Supplement einschließlich des Transcript of Records werden vom Studierendenservice des KIT ausgestellt.

III. Schlussbestimmungen

§ 23 Bescheinigung von Prüfungsleistungen

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

§ 24 Aberkennung des Bachelorgrades

(1) Haben Studierende bei einer Prüfungsleistung getäuscht und wird diese Tatsache nach der Aushändigung des Zeugnisses bekannt, so können die Noten der Modulprüfungen, bei denen getäuscht wurde, berichtigt werden. Gegebenenfalls kann die Modulprüfung für „nicht ausreichend“ (5,0) und die Bachelorprüfung für „nicht bestanden“ erklärt werden.

(2) Waren die Voraussetzungen für die Zulassung zu einer Prüfung nicht erfüllt, ohne dass 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 Bachelorprüfung für „nicht bestanden“ erklärt werden.

(3) Vor einer Entscheidung des Prüfungsausschusses ist Gelegenheit zur Äußerung zu geben.

(4) Das unrichtige Zeugnis ist zu entziehen und gegebenenfalls ein neues zu erteilen. Mit dem unrichtigen Zeugnis ist auch die Bachelorurkunde einzuziehen, wenn die Bachelorprüfung aufgrund einer Täuschung für „nicht bestanden“ erklärt wurde.

(5) Eine Entscheidung nach Absatz 1 und Absatz 2 Satz 2 ist nach einer Frist von fünf Jahren ab dem Datum des Zeugnisses ausgeschlossen.

(6) Die Aberkennung des akademischen Grades richtet sich nach § 36 Abs. 7 LHG.

§ 25 Einsicht in die Prüfungsakten

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

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

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

(4) Prüfungsunterlagen sind mindestens fünf Jahre aufzubewahren.

§ 26 Inkrafttreten, Übergangsvorschriften

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

(2) Gleichzeitig tritt die Studien- und Prüfungsordnung des KIT für den Bachelorstudiengang Mechatronik und Informationstechnik vom 24. Juli 2012 (Amtliche Bekanntmachung des KIT Nr. 38 vom 24. Juli 2012, zuletzt geändert durch die Dritte Satzung zur Änderung der Studien- und Prüfungsordnung des Karlsruher Instituts für Technologie (KIT) für den Bachelorstudiengang Mechatronik und Informationstechnik vom 10. Juli 2015 (Amtliche Bekanntmachung des KIT Nr. 51 vom 15. Juli 2015), außer Kraft.

(3) Studierende, die auf Grundlage der Studien- und Prüfungsordnung für den Bachelorstudiengang Mechatronik und Informationstechnik vom 24. Juli 2012 (Amtliche Bekanntmachung des KIT Nr. 38 vom 24. Juli 2012) zuletzt geändert durch die Dritte Satzung zur Änderung der Studien- und Prüfungsordnung des Karlsruher Instituts für Technologie (KIT) für den Bachelorstudiengang Mechatronik und Informationstechnik vom 10. Juli 2015 (Amtliche Bekanntmachung des KIT Nr. 51 vom 15.Juli 2015), ihr Studium am KIT aufgenommen haben, können Prüfungen auf Grundlage dieser Studien- und Prüfungsordnung letztmalig am 30. September 2021 ablegen.

(4) Studierende, die auf Grundlage der Studien- und Prüfungsordnung der Universität Karlsruhe für den interfakultativen Diplomstudiengang Mechatronik vom 15. August 2001 (Amtliche Bekanntmachungen der Universität Karlsruhe (TH) Nr. 24 vom 04. September 2001), zuletzt geändert durch die Satzung zur Änderung der Prüfungsordnung der Universität Karlsruhe (TH) für den interfakultativen Diplomstudiengang Mechatronik vom 10. September 2003 (Amtliche Bekanntmachungen der Universität Karlsruhe Nr. 34 vom 22. Oktober 2003), ihr Studium an der Universität Karlsruhe (TH) aufgenommen haben, können die Diplomprüfung einschließlich etwaiger Wiederholungen letztmalig bis zum 30. September 2017 ablegen.

Karlsruhe, den 03. Mai 2016

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

Karlsruher Institut für Technologie

Die Forschungsuniversität in der Helmholtz-Gemeinschaft

Amtliche Bekanntmachung

2018 Ausgegeben Karlsruhe, den 28. September 2018 Nr. 54

I n h a l t Seite

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

vom 26. September 2018

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 17. September 2018 die folgende Satzung zur Änderung der Studien- und Prüfungsordnung für den Bachelorstudiengang Mechatronik und Informationstechnik vom 03. Mai 2016 (Amtliche Bekanntmachung des Karlsruher Instituts für Technologie (KIT) Nr. 29 vom 10. Mai 2016) beschlossen.

Der Präsident hat seine Zustimmung gemäß § 20 Absatz 2 Satz 1 KITG i.V.m. § 32 Absatz 3 Satz 1 LHG am 26. September 2018 erteilt.

Artikel 1 – Änderung der Studien- und Prüfungsordnung

1. § 8 Absatz 1 wird wie folgt gefasst:

„(1) Die Teilmodulprüfung „Technische Mechanik I“ im Modul „Technische Mechanik“ und die Modulprüfung im Modul „Lineare Elektrische Netze“ sind bis zum Ende des Prüfungszeitraums des zweiten Fachsemesters abzulegen (Orientierungsprüfungen).

2. § 12 Absatz 1 wird wie folgt geändert:

a) Satz 1 wird wie folgt gefasst:

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

b) Satz 2 wird aufgehoben.

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

3. § 14 Absatz 1a wird wie folgt geändert:

a) In Satz 1 wird die Angabe „12 LP“ durch die Angabe „15 LP“ ersetzt.

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

4. § 17 Absatz 7 wird wie folgt geändert:

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

5. § 18 Absatz 3 wird wie folgt geändert:

Nach dem Wort „sofern“ werden die Wörter „eine der gemäß § 1 Satz 2 beteiligten KIT-Fakultäten eine Prüfungsbefugnis erteilt hat und“ gestrichen.

6. § 20 Absatz 2 wird wie folgt geändert:

a) In Satz 1 Nummer 2 wird nach dem Wort „von“ die Angabe „37 LP“ durch die Angabe „38 LP“ ersetzt.

b) In Satz 1 Nummer 3 wird nach dem Wort „von“ die Angabe „6 LP“ durch die Angabe „2 LP“ ersetzt.

c) Nach Satz 1 wird folgender Satz 2 eingefügt:

„Die Vermittlung weiterer überfachlicher Qualifikationen im Umfang von 4 LP gemäß § 16 findet im Rahmen der fachwissenschaftlichen Module Lineare Elektrische Netze, Elektronische Schaltungen sowie Signale und Systeme im Pflichtfach Ingenieurwissenschaftliche Grundlagen statt.“

d) Der bisherige Satz 2 wird Satz 3.

7. Dem § 21 Absatz 2 wird folgender Satz angefügt:

„Dabei wird die Note des Moduls Bachelorarbeit mit dem doppelten Gewicht berücksichtigt.“

Artikel 2 – Inkrafttreten, Übergangsvorschrift

(1) Die Satzung tritt am 01. Oktober 2018 in Kraft und gilt für

1. Studierende, die ihr Studium im Bachelorstudiengang Mechatronik und Informationstechnik am KIT im ersten Fachsemester aufnehmen, sowie für

2. Studierende, die ihr Studium im Bachelorstudiengang Mechatronik und Informationstechnik am KIT in einem höheren Fachsemester aufnehmen, sofern dieses Fachsemester nicht über dem Fachsemester liegt, das der erste Jahrgang nach Ziff. 1 erreicht.

(2) Die Studien- und Prüfungsordnung des KIT für den Bachelorstudiengang Mechatronik und Informationstechnik in der Fassung vom 03. Mai 2016 (Amtliche Bekanntmachung des KIT Nr. 29 vom 10. Mai 2016) gilt für

1. Studierende, die ihr Studium im Bachelorstudiengang Mechatronik und Informationstechnik am KIT zuletzt im Sommersemester 2018 aufgenommen haben, sowie für

2. Studierende, die ihr Studium im Bachelorstudiengang Mechatronik und Informationstechnik am KIT ab dem Wintersemester 2018/19 in einem höheren Fachsemester aufnehmen, sofern das Fachsemester über dem liegt, das der erste Jahrgang nach Absatz 1 Ziff. 1 erreicht hat.

(3) Studierende, die auf Grundlage der Studien- und Prüfungsordnung für den Bachelorstudiengang Mechatronik und Informationstechnik in der Fassung vom 03. Mai 2016 (Amtliche Bekanntmachung des Karlsruher Instituts für Technologie (KIT) Nr. 29 vom 10. Mai 2016) ihr Studium am KIT aufgenommen haben, können Prüfungen gemäß der vorgenannten Studien- und Prüfungsordnung letztmalig am 30. September 2023 ablegen.

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Karlsruhe, den 26. September 2018

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

Qualification **Objectives**

Having passed KIT's research-oriented and practice-based six-semester Bachelor's Program of Mechatronics and Information Technology, graduates are prepared for lifelong learning and employment in typical professional fields of mechatronics in industry, the service sector, and public administration. Graduates have acquired the scientific knowledge and methodological skills needed to pursue the Master's Program of Mechatronics and Information Technology or master's programs in related disciplines.

In the course of the basic studies, graduates acquire sound basic knowledge in mathematics, mechanics, and electrical engineering, complemented by basic knowledge of mechanical design, automation and information technology, production technology, and mechatronic systems and products. Moreover, students learn to link these disciplines for developing interdisciplinary problem solutions. This in-depth knowledge of scientific theories, principles, and methods enables graduates to successfully deal with clearly specified problems having a unique solution approach in mechatronics.

In the specialization subject and the bachelor's thesis, cross-disciplinary problem-solving and synthesis skills are developed for engineering systems. Graduates are able to generate new solutions in the engineering areas of their choice.

Graduates of the Bachelor's Program of Mechatronics and Information Technology at KIT can select basic methods to create and compare models under familiar conditions. They are able to tackle given problems and to work independently on the resulting tasks in organized teams, to integrate the results of others, and to present and interpret their own results in written form. They can identify, analyze, and develop systems and processes and apply predefined assessment criteria.

Ansprechpersonen
im Bachelorstudiengang Mechatronik und Informationstechnik

Studiengangservice Bachelor und Prüfungsausschuss

Beim MIT-Beratungsteam der Fakultät ETIT finden Sie Ihre Ansprechpersonen bei Fragen zum Studiengang, Studienverlauf und Verwaltungsabläufen. Sie sind außerdem Ihre erste Anlaufstelle bei Anfragen oder Anträgen an den Prüfungsausschuss.

Studiengangservice ETIT (Geb. 30.36, Raum 115 &117)
Tel.: 0721/608-42636 oder -42746, E-Mail: Bachelor-Info@etit.kit.edu

Praktikantenamt

Fragen zum Berufspraktikum stellen Studierende an das Praktikantenamt der Fakultät ETIT,
E-Mail: praktikantenamt@etit.kit.edu

Fachstudienberatung

Studiendekane:
Prof. Dr.-Ing. Martin Doppelbauer (martin.doppelbauer@kitedu) und .
Prof. Dr.-Ing. Marcus Geimer (marcus.geimer@kit.edu)

Studierendenservice

Bei organisatorischen Fragen zum Studium (Bewerbung, Einschreibung, Rückmeldung, Abschlussdokumente, Bescheinigungen, …):
https://www.sle.kit.edu/wirueberuns/studierendenservice.php
Kontaktpersonen bezüglich des Studienganges:
https://www.sle.kit.edu/wirueberuns/studierendenservice_team4.php

Auslandsaufenthalt

Sie können einen Auslandsaufenthalt über beide Fakultäten planen:

ETIT: https://www.etit.kit.edu/internationales.php

MACH: International Studieren im Maschinenbau (ISIM), E-Mail: isim@mach.kit.edu
https://www.mach.kit.edu/4201.php

Ansprechpersonen Stand 15.10.2023

Ansprechpersonen
im Bachelorstudiengang Mechatronik und Informationstechnik

Studiengangservice Bachelor und Prüfungsausschuss

Beim MIT-Beratungsteam der Fakultät ETIT finden Sie Ihre Ansprechpersonen bei Fragen zum Studiengang, Studienverlauf und Verwaltungsabläufen. Sie sind außerdem Ihre erste Anlaufstelle bei Anfragen oder Anträgen an den Prüfungsausschuss.

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E-Mail: praktikantenamt@etit.kit.edu

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Studierendenservice

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https://www.sle.kit.edu/wirueberuns/studierendenservice.php
Kontaktpersonen bezüglich des Studienganges:
https://www.sle.kit.edu/wirueberuns/studierendenservice_team4.php

Auslandsaufenthalt

Sie können einen Auslandsaufenthalt über beide Fakultäten planen:

ETIT: https://www.etit.kit.edu/internationales.php

MACH: International Studieren im Maschinenbau (ISIM), E-Mail: isim@mach.kit.edu
https://www.mach.kit.edu/4201.php

Ansprechpersonen Stand 15.10.2023

Anerkennung von Studien- und Prüfungsleistungen im Bachelorstudiengang Mechatronik und Informationstechnik

Grundsätzliche Regelungen

Die grundsätzlichen Regelungen finden sich in den Studien- und Prüfungsordnungen:
Bachelor MIT SPO 2016 vom 10. Mai 2016, §19 und deren Änderungen.

Danach können die im Studienplan jeweils geforderten Leistungen auch durch Anerkennung externer Leistungen erbracht werden.

Externe Leistungen können dabei wie folgt erworben sein:

1. innerhalb des Hochschulsystems (weltweit)
2. außerhalb des Hochschulsystems (an Institutionen mit genormtem Qualitätssicherungssystemen; die Anerkennung kann versagt werden, wenn mehr als 50 Prozent des Hochschulstudiums ersetzt werden sollen)

Die Anerkennung erfolgt auf Antrag der Studierenden, unter der Voraussetzung, dass hinsichtlich der erworbenen Kompetenzen kein wesentlicher Unterschied zu den Leistungen oder Abschlüssen besteht, die ersetzt werden sollen. Der Antrag muss innerhalb des ersten Semesters nach Immatrikulation am KIT gestellt werden. Zuständig für Anerkennung und Anrechnung ist der Prüfungsausschuss, der unter Einbeziehung der fachlichen Prüfung durch den zuständigen Fachvertreter über die Anerkennung entscheidet. Anerkannte Leistungen, die nicht am KIT erbracht wurden, werden im Notenauszug als „anerkannt“ ausgewiesen.

Benotung

Wenn es sich um ein vergleichbares Notensystem handelt, wird die Note der anzuerkennenden Leistung übernommen. Bei nicht vergleichbaren Notensystemen wird die Note umgerechnet. Prüfungsleistungen, die anstelle einer benoteten Prüfungsleistung anerkannt werden sollen, müssen ebenfalls benotet sein.

Vorgehensweise

I. Gehen Sie zunächst zu einer Fachprüferin oder einem Fachprüfer* und legen Sie dort das Antragsformular zusammen mit den erforderlichen Unterlagen vor**.
Wichtig: Anerkennungen müssen innerhalb des ersten Semesters nach Immatrikulation beim Prüfungsausschuss beantragt werden.

II. Besteht Gleichwertigkeit im Hinblick auf die erworbenen Kompetenzen (Qualifikationsziele), wird dies mit Stempel und Unterschrift durch die Fachprüferin oder den Fachprüfer bestätigt.

III. Geben Sie dann den fertig ausgefüllten und unterschriebenen Antrag zusammen mit dem entsprechenden Notenauszug im Büro des Prüfungsausschusses ab.

Hinweis zu Auslandsprüfungsleistungen

Bei Anerkennung von Prüfungsleistungen aus einem Auslandssemester ist es empfehlenswert, vor dem Auslandsaufenthalt die geplanten Auslandsprüfungsleistungen im Hinblick auf die spätere Anerkennung mit einem Fachstudienberater zu besprechen.

*Wenn Sie eine Leistung anstelle eines KIT-Moduls anerkennen lassen möchten, wenden Sie sich für die Fachprüfung an die/den Modulverantwortliche/n des KIT-Moduls. Für Anerkennungen im Wahlbereich/Interdisziplinären Fach/Profilierungsfach wenden Sie sich an eine/n der Fachstudienberater*innen der Fakultät ETIT.

**Für die Anerkennung erforderlich sind Unterlagen, auf denen die der Anerkennung zugrundeliegenden Prüfungsleistungen dokumentiert sind. (Zeugnisse, Transcript of Records, Auszüge aus dem Modulhandbuch, Skripte o.ä.). Bei Unterlagen, die nicht in deutscher oder englischer Sprache vorliegen, kann eine amtlich beglaubigte Übersetzung verlangt werden.

Falls Sie weitere Fragen haben, wenden Sie sich gerne an den Studiengangservice Bachelor:
bachelor-info@etit.kit.edu, Tel.: 0721/608-42636 oder -42746, Geb. 30.36, 1. OG, Raum 117

Stand 15.10.2023

Studienplan für den
Bachelorstudiengang Mechatronik und Informationstechnik

Dieser Studienplan tritt zum 01.10.2020 in Kraft und ist gültig für den Bachelorstudiengang Mechatronik und Informationstechnik gemäß der SPO 2016 (2016_AB_029 vom 10.05.2016) zusammen mit der Änderungssatzung 2018_AB_054, mit redaktionellen Änderungen vom 15.09.2021.

Zusammensetzung der Leistungspunkte (LP) insgesamt

Module im Pflichtfach „Ingenieurwissenschaftliche Grundlagen": 110 LP
Module im Vertiefungsfach „Vertiefung in der Mechatronik": 38 LP
Modul im Fach „Überfachliche Qualifikationen": 2 LP
Berufspraktikum: 15 LP
Bachelorarbeit: 15 LP
Summe: 180 LP

Prüfungsart und -dauer

Angaben über Prüfungsart oder -dauer werden nach § 6 Absatz 2 der Prüfungsordnung für den Bachelorstudiengang fristgerecht bekannt gegeben. Prüfungsart und/oder -dauer können nach § 6 Absatz 2 und 3 geändert werden.

Zusammensetzung der Module im Pflichtfach „Ingenieurwissenschaftliche Grundlagen"

Modul M-MATH-102859 - Höhere Mathematik (21 LP)
- T-MATH-100525 - Übungen zu Höhere Mathematik I
- T-MATH-100275 - Höhere Mathematik I (7 LP)
- T-MATH-100526 - Übungen zu Höhere Mathematik II
- T-MATH-100276 - Höhere Mathematik II (7 LP)
- T-MATH-100527 - Übungen zu Höhere Mathematik III
- T-MATH-100277 - Höhere Mathematik III (7 LP)

Modul M-MACH-102402 - Technische Mechanik (18 LP)
- T-MACH-100528 - Übungen zu Technische Mechanik I
- T-MACH-100282 - Technische Mechanik I (7 LP)
- T-MACH-100284 - Übungen zu Technische Mechanik II
- T-MACH-100283 - Technische Mechanik II (6 LP)
- T-MACH-105202 - Übungen zu Technische Mechanik III
- T-MACH-100299 - Technische Mechanik III (5 LP)

Modul M-ETIT-104519 - Lineare elektrische Netze (9 LP)
- T-ETIT-109317 - Lineare Elektrische Netze – Workshop A (1 LP)
- T-ETIT-109811 - Lineare Elektrische Netze – Workshop B (1 LP)
- T-ETIT-109316 - Lineare Elektrische Netze (7 LP)

Modul M-ETIT-104465 - Elektronische Schaltungen (7 LP)
- T-ETIT-109138 - Elektronische Schaltungen - Workshop (1 LP)
- T-ETIT-109318 - Elektronische Schaltungen (6 LP)

Modul M-ETIT-104428 - Elektromagnetische Felder (6 LP)
- T-ETIT-109078 - Elektromagnetische Felder (6 LP)

Modul M-ETIT-102124 - Elektrische Maschinen und Stromrichter (6 LP)
- T-ETIT-101954 - Elektrische Maschinen und Stromrichter (6 LP)

Studienplan BSc Mechatronik und Informationstechnik

Modul M-MACH-101299 - Maschinenkonstruktionslehre (8 LP)
- T-MACH-110364 - Maschinenkonstruktionslehre Grundlage I, Vorleistung (1 LP)
- T-MACH-110365 - Maschinenkonstruktionslehre Grundlage II, Vorleistung (1 LP)
- T-MACH-110363 - Maschinenkonstruktionslehre Grundlagen I und II (6 LP)

Modul M-MACH-102549 - Fertigungsprozesse (4 LP)
- T-MACH-105219 - Grundlagen der Fertigungstechnik (4 LP)

Modul M-ETIT-102102 - Digitaltechnik (6 LP)
- T-ETIT-101918 - Digitaltechnik (6 LP)

Modul M-ETIT-104539 - Informationstechnik I (6 LP)
- T-ETIT-109301 - Informationstechnik I - Praktikum (2 LP)
- T-ETIT-109300 - Informationstechnik I (4 LP)

Modul M-ETIT-104525 - Signale und Systeme (7 LP)
- T-ETIT-109314 - Signale und Systeme - Workshop (1 LP)
- T-ETIT-109313 - Signale und Systeme (6 LP)

Modul M-ETIT-102181 - Systemdynamik und Regelungstechnik (6 LP)
- T-ETIT-101921 - Systemdynamik und Regelungstechnik (6 LP)

Modul M-MACH-102749 - Mechatronische Systeme und Produkte (6 LP)
- T-MACH-108680 - Workshop Mechatronische Systeme und Produkte (3 LP)
- T-MACH-105574 - Mechatronische Systeme und Produkte (3 LP)

Zusammensetzung der Module im Vertiefungsfach „Vertiefung in der Mechatronik“

Das Vertiefungsfach setzt sich aus 3 Wahlblöcken zusammen und wird ggfs. von weiteren Ergänzungsmodulen vervollständigt. Die Wahlblöcke und die jeweiligen Wahlmöglichkeiten sind im Modulhandbuch beschrieben.

Vertiefung in der Mechatronik Wahlblock 1: „Elektrotechnik und Informationstechnik“

Wählen Sie in diesem Wahlblock **1 Modul** aus. Wählbare Module siehe Modulhandbuch.

Vertiefung in der Mechatronik Wahlblock 2: „Maschinenbau“

Wählen Sie in diesem Wahlblock **1 Modul** aus. Wählbare Module siehe Modulhandbuch.

Vertiefung in der Mechatronik Wahlblock 3:

Wählen Sie in diesem Wahlblock **weitere 1 bis 2 Module, bis 8 LP erreicht oder erstmalig überschritten** werden. Wählbare Module siehe Modulhandbuch

Vertiefung in der Mechatronik Ergänzungsbereich

Sofern nach Auswahl der Module in den Wahlblöcken 1 bis 3 in Summe noch keine 38 LP im Vertiefungsfach erreicht sind, müssen Ergänzungsmodule gewählt werden, bis mindestens 38 LP erreicht werden. Nicht zulässig ist es, weitere Module anzumelden, wenn bereits 38 LP erreicht oder erstmalig überschritten wurden.

Studienplan BSc Mechatronik und Informationstechnik

Als Ergänzungsmodule können alle noch nicht verwendeten Module aus den Wahlblöcken 1 bis 3 ausgewählt werden. (Bereits in den Modulen der Wahlblöcke 1 bis 3 erbrachte Leistungen können gemäß § 7 (5) der SPO nicht nochmal in Ergänzungsmodulen anerkannt werden.)
Weitere Ergänzungsmodule sind im Modulhandbuch aufgeführt.

Zusammensetzung des Moduls im Fach „Überfachliche Qualifikationen“

Das Fach „überfachliche Qualifikationen“ besteht aus dem Modul B-SQ „Schlüsselqualifikationen“ mit 2 Leistungspunkten.

Modul M-MACH-104355 Schlüsselqualifikationen (2 LP)
- T-MACH-105699 - Kooperation in interdisziplinären Teams (2 LP)

Die Vermittlung weiterer überfachlicher Qualifikationen im Umfang von 4 LP gemäß § 16 SPO findet im Rahmen der fachwissenschaftlichen Module „Lineare Elektrische Netze“, „Elektronische Schaltungen“ und „Signale und Systeme“ im Pflichtfach „Ingenieurwissenschaftliche Grundlagen“ statt.
Weitere überfachliche Qualifikationen können als Zusatzleistung erworben werden.

Modul Berufspraktikum

Modul M-MACH-104265 - Berufspraktikum (15 LP)
- T-MACH-108803 - Berufspraktikum (15 LP)

Während des Bachelorstudiums ist ein mindestens 13-wöchiges Berufspraktikum nachweislich abzuleisten, welches geeignet ist, dem Studierenden eine Anschauung von berufspraktischer Tätigkeit in Mechatronik und Informationstechnik zu vermitteln. Näheres regeln die Praktikantenrichtlinien. Dem Berufspraktikum sind 15 Leistungspunkte zugeordnet. Das Berufspraktikum geht nicht in die Gesamtnote ein. Zeiten einer Berufsausbildung können als Berufspraktikum anerkannt werden. Die Anerkennung erfolgt durch das zuständige Praktikantenamt.

Modul Bachelorarbeit

Modul M-MACH-104262 - Bachelorarbeit (15 LP)
- T-MACH-107760 - Präsentation (3 LP)
- T-MACH-108800 - Bachelorarbeit (12 LP)

Das Modul Bachelorarbeit hat einen Umfang von 15 LP. Es besteht aus der Bachelorarbeit mit 12 LP und einer Präsentation mit 3 LP. Die Bachelorarbeit kann von jedem Hochschullehrer/in der KIT-Fakultäten Elektrotechnik und Informationstechnik und Maschinenbau vergeben und betreut werden.
Die maximale Bearbeitungsdauer beträgt sechs Monate. Voraussetzung zur Zulassung zur Bachelorarbeit ist, dass der/die Studierende Modulprüfungen im Umfang von 120 LP erfolgreich abgelegt hat.
Die Note des Moduls Bachelorarbeit wird bei der Bildung der Gesamtnote mit dem doppelten Gewicht berücksichtigt (SPO § 21(2)).

Orientierungsprüfung

Die Orientierungsprüfung nach SPO § 8 besteht aus der Teilmodulprüfung „Technische Mechanik I“ im Modul „Technische Mechanik“ und der Modulprüfung „Lineare elektrische Netze“.

Zusätzliche Leistungen

Es können nach SPO § 15 (1) auch Leistungen mit bis zu 30 Leistungspunkten mehr erworben werden, als für das Bestehen der Bachelorprüfung erforderlich sind. Die Studierenden haben bereits bei der Anmeldung zu einer Prüfung in einem Modul diese als Zusatzleistung zu deklarieren.

Mastervorzug

Studienplan BSc Mechatronik und Informationstechnik

Studierende, die bereits mindestens 120 LP erworben haben, können gemäß SPO § 15 a Leistungspunkte aus einem konsekutiven Masterstudiengang am KIT im Umfang von höchstens 30 LP erwerben. Die Studierenden haben bereits bei der Anmeldung zu einer Prüfung in einem Modul diese als Mastervorzug zu deklarieren.

Exemplarischer Studienablaufplan

Sem.	Fach	Modul	Teilleistungen	LP	Prüfung / Studienleistung
1	Ingenieurwissenschaftliche Grundlagen	M-MATH-102859	T-MATH-100525 - Übungen zu Höhere Mathematik I T-MATH-100275 - Höhere Mathematik I	7	Studienleistung Prüfung
		M-MACH-102402	T-MACH-100528 - Übungen zu Technische Mechanik I T-MACH-100282 - Technische Mechanik I	7	Studienleistung Prüfung
		M-ETIT-104519	T-ETIT-109317 - Lineare Elektrische Netze - Workshop A T-ETIT-109811 - Lineare Elektrische Netze - Workshop B T-ETIT-109316 - Lineare Elektrische Netze	1 1 7	Studienleistung Prüfung
		M-ETIT-102102	T-ETIT-101918 - Digitaltechnik	6	Prüfung
		M-MACH-101299	T-MACH-110364- Maschinenkonstruktionslehre Grundlage I, Vorleistung	1	Studienleistung
2	Ingenieurwissenschaftliche Grundlagen	M-MATH-102859	T-MATH-100526 - Übungen zu Höhere Mathematik II T-MATH-100276 - Höhere Mathematik II	7	Studienleistung Prüfung
		M-MACH-102402	T-MACH-100284 - Übungen zu Technische Mechanik II T-MACH-100283 - Technische Mechanik II	6	Studienleistung Prüfung
		M-ETIT-104465	T-ETIT-109138 - Elektronische Schaltungen - Workshop T-ETIT-109318 - Elektronische Schaltungen	1 6	Studienleistung Prüfung
		M-ETIT-104428	T-ETIT-109078 - Elektromagnetische Felder	6	Prüfung
		M-MACH-101299	T-MACH-110365 - Maschinenkonstruktionslehre Grundlage II, Vorleistung T-MACH-110363 - Maschinenkonstruktionslehre Grundlagen I und II	1 6	Studienleistung Prüfung
3	Ingenieurwissenschaftliche Grundlagen	M-MATH-102859	T-MATH-100527 - Übungen zu Höhere Mathematik III T-MATH-100277 - Höhere Mathematik III	7	Studienleistung Prüfung
		M-MACH-102402	T-MACH-105202 - Übungen zu Technische Mechanik III T-MACH-100299 - Technische Mechanik III	5	Studienleistung Prüfung
		M-ETIT-102124	T-ETIT-101954 - Elektrische Maschinen und Stromrichter	6	Prüfung
		M-ETIT-104525	T-ETIT-109314 - Signale und Systeme - Workshop T-ETIT-109313 - Signale und Systeme	1 6	Studienleistung Prüfung
		M-MACH-102549	T-MACH-105219 - Grundlagen der Fertigungstechnik	4	Prüfung
4	Ingenieurwissenschaftliche Grundlagen	M-ETIT-104539	T-ETIT-109301 - Informationstechnik I - Praktikum T-ETIT-109300 - Informationstechnik I	2 4	Prüfung Prüfung
	Vertiefung in der Mechatronik		siehe S. 2	22	
5	Ingenieurwissenschaftliche Grundlagen	M-MACH-102749	T-MACH-108680 - Workshop Mechatronische Systeme und Produkte T-MACH-105574 - Mechatronische Systeme und Produkte	3 3	Prüfung Prüfung
		M-ETIT-102181	T-ETIT-101921 - Systemdynamik und Regelungstechnik	6	Prüfung
	Überfachliche Qualifikationen	M-MACH-104355	T-MACH-105699 - Kooperation in interdisziplinären Teams	2	Studienleistung
	Vertiefung in der Mechatronik		siehe S. 2	16	
6		M-MACH-104265	T-MACH-108803 - Berufspraktikum	15	Studienleistung
		M-MACH-104262	T-MACH-107760 - Präsentation T-MACH-108800 - Bachelorarbeit	3 12	Studienleistung Abschlussarbeit

Gültig ab WS 21/22, Stand 15.09.2021.
Für Bachelorstudiengang MIT gemäß SPO 2016 (2016_AB_029) und der Änderungssatzung 2018 (2018_AB_054) vom 28.09.2018.

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Studienplan BSc Mechatronik und Informationstechnik

Exemplarische Wahloption

Die exemplarische Wahloption zeigt beispielhaft ***eine*** zulässige Kombination von Modulen im ***Vertiefungsfach***, mit der exakt die angegebenen Leistungspunkte im 4. und 5. Semester erreicht werden können.

Sem.	Wahlblock	Modul	Teilleistungen	LP	Prüfung / Studienleistung
3	Wahlblock 2	M-MACH-102829	T-MACH-110955 - Maschinenkonstruktionslehre III, Vorleistung	1	Studienleistung
4	Wahlblock 1	M-ETIT-105643	T-ETIT-101923 - Elektroenergiesysteme	5	Prüfung
	Wahlblock 2	M-MACH-102829	T-MACH-110956 - Maschinenkonstruktionslehre IV, Vorleistung T-MACH-104810 - Maschinenkonstruktionslehre III & IV	1 11	Studienleistung Prüfung
	Wahlblock 3	M-ETIT-104547	T-ETIT-109319 - Informationstechnik II und Automatisierungstechnik	4	Prüfung
5	Wahlblock 1	M-ETIT-105643	T-ETIT-100784 - Hybride und elektrische Fahrzeuge	4	Prüfung
	Wahlblock 3	M-ETIT-102103	T-ETIT-101936 – Nachrichtentechnik I	6	Prüfung
	Ergänzungsbereich	M-INFO-100893	T-INFO-108014 - Robotik I - Einführung in die Robotik	6	Prüfung

Gültig ab WS 21/22, Stand 15.09.2021.
Für Bachelorstudiengang MIT gemäß SPO 2016 (2016_AB_029) und der Änderungssatzung 2018 (2018_AB_054) vom 28.09.2018.

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9 Field of study structure

Mandatory	
Orientation Exam *This field will not influence the calculated grade of its parent.*	
Bachelor's Thesis	15 CR
Internship	15 CR
Engineering Fundamentals	110 CR
Specialization in Mechatronics *First usage possible from 4/1/2021.*	38 CR
Interdisciplinary Qualifications	2 CR
Voluntary	
Additional Examinations *This field will not influence the calculated grade of its parent.*	
Master's Transfer Account *This field will not influence the calculated grade of its parent.*	

9.1 Orientation Exam

Mandatory		
M-MACH-104333	Orientation Exam	0 CR

9.2 Bachelor's Thesis

Credits
15

Mandatory		
M-MACH-104262	Bachelor's Thesis	15 CR

9.3 Internship

Credits
15

Mandatory		
M-MACH-104265	Internship	15 CR

9.4 Engineering Fundamentals

Credits
110

Mandatory		
M-MATH-102859	Advanced Mathematics	21 CR
M-MACH-102402	Engineering Mechanics	18 CR
M-ETIT-104519	Linear Electric Circuits	9 CR
M-ETIT-104465	Electronic Devices and Circuits	7 CR
M-ETIT-104428	Electromagnetic Fields	6 CR
M-ETIT-102124	Electrical Machines and Power Electronics	6 CR
M-MACH-101299	Mechanical Design	8 CR
M-MACH-102549	Manufacturing Processes	4 CR
M-ETIT-102102	Digital Technology	6 CR
M-ETIT-104539	Information Technology I	6 CR
M-ETIT-104525	Signals and Systems	7 CR
M-ETIT-102181	System Dynamics and Control Engineering	6 CR
M-MACH-102749	Mechatronical Systems and Products	6 CR

9.5 Specialization in Mechatronics

Credits
38

Note regarding usage
First usage possible from 4/1/2021.

Election notes
Compulsary Elective Modules

1. Part 1: Electrical Engineering and Information Technology
You have to select one of the listed modules.

2. Part 2: Mechanical Engineering
You have to select one of the listed modules.

3. Part 3: Electrical Engineering and Information Technology, Mechanical Engineering, Informatics, Economics and Management
You have to select one or two modules so that 8 LP are achieved or for the first time exceeded.

4. Part 4: Supplementary Modules
If you have not achieved 38 LP after having selected modules in part 1-3, you have to select supplementary modules until 38 LP are achieved. It is not allowed to select further modules, if 38 LP are achieved or for the first time exceeded. Modules already selected in part 1-3 cannot be acknowledged as supplementary modules.

Compulsary Elective Modules: Electrical Engineering and Information Technology (Election: 1 item)		
M-ETIT-105643	Electric Energy Systems/Hybrid and Electric Vehicles	9 CR
M-ETIT-105644	Information and Automation Technology II/Laboratory for Machine Learning Algorithms	10 CR
M-ETIT-105645	Information and Automation Technology II/Seminar Embedded Systems	8 CR
M-ETIT-105646	Theory of Probability/Communication Engineering I	11 CR
M-ETIT-105647	Electromagnetic Waves/Fundamentals on High Frequency Techniques	12 CR
Compulsary Elective Modules: Mechanical Engineering (Election: 1 item)		
M-MACH-102829	Mechanical Design III and IV	13 CR
M-MACH-102565	Fluid Mechanics	8 CR
M-MACH-102386	Technical Thermodynamics and Heat Transfer I	8 CR
M-MACH-102567	Material Science and Engineering	9 CR
Compulsary Elective Modules: Electrical Engineering and Information Technology, Mechanical Engineering, Informatics, Economics and Management (Election: at least 8 credits)		
M-INFO-100803	Real-Time Systems	6 CR
M-WIWI-101418	Introduction to Operations Research	9 CR
M-ETIT-102156	Electric Energy Systems	5 CR
M-ETIT-104515	Electromagnetic Waves	6 CR
M-ETIT-106037	Engineering of Automation Systems *First usage possible from 10/1/2022.*	4 CR
M-ETIT-102129	Fundamentals on High Frequency Techniques	6 CR
M-ETIT-100514	Hybrid and Electric Vehicles	4 CR
M-ETIT-104547	Information Technology II and Automation Technology	4 CR
M-MACH-102829	Mechanical Design III and IV	13 CR
M-INFO-100757	Mechano-Informatics and Robotics	4 CR
M-ETIT-102103	Communications Engineering I	6 CR
M-INFO-101174	Programming	6 CR
M-INFO-103179	Computer Organization	6 CR
M-INFO-100893	Robotics I - Introduction to Robotics	6 CR
M-ETIT-105320	Seminar Fuel Cell I	3 CR
M-ETIT-100455	Seminar Embedded Systems	4 CR
M-INFO-101175	Software Engineering I	6 CR
M-MACH-102565	Fluid Mechanics	8 CR
M-MACH-102386	Technical Thermodynamics and Heat Transfer I	8 CR
M-ETIT-102104	Theory of Probability	5 CR
M-MACH-102567	Material Science and Engineering	9 CR
Supplementary Modules (Election: between 1 and 15 credits)		
M-INFO-100030	Algorithms I	6 CR
M-ETIT-100565	Antennas and Multiple Antenna Systems	5 CR
M-INFO-100764	Accessibility - Assistive Technologies for Visually Impaired Persons	3 CR
M-ETIT-103271	Battery Modeling in MATLAB	3 CR
M-ETIT-102651	Image Processing	3 CR
M-INFO-100803	Real-Time Systems	6 CR
M-WIWI-101418	Introduction to Operations Research	9 CR
M-INFO-100736	Introduction to Video Analysis	3 CR
M-ETIT-105276	Introduction to High Voltage Engineering	3 CR
M-ETIT-102156	Electric Energy Systems	5 CR
M-ETIT-104515	Electromagnetic Waves	6 CR
M-ETIT-102113	Basic Electronic Circuits Laboratory	6 CR
M-ETIT-106037	Engineering of Automation Systems *First usage possible from 10/1/2022.*	4 CR
M-ETIT-100407	Power Generation	3 CR
M-ETIT-103043	Manufacturing Measurement Technology	3 CR
M-ETIT-102129	Fundamentals on High Frequency Techniques	6 CR

M-ETIT-100514	Hybrid and Electric Vehicles	4 CR
M-ETIT-104547	Information Technology II and Automation Technology	4 CR
M-INFO-100895	Information Processing in Sensor Networks	6 CR
M-ETIT-104534	Complex Analysis and Integral Transformations	4 CR
M-ETIT-104823	Laboratory for Applied Machine Learning Algorithms	6 CR
M-ETIT-100518	Laboratory Circuit Design	6 CR
M-MACH-102829	Mechanical Design III and IV	13 CR
M-INFO-100757	Mechano-Informatics and Robotics	4 CR
M-ETIT-106449	Medical Imaging Technology I *First usage possible from 10/1/2023.*	3 CR
M-INFO-100729	Human Computer Interaction	6 CR
M-INFO-100824	Human-Machine-Interaction in Anthropomatics: Basics	3 CR
M-INFO-101249	Mobile Computing and Internet of Things	5 CR
M-ETIT-102103	Communications Engineering I	6 CR
M-ETIT-100440	Communications Engineering II	4 CR
M-ETIT-105005	Optics and Solid State Electronics *First usage possible from 10/1/2021.*	6 CR
M-ETIT-100509	Optoelectronic Components	4 CR
M-ETIT-100480	Optoelectronics	4 CR
M-ETIT-100411	Photovoltaic System Design	3 CR
M-ETIT-100390	Physiology and Anatomy for Engineers I	3 CR
M-ETIT-103263	Laboratory Hardware and Software in Power Electronic Systems	6 CR
M-INFO-101174	Programming	6 CR
M-ETIT-100562	Radiation Protection	3 CR
M-ETIT-105124	Radio-Frequency Electronics	5 CR
M-INFO-103179	Computer Organization	6 CR
M-INFO-100893	Robotics I - Introduction to Robotics	6 CR
M-ETIT-105319	Seminar Battery I *First usage possible from 4/1/2020.*	3 CR
M-ETIT-105320	Seminar Fuel Cell I	3 CR
M-ETIT-100397	Seminar Power Electronics in Regenerative Energy Systems	4 CR
M-ETIT-100383	Seminar on Selected Chapters of Biomedical Engineering	3 CR
M-INFO-101175	Software Engineering I	6 CR
M-INFO-100833	Software Engineering II	6 CR
M-MACH-102565	Fluid Mechanics	8 CR
M-ETIT-105299	Superconductors for Energy Applications	5 CR
M-ETIT-106684	Superconducting Magnet Technology *First usage possible from 4/1/2024.*	4 CR
M-ETIT-106683	Superconducting Power Systems *First usage possible from 4/1/2024.*	4 CR
M-MACH-102831	Engineering Mechanics IV	5 CR
M-MACH-102386	Technical Thermodynamics and Heat Transfer I	8 CR
M-MACH-102830	Technical Thermodynamics and Heat Transfer II	7 CR
M-ETIT-102104	Theory of Probability	5 CR
M-MACH-104919	Advanced Topics and Methods in Mechanical Engineering (4 CP)	4 CR
M-MACH-105091	Advanced Topics and Methods in Mechanical Engineering (5 CP)	5 CR
M-MACH-106309	Advanced Topics and Methods in Mechanical Engineering (6 CP)	6 CR
M-MACH-102567	Material Science and Engineering	9 CR

9.6 Interdisciplinary Qualifications

Credits
2

Mandatory		
M-MACH-104355	Soft Skills	2 CR

9.7 Additional Examinations

Additional Examinations (Election: at most 30 credits)		
M-MACH-104332	Further Examinations	30 CR
M-ZAK-106099	Supplementary Studies on Sustainable Development *First usage possible from 4/1/2023.*	19 CR
M-ZAK-106235	Supplementary Studies on Culture and Society *First usage possible from 4/1/2023.*	22 CR

9.8 Master's Transfer Account

Election notes

Please note: Upon successful completion of all studies and exams needed for the bachelor’s degree, a control of success registered as a prior master’s examination may only be passed as long as you are enrolled in the bachelor’s program. You should not yet have been admitted to the master’s program and the master’s semester should not yet have started.

This means that as soon as your admission to the master’s program has been expressed and the master’s semester has started, your participation in the examination is the **first regular examination** attempt within the framework of your master’s studies.

Master Transfer Account (Election: at most 30 credits)		
M-MACH-102698	Actuators and Sensors in Nanotechnology	4 CR
M-INFO-103294	Wearable Robotic Technologies	4 CR
M-INFO-100826	Automated Visual Inspection and Image Processing	6 CR
M-MACH-105108	Automated Manufacturing Systems	8 CR
M-MACH-103232	Rail System Technology	4 CR
M-INFO-100814	Biologically Inspired Robots	3 CR
M-ETIT-100387	Biomedical Measurement Techniques I	3 CR
M-MACH-100489	BioMEMS - Microsystems Technologies for Life Sciences and Medicine I	4 CR
M-MACH-100490	BioMEMS - Microsystems Technologies for Life Sciences and Medicine II	4 CR
M-MACH-100491	BioMEMS - Microsystems Technologies for Life Sciences and Medicine III	4 CR
M-ETIT-105616	Channel Coding: Algebraic Methods for Communications and Storage *First usage possible from 4/1/2021.*	3 CR
M-MACH-105296	Computational Intelligence *First usage possible from 4/2/2020.*	4 CR
M-INFO-104460	Deep Learning and Neural Networks	6 CR
M-MACH-102687	Decentrally Controlled Intralogistic Systems	4 CR
M-MACH-106513	Railway System Digitalisation *First usage possible from 10/1/2023.*	4 CR
M-MACH-102700	Dynamics of the Automotive Drive Train	5 CR
M-WIWI-100498	Introduction into Energy Economics	5 CR
M-MACH-102688	Elements of Technical Logistics	4 CR
M-MACH-105015	Elements of Technical Logistics incl. Project	6 CR
M-ETIT-100419	Lab Course Electrical Power Engineering	6 CR
M-ETIT-100534	Power Transmission and Power Network Control	5 CR
M-MACH-102702	Organ Support Systems	4 CR
M-MACH-105288	Handling Characteristics of Motor Vehicles I	4 CR
M-MACH-102703	Vehicle Lightweight Design - Strategies, Concepts, Materials	4 CR
M-MACH-102693	Automotive Vision	6 CR
M-MACH-106515	Vehicle Systems for Urban Mobility *First usage possible from 10/1/2023.*	4 CR
M-INFO-106299	Advanced Artificial Intelligence *First usage possible from 4/1/2023.*	6 CR
M-MACH-102705	Appliance and Power Tool Design	8 CR
M-MACH-102690	Fundamentals of Energy Technology	8 CR
M-MACH-100501	Automotive Engineering I	8 CR
M-MACH-100502	Automotive Engineering II	4 CR
M-MACH-102720	Principles of Medicine for Engineers	4 CR
M-MACH-102691	Introduction to Microsystem Technology I	4 CR
M-MACH-102706	Introduction to Microsystem Technology II	4 CR
M-MACH-102707	Fundamentals of Combustion I	4 CR
M-MACH-105824	Fundamentals in the Development of Commercial Vehicles *First usage possible from 10/1/2021.*	4 CR
M-MACH-105289	Principles of Whole Vehicle Engineering I	2 CR
M-MACH-105290	Principles of Whole Vehicle Engineering II	2 CR
M-MACH-105281	Information Systems and Supply Chain Management *First usage possible from 4/1/2020.*	3 CR
M-INFO-100895	Information Processing in Sensor Networks	6 CR
M-MACH-106514	Innovation and Project Management in Rail Vehicle Engineering *First usage possible from 10/1/2023.*	4 CR
M-INFO-100791	Innovative Concepts for Programming Industrial Robots	4 CR
M-MACH-105282	IT-Fundamentals of Logistics: Opportunities for Digital Transformation *First usage possible from 4/1/2020.*	4 CR
M-MACH-102696	Lightweight Engineering Design	4 CR
M-MACH-102695	Motor Vehicle Laboratory	4 CR

M-ETIT-105467	Control Theory Laboratory *First usage possible from 10/1/2020.*	6 CR
M-ETIT-106067	Power Electronic Systems in Energy Technology *First usage possible from 10/1/2022.*	6 CR
M-MACH-105298	Logistics and Supply Chain Management *First usage possible from 4/1/2020.*	9 CR
M-INFO-100840	Localization of Mobile Agents	6 CR
M-MACH-101923	Machine Vision *First usage possible from 10/1/2021.*	8 CR
M-WIWI-105003	Machine Learning 1	5 CR
M-WIWI-105006	Machine Learning 2	5 CR
M-MACH-106457	Machine Learning for Robotic Systems 1 *First usage possible from 10/1/2023.*	5 CR
M-MACH-106652	Machine Learning for Robotic Systems 2 *First usage possible from 4/1/2024.*	5 CR
M-MACH-102694	Machine Dynamics	5 CR
M-MACH-104984	Material Flow in Logistic Systems	9 CR
M-ETIT-105982	Measurement Technology *First usage possible from 10/1/2022.*	5 CR
M-MACH-102713	Mechanics in Microtechnology	4 CR
M-MACH-102699	Laboratory Mechatronics	4 CR
M-ETIT-106449	Medical Imaging Technology I *First usage possible from 10/1/2023.*	3 CR
M-ETIT-106670	Medical Imaging Technology II *First usage possible from 4/1/2024.*	3 CR
M-MACH-102714	Microenergy Technologies	4 CR
M-MACH-100487	Microactuators	4 CR
M-MACH-105292	Novel Actuators and Sensors	4 CR
M-MATH-105831	Numerical Methods *First usage possible from 10/1/2021.*	5 CR
M-ETIT-104567	Power Electronics *First usage possible from 10/1/2022.*	6 CR
M-ETIT-100389	Laboratory Biomedical Engineering	6 CR
M-ETIT-100401	Lab Course Electrical Drives and Power Electronics	6 CR
M-ETIT-103448	Laboratory Mechatronic Measurement Systems	6 CR
M-ETIT-100394	Practical Aspects of Electrical Drives	4 CR
M-MACH-105291	Lab Computer-Aided Methods for Measurement and Control	4 CR
M-MACH-102718	Product Development – Methods of Product Engineering	6 CR
M-MACH-102711	Production Techniques Laboratory	4 CR
M-ETIT-104475	Project Management in the Development of Products for Safety-Critical Applications	4 CR
M-INFO-102224	Practical Project Robotics and Automation I (Software)	6 CR
M-INFO-102230	Practical Project Robotics and Automation II (Hardware)	6 CR
M-MACH-105332	Quality Management	4 CR
M-ETIT-100374	Control of Linear Multivariable Systems	6 CR
M-INFO-102522	Robotics - Practical Course	6 CR
M-INFO-100893	Robotics I - Introduction to Robotics	6 CR
M-INFO-102756	Robotics II - Humanoid Robotics	3 CR
M-INFO-104897	Robotics III - Sensors and Perception in Robotics	3 CR
M-MACH-102683	Rail Vehicle Technology	4 CR
M-MACH-105725	Seamless Engineering	9 CR
M-ETIT-100378	Sensors	3 CR
M-INFO-100829	Stochastic Information Processing	6 CR
M-MACH-103205	Engineering Mechanics	5 CR
M-MACH-105318	Technical Design in Product Development	4 CR
M-MACH-102388	Thermal Solar Energy	4 CR
M-INFO-100839	Fuzzy Sets	6 CR

M-ETIT-100361	Distributed Discrete Event Systems	4 CR
M-MACH-105293	Virtual Engineering 1	4 CR
M-MACH-102717	Heat and Mass Transfer	4 CR
M-ETIT-102734	Materials	5 CR
M-MACH-105107	Machine Tools and Industrial Handling *First usage possible from 4/1/2020.*	8 CR

Modelled Conditions
The following conditions have to be fulfilled:

1. You need to have earned at least 120 credits in the following fields:
    - Bachelor's Thesis
    - Internship
    - Engineering Fundamentals
    - Interdisciplinary Qualifications
    - Specialization in Mechatronics
    - Specialization in Mechatronics
    - Specialization in Mechatronics

10 Modules

10.1 Module: Accessibility - Assistive Technologies for Visually Impaired Persons (2400052) [M-INFO-100764]

Responsible: Prof. Dr.-Ing. Rainer Stiefelhagen
Organisation: KIT Department of Informatics
Part of: Specialization in Mechatronics (Supplementary Modules)

Credits	Grading scale	Recurrence	Duration	Language	Level	Version
3	Grade to a tenth	Each summer term	1 term	German	3	2

Mandatory			
T-INFO-101301	Accessibility - Assistive Technologies for Visually Impaired Persons	3 CR	Stiefelhagen

M 10.2 Module: Actuators and Sensors in Nanotechnology [M-MACH-102698]

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

Part of: Master's Transfer Account

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

Mandatory			
T-MACH-105238	Actuators and Sensors in Nanotechnology	4 CR	Kohl

Competence Certificate
oral exam: 45 min

Prerequisites
keine

Competence Goal
The students can:

- describe the principles of actuation and sensing and exemplify them
- describe important nano fabrication technologies and assess the influence of process parameters
- illustrate the layout and function of nano actuators and sensors and determine their characteristic properties (time constants, sensitivities, forces, etc.)
- evaluate their suitability for specific applications

Content
- Physical principles of actuation and sensing
- Scaling and size effects
- Fabrication technologies
- Selected developments
- Applications

The lecture includes amongst others the following topics:

- Nano technologies
- Nano electro mechanical systems (NEMS)
- Nano magneto mechanical and multiferroic systems
- Polymer-based nano actuators
- Nano motors, molecular systems
- Adaptive nano optical systems
- Nanosensors: concepts, materials, fabrication
- Examples on different categories of materials and applications:

  - C-based, MeOx-based nano sensors
  - Physical, chemical, biological nano sensors

- Multivariant data analysis / interpretation

Module grade calculation
Module grade calculation
The module grade is the grade of the written exam.

Workload
Time of attendance: 15 * 1,5 h = 22,5 h
Preparation and follow up: 15 * 5,5 h = 82,5 h
Exam Preaparation and Exam: 15 h
Total: 120 h = 4 LP

Recommendation
The lecture addresses students in the fields of mechanical engineering, mechatronics and information technology, materials science and engineering, physics, electrical engineering and economic sciences. A comprehensive introduction is given in the basics and current developments on the nanoscopic length scale.

Literature
- Lecture notes

- 2. Balzani, V., Credi, A., & Venturi, M., Molecular devices and machines: concepts and perspectives for the nanoworld, 2008

- „Nanowires and Nanobelts, - Materials, Properties and Devices -, Volume 2: Nanowires and Nanobelts of Functional Materials", Edited by Zhong Lin Wang, Springer, 2003, ISBN 10 0-387-28706-X

- „Sensors Based on Nanostructured Materials", Edited by Francisco J. Arregui, Springer, 2009, ISBN: 978-0-387-77752-8

- "Multivariate Datenanalyse – Methodik und Anwendungen in der Chemie", R. Henrion, G. Henrion, Springer 1994, ISBN 3-540-58188-X

M 10.3 Module: Advanced Artificial Intelligence [M-INFO-106299]

Responsible: Prof. Dr. Jan Niehues
Organisation: KIT Department of Informatics
Part of: Master's Transfer Account (Usage from 4/1/2023)

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

Mandatory			
T-INFO-112768	Advanced Artificial Intelligence	6 CR	Niehues

Competence Certificate
See partial achievements (Teilleistung)

Prerequisites
See partial achievements (Teilleistung)

Competence Goal
● The students know the relevant elements of a technical cognitive system.
● The students understand the algorithms and methods of AI to model cognitive systems.
● The students are able to understand the different sub-components to develop and analyze a system .
● The students can transfer this knowledge to new applications, as well as analyze and compare different methods.

Content
Due to the successes in research, AI systems are increasingly integrated into our everyday lives. These are, for example, systems that can understand and generate language or analyze images and videos. In addition, AI systems are essential in robotics in order to be able to develop the next generation of intelligent robots .

Based on the knowledge of the lecture “Introduction to AI”, the students learn to understand, develop and evaluate these systems.
In order to bring this knowledge closer to the students, the lecture is divided into 4 parts. First, the lecture investigates method of perception using different modalities. The second part deals with advanced methods of learning that go beyond supervised learning. Then methods are discussed that are required for the representation of knowledge in AI systems. Finally, methods that enable AI systems to generate content are presented.

Workload
Lecture with 3 SWS + 1 SWS exercise , 6 CP.
6 LP corresponds to approx. 180 hours, of which
approx. 45 hours lecture attendance
approx. 15 hours exercise visit
approx. 90 hours post-processing and processing of the exercise sheets
approx. 30 hours exam preparation

M 10.4 Module: Advanced Mathematics [M-MATH-102859]

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

Credits	Grading scale	Duration	Language	Level	Version
21	Grade to a tenth	3 terms	German	3	1

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

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

Prerequisites
None.

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

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

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

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

Workload
In class: 270 hours

- lectures, tutorials and examinations

Independent study: 360 hours

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

Learning type
Lecture, problem classes, tutorials

M 10.5 Module: Advanced Topics and Methods in Mechanical Engineering (4 CP) [M-MACH-104919]

Responsible: Prof. Dr.-Ing. Sven Matthiesen
Organisation: KIT Department of Mechanical Engineering
Part of: Specialization in Mechatronics (Supplementary Modules)

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

Election notes
Only one of the listed bricks can be choosen in the compulsory-elective block.

Advanced Topics and Methods in Mechanical Engineering (4 CP) (Election: 1 item)			
T-MACH-105381	Virtual Engineering (Specific Topics)	4 CR	Ovtcharova
T-MACH-105212	CAE-Workshop	4 CR	Albers, Matthiesen
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-105147	Product Lifecycle Management	4 CR	Ovtcharova
T-MACH-100531	Systematic Materials Selection	5 CR	Dietrich, Schulze
T-MACH-102083	Integrated Information Systems for Engineers	4 CR	Ovtcharova
T-MACH-105292	Heat and Mass Transfer	4 CR	Maas, Yu
T-MACH-100532	Scientific Computing for Engineers	4 CR	Gumbsch, Weygand

Competence Certificate
oral/written exam

Prerequisites
None

Competence Goal
The Student have learned to evaluate, select and apply scientific methods in Mechanical Engineering in different areas (according to their choice of course).

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

Learning type
Lectures, Tutorials

M 10.6 Module: Advanced Topics and Methods in Mechanical Engineering (5 CP) [M-MACH-105091]

Responsible: Prof. Dr.-Ing. Sven Matthiesen
Organisation: KIT Department of Mechanical Engineering
Part of: Specialization in Mechatronics (Supplementary Modules)

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

Election notes
Only one of the listed bricks can be choosen in the compulsory-elective block.

Advanced Topics and Methods in Mechanical Engineering (5 CP) (Election: 1 item)			
T-MACH-105209	Introduction to Multi-Body Dynamics	5 CR	Römer
T-MACH-105210	Machine Dynamics	5 CR	Proppe
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-105652	Fundamentals of Combustion Engine Technology	5 CR	Bernhardt, Kubach, Pfeil, Toedter, Wagner
T-MACH-105290	Vibration Theory	5 CR	Fidlin

Competence Certificate
see course

Prerequisites
None

Competence Goal
Students will be able to select, apply, and evaluate scientific methods of mechanical engineering in the areas of the selected course.

Workload
The workload is approximately 150 time hours and corresponds to 5 credit points. The workload varies depending on the event.

Learning type
Lecture, exercise, practical course

M 10.7 Module: Advanced Topics and Methods in Mechanical Engineering (6 CP) [M-MACH-106309]

Responsible: Prof. Dr.-Ing. Sven Matthiesen
Organisation: KIT Department of Mechanical Engineering
Part of: Specialization in Mechatronics (Supplementary Modules)

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

Election notes
Only one of the listed bricks can be choosen in the compulsory-elective block.

Advanced Topics and Methods in Mechanical Engineering (6 CP) (Election: 1 item)			
T-MACH-105293	Mathematical Methods in Dynamics	6 CR	Proppe
T-MACH-105294	Mathematical Methods of Vibration Theory	6 CR	Fidlin, Römer
T-MACH-105295	Mathematical Methods in Fluid Mechanics	6 CR	Frohnapfel

Competence Certificate
See course

Prerequisites
None

Competence Goal
The Student have learned to evaluate, select and apply scientific methods in Mechanical Engineering in different areas (according to their choice of course).

Workload
The workload is approximately 180 time hours and corresponds to 6 credit points.

Learning type
Lecture, exercise, practical course

M 10.8 Module: Algorithms I [M-INFO-100030]

Responsible: TT-Prof. Dr. Thomas Bläsius
Organisation: KIT Department of Informatics
Part of: Specialization in Mechatronics (Supplementary Modules)

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

Mandatory			
T-INFO-100001	Algorithms I	6 CR	Bläsius

M 10.9 Module: Antennas and Multiple Antenna Systems [M-ETIT-100565]

Responsible: Prof. Dr.-Ing. Thomas Zwick
Organisation: KIT Department of Electrical Engineering and Information Technology
Part of: Specialization in Mechatronics (Supplementary Modules)

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

Mandatory			
T-ETIT-106491	Antennas and Multiple Antenna Systems	5 CR	Zwick

Competence Certificate
The success control takes place within the framework of an oral overall examination (20 minutes).

Prerequisites
The "Antenna and Multiple Antenna Systems" module must not be started or completed.

Competence Goal
The students have in-depth knowledge of antennas and antenna systems. This includes functionality, calculation methods but also aspects of practical implementation. You will be able to understand how any antenna works and to develop and dimension antennas with specified properties.

Content
The lecture teaches the basics of field theory as well as the functioning of all essential antenna structures. The functionality of antenna arrays is also visualized using Matlab exercises. Furthermore, antenna measurement methods are taught, as well as an insight into modern antenna and multi-antenna systems. In addition, a practice-oriented workshop on computer-aided design and simulation of antennas is carried out, in which the students learn to use the software tool CST and thus carry out antenna design tasks independently. Individual antennas are then set up and measured so that the students get to know the entire process.

Module grade calculation
The module grade is the grade of the oral exam.

Workload
The workload includes:

Attendance study time lecture / exercise: 30 h

Attendance study time computer exercise CST / MATLAB: 30h

Self-study time including exam preparation: 90 h

A total of 150 h = 5 LP

M 10.10 Module: Appliance and Power Tool Design [M-MACH-102705]

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

Part of: Master's Transfer Account

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

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

Competence Certificate
Approx. 30 min oral examination.

The project work on device technology is examined together with the lecture on device design.

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
The students are able to ...

- analyze complex and contradictory problems regarding the overall system user –machine and hence to create new solutions with focus on customer use.
- list, to identify and to explain strategies and approaches for the design of technical machines, to transfer them on new problems and to evaluate the working results concerning quality, costs and customer use.
- name the impact of specific boundary conditions, e.g. high quantities of mechatronic systems considering the customer, on the resulting design, to interpret the consequences and to evaluate the effects in unknown situations.
- name aspects of a successful product engineering in a team of worldwide acting companies regarding the field customer, company and market.
- evaluate their relevance for self-chosen examples and to transfer them on unknown problems.

Content
Operation system, system of objects and system of objectives of mechatronic appliances and power tool designs.

Mode of operation as enabler of design, components of mechatronic systems, application oriented design, guidelines for appliance and power tool design.

Part of the lecture is a project work, in which theory will be reprocessed and presented in a practical way. In such exercises the students also will present their results developed in project teams.

The interaction of analysis and sysnthesis will be acquired in student teams at the example of different appliances and power tools.

Module grade calculation
The module grade consists only of the grade for the lecture Appliance and Power Tool Design.

Annotation
Participation in the course on device design requires simultaneous participation in the project work on device technology. For organisational reasons the number of participants is limited. A registration form will be provided on the IPEK homepage at the beginning of August. If the number of applicants is too large, a selection procedure will take place. This is based on the following selection criteria:

- 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
Lecture Appliance and Power Tool Design: 60 h

Appliance and Power Tool Design Project Work: 180 h

Recommendation
None

Learning type
Lecture, exercise, project work

M 10.11 Module: Automated Manufacturing Systems [M-MACH-105108]

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

Part of: Master's Transfer Account

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

Mandatory			
T-MACH-108844	Automated Manufacturing Systems	8 CR	Fleischer

Competence Certificate
oral exam (40 min)

Competence Goal
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.

Content
The module 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 module, 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 module are deepened and applied to concrete problems and tasks.

Workload
1. Presence time lecture/exercise: 15 * 6 h = 90 h
2. Pre- and post-processing time lecture/exercise: 15 * 9 h = 135 h
3. Exam preparation and presence in the same: 15 h
In total: 240 h = 8 LP

Learning type
Lectures, exercise, field trip

M 10.12 Module: Automated Visual Inspection and Image Processing (24169) [M-INFO-100826]

Responsible: Prof. Dr.-Ing. Jürgen Beyerer
Organisation: KIT Department of Informatics
Part of: Master's Transfer Account

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

Mandatory			
T-INFO-101363	Automated Visual Inspection and Image Processing	6 CR	Beyerer

M 10.13 Module: Automotive Engineering I [M-MACH-100501]

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

Part of: Master's Transfer Account

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

Mandatory			
T-MACH-100092	Automotive Engineering I	8 CR	Gauterin, Gießler

Competence Certificate
written exam; duration approximately 2 hours

Prerequisites
Only one out of the two moduls "M-MACH-100501 - Grundlagen der Fahrzeugtechnik I" and "M-MACH-102686 - Automotive Engineering I" is allowed.

Competence Goal
The students know the movements and the forces at the vehicle and are familiar with active and passive security. They have proper knowledge about operation of engines and alternative drives, the necessary transmission between engine and drive wheels and the power distribution, so that they can apply their knowledge effectively in actual practise. They have an overview of the components necessary for the drive and have the basic knowledge, to analyze, to judge and to develop the complex system "vehicle".

Content
The module provides an overview of:

1. History and future of the automobile

2. Driving mechanics: driving resistances and driving performances, mechanics of the longitudinal and transverse forces, passive safety

3. Engines: combustion engine, alternative drives (e.g. electric motor, fuel cell)

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

Workload
1. regular attendance lecture: 15 * 2 * 2 h = 60 h

2. pre and post processing lecture: 15 * 2 * 3 h = 90 h

3. examination preparation and presence in examination: 90 h

In total: 240 h = 8 LP

Literature
1. Mitschke, M./ Wallentowitz, H.: Dynamik der Kraftfahrzeuge, Springer-Verlag, Berlin, 2004

2. Braes, H.-H.; Seiffert, U.: Handbuch Kraftfahrzeugtechnik, Vieweg&Sohn Verlag, 2005

3. Gnadler, R.: Script to the lecture 'Automotive Engineering I'

M 10.14 Module: Automotive Engineering II [M-MACH-100502]

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

Organisation: KIT Department of Mechanical Engineering

Part of: Master's Transfer Account

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

Mandatory			
T-MACH-102117	Automotive Engineering II	4 CR	Gauterin, Gießler

Competence Certificate
Written exam; duration approximately 1,5 h

Prerequisites
none

Competence Goal
The students have an overview of the modules, which are necessary for the road holding of a motor vehicle and the power transmission between vehicle bodywork and roadway. They have knowledge of different wheel suspensions, the tyres, the steering elements and the brakes. They know different execution forms, the function and the influence on the driving or brake behavior. They can apply their knowledge effectively in actual practise.They are able to develop the appropriate components correctly. They are ready to analyze, to judge and to optimize the complex relationship of the different components under consideration of boundary conditions.

Content
The module provides an overview of:

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

Workload
1. regular attendance lecture: 15 * 2 h = 30 h

2. pre and postprocessing lecture: 15 * 3 h = 45 h

3. examination preparation and presence in examnation: 45 h

In total: 120 h = 4 LP

Literature
1. Heißing, B./Ersoy, M.: Fahrwerkhandbuch: Grundlagen, Fahrdynamik, Komponenten, Systeme, Mechatronik, Perspektiven, Vieweg-Verlag, Wiesbaden, 2011

2. Breuer, B./Bill, K.-H.: Bremsenhandbuch: Grundlagen - Komponenten - Systeme - Fahrdynamik, Vieweg-Verlag, Wiesbaden, 2012

3. Gnadler, R.: Script to the lecture 'Automotive Engineering II'

10.15 Module: Automotive Vision [M-MACH-102693]

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

Organisation: KIT Department of Mechanical Engineering

Part of: Master's Transfer Account

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

Mandatory			
T-MACH-105218	Automotive Vision	6 CR	Lauer, Stiller

Competence Certificate
Type of Examination: written exam

Duration of Examination: 60 minutes

Prerequisites
none

Competence Goal
After having participated in th lecture the participants have gained knowledge on modern techniques of signal processing and artificial intelligence which can be used to evaluate video sequences, to relate the image content to a spatial context and to interpret the content semantically. This comprises, binocular reconstruction, recognition of movements in video sequences, state space modeling and Bayesian filters, and the recognition of road surfaces and object behavior. The participants have learned to analyze the algorithms mathematically, to implement them in software, and to apply them to tasks in autonomous driving and mobile robots. The participants are able to analyze problems in the areas mentioned before and to develop appropriate solutions.

Content
Machine perception and interpretation of the environment forms the basis for the generation of intelligent behavior. Especially visual perception opens the door to novel automotive applications. Driver assistance systems already improve safety, comfort and efficiency in vehicles. Yet, several decades of research will be required to achieve an automated behavior 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 and advanced information processing techniques are presented to provide a broad overview on seeing vehicles. Application examples from cutting-edge and future driver assistance systems illustrate the discussed subjects. The lecture consists out of 2 hours/week of lecture and 1 hour/week of computer exercises. In the computer exercises methods introduced in the lecture will be implemented in MATLAB and tested experimentally.

Workload
180 hours

composed out of

hours of lecture: 15*3 h = 45 h

preparation time prior to and after lecture: 15*5 h = 75 h

exam preparation and exam: 60 h

Learning type
Lecture

Literature
TBA

M 10.16 Module: Bachelor's Thesis [M-MACH-104262]

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

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

Mandatory			
T-MACH-108800	Bachelor's Thesis	12 CR	Matthiesen
T-MACH-107760	Presentation	3 CR	Matthiesen

Competence Certificate
The module Bachelor Thesis consists of a written bachelor thesis and an oral presentation of a scientific subject chosen by the student himself/herself or given by the supervisor. The bachelor thesis is designed to show that the student is able to deal with a problem of his/her subject area in an independent manner and within the given period of time using scientific methods.

The scope of the module Bachelor Thesis corresponds to 15 ECTS (written thesis 12 LP, oral presentation 3 ECTS). The maximal processing time of the bachelor thesis takes 6 months. The examination board defines the languages the thesis has to be written in. The date of issue of the subject has to be fixed by the supervisor and the student and to be put on record at the examination board. The subject of the bachelor thesis may be only returned once and only within the first month of processing time

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

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

Prerequisites
The requirement for admission to the bachelor’s thesis module are 120 ECTS. As to exceptions, the examination board decides on a request of the student.

Modeled Conditions
The following conditions have to be fulfilled:

1. You need to have earned at least 120 credits in the following fields:
    - Internship
    - Engineering Fundamentals
    - Interdisciplinary Qualifications
    - Specialization in Mechatronics
    - Specialization in Mechatronics
    - Specialization in Mechatronics

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

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

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

Workload
450 hours

Learning type
Bachelor Thesis and presentation

M 10.17 Module: Basic Electronic Circuits Laboratory [M-ETIT-102113]

Responsible: Dr.-Ing. Armin Teltschik
Organisation: KIT Department of Electrical Engineering and Information Technology
Part of: Specialization in Mechatronics (Supplementary Modules)

Credits	Grading scale	Recurrence	Duration	Language	Level	Version
6	pass/fail	Each summer term	1 term	German	3	4

Mandatory			
T-ETIT-101943	Basic Electronic Circuits Laboratory	6 CR	Teltschik

Competence Certificate
The success control takes place in the form of an oral final colloquium of approximately 20 minutes duration and during the internship by checking the completed test tasks. To participate in the final colloque, at least 8 of the 9 attempts must be successfully completed. The successfully carried out experiments together with the final colloquium form an examination unit. If you fail, the internship must be repeated completely. The event is not graded.

Prerequisites
Knowledge of the contents of the following modules ist necessary: „M-ETIT-102102 – Digitaltechnik“ and „M-ETIT-104465 – Elektronische Schaltungen“.

Competence Goal
The students learn how to use typical electrical engineering laboratory equipment (e.g. multimeter, function generator, oscilloscope). Measuring devices are used in practical tests. The students deepen the already learned basics of electronic circuit technology and digital technology in practice. You will learn how to use the associated measurement, analysis and simulation tools and will be familiarized with the interpretation of data sheets.

Content
Tests are carried out in the following areas:

- oscilloscope measurement technology,
- Operational amplifiers: basic circuits, arithmetic circuits, Fourier / analysis & synthesis
- Measurement technology with LabVIEW
- Circuit simulation with SPICE
- Small signal behavior of bipolar transistors
- AC voltage, small transformers, rectifiers, linear regulators
- digital technology, machine design, Detection of runtime errors
- DC chopper

Module grade calculation
The event is not graded.

Annotation
To participate in the final colloque, at least 8 of the 9 attempts must be successfully completed. The successfully carried out experiments together with the final colloquium form an examination unit. If you fail, the internship must be repeated completely.

Workload
Workload (for a lecture)

Attendance time in the internship: 36 h
Preparation / follow-up of the same: 63/36 h
Exam preparation and attendance yourself: 20 h

M 10.18 Module: Battery Modeling in MATLAB [M-ETIT-103271]

Responsible: Dr.-Ing. Andre Weber
Organisation: KIT Department of Electrical Engineering and Information Technology
Part of: Specialization in Mechatronics (Supplementary Modules)

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

Mandatory			
T-ETIT-106507	Battery Modeling in MATLAB	3 CR	Weber

Prerequisites
none

M 10.19 Module: Biologically Inspired Robots (24619) [M-INFO-100814]

Responsible: Prof. Dr.-Ing. Rüdiger Dillmann
Organisation: KIT Department of Informatics
Part of: Master's Transfer Account

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

Mandatory			
T-INFO-101351	Biologically Inspired Robots	3 CR	Rönnau

M 10.20 Module: Biomedical Measurement Techniques I [M-ETIT-100387]

Responsible: Prof. Dr. Werner Nahm
Organisation: KIT Department of Electrical Engineering and Information Technology
Part of: Master's Transfer Account

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

Mandatory			
T-ETIT-106492	Biomedical Measurement Techniques I	3 CR	Nahm

Competence Certificate
The assessment takes place in the form of a written examination lasting 60 min. The module grade is the grade of the written exam.

Bonus points can also be awarded. Information on this can be found under "Module grade calculation".

Prerequisites
none

Module grade calculation
The module grade is the grade of the written exam.
Bonus points can also be awarded. The achievement of bonus points works as follows:

- Bonus tasks are solved voluntarily.
- In ILIAS the students wear groups of max. 3 participants for a bonus task.
- The solution to the bonus task must be set in ILIAS at the specified time.
- The solutions are read by the lecture assistants and corrected and approved if necessary.
- The groups present their solutions in the lecture (20 min).
- Lecturers award the bonus points individually for each student based on the written solution and the presentation.
- Each participant can acquire a maximum of 6 bonus points.
- Bonus points can only be earned once.

The bonus points are credited as follows:

- Success control is carried out in a written test (written exam) of 60 min (max. 60 points).
- The exam consists of 6 tasks with 5 points each and 5 tasks with 6 points = 11 tasks.
- For the passed bonus task, a maximum of 6 points can be credited to the exam result.
- The grade can thus be improved by a maximum one step.

The total number of points remains limited to 60 points. The bonus points are only taken into account if the exam is passed. Bonus points do not expire and are retained for any examination achievements taken at a later date.

M 10.21 Module: BioMEMS - Microsystems Technologies for Life Sciences and Medicine I [M-MACH-100489]

Responsible: Prof. Dr. Andreas Guber
Organisation: KIT Department of Mechanical Engineering

Part of: Master's Transfer Account

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

Mandatory			
T-MACH-100966	BioMEMS - Microsystems Technologies for Life-Sciences and Medicine I	4 CR	Guber

Competence Certificate
Written exam (75 min)

Prerequisites
none

Competence Goal
The lecture will first address relevant microtechnical manufacturing methods. Then,
selected biomedical applications will be presented, as the increasing use of
microstructures and microsystems in Life-Sciences und in medicine leads to improved medico-technical
products, instruments, and operation and analysis systems.

Content
Introduction into various microtechnical manufacturing methods: LIGA, Micro milling, Silicon Micromachining, Laser Microstructuring, µEDM, Metal-Etching
Biomaterials, Sterilisation.
Examples of use in the life science sector: basic micro fluidic strucutures: micro channels, micro filters, micromixers, micropumps, microvalves, Micro and nanotiter plates, Microanalysis systems (µTAS),
Lab-on-chip applications.

Workload
Literature: 20 h

Lessions: 21 h

Preparation and Review: 50 h

Exam preparation: 30 h

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

10.22 Module: BioMEMS - Microsystems Technologies for Life Sciences and Medicine II [M-MACH-100490]

Responsible: Prof. Dr. Andreas Guber
Organisation: KIT Department of Mechanical Engineering

Part of: Master's Transfer Account

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

Mandatory			
T-MACH-100967	BioMEMS - Microsystems Technologies for Life-Sciences and Medicine II	4 CR	Guber

Competence Certificate
Written exam (75 min)

Prerequisites
None

Competence Goal
The lecture will first shortly address some relevant microtechnical manufacturing methods. Then, selected biomedical applications will be presented, as the increasing use of microstructures and microsystems in Life-Sciences und in medicine leads to improved medico-technical products, instruments, and operation and analysis systems.

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

Workload
Literature: 20 h

Lessions: 21 h

Preparation and Review: 50 h

Exam preparation: 30 h

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

M 10.23 Module: BioMEMS - Microsystems Technologies for Life Sciences and Medicine III [M-MACH-100491]

Responsible: Prof. Dr. Andreas Guber
Organisation: KIT Department of Mechanical Engineering

Part of: Master's Transfer Account

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

Mandatory			
T-MACH-100968	BioMEMS - Microsystems Technologies for Life-Sciences and Medicine III	4 CR	Guber

Competence Certificate
Written exam (75 min)

Prerequisites
none

Competence Goal
The lecture will first shortly address some relevant microtechnical manufacturing methods. Then, selected biomedical applications will be presented, as the increasing use of microstructures and microsystems in Life-Sciences und in medicine leads to improved medico-technical products, instruments, and operation and analysis systems.

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

Workload
Literature: 20 h

Lessions: 21 h

Preparation and Review: 50 h

Exam preparation: 30 h

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

M 10.24 Module: Channel Coding: Algebraic Methods for Communications and Storage [M-ETIT-105616]

Responsible: Prof. Dr.-Ing. Laurent Schmalen
Organisation: KIT Department of Electrical Engineering and Information Technology
Part of: Master's Transfer Account (Usage from 4/1/2021)

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

Mandatory			
T-ETIT-111244	Channel Coding: Algebraic Methods for Communications and Storage	3 CR	Schmalen

Competence Certificate
The exam is held as an oral exam of approx. 20 min.

Competence Goal
The students are able to analyse and assess problems of algebraic channel coding. They can apply methods of algebraic coding theory in the context of communication systems for data transmission and data storage and are able to assess their implementation.Additionally, they will get knowledge to current research topics and research results.

Content
This course focuses on the formal and mathematical basics for the design of coding schemes in digital communication systems. These include schemes for data transmission, data storage and networking. The course starts by introducing he necessary fundamentals of algebra which are then used to derive codes for different applications. Besides codes that are important for data transmission appliations, e.g., BCH and Reed-Solomon-Codes, we also investigate codes for the efficient storage and reconstruction of data in distributed systems (locally repairable codes) and codes that increase the throughput in computer networks (network codes). Real applications are always given to discuss practical aspects and implementations of these coding schemes. Many of these applications are illustrated by example code in software (python/MATLAB).

Module grade calculation
Grade of the module corresponds to the grade of the oral exam.

Workload

1. *Attendance to the lecture: 15 * 2 h = 30 h*
2. *Preparation and review: 15 * 4 h = 60 h*
3. *Preparation for the exam: included in preparation and review*
4. *In total: 90 h = 3 LP*

Recommendation
Knowledge of basic engineering as well as basic knowledge of communications engineering.

Previous attendance of the lectures "Communication Engineering I" and "Probability Theory" is recommended.

M 10.25 Module: Communications Engineering I [M-ETIT-102103]

Responsible: Prof. Dr.-Ing. Laurent Schmalen
Organisation: KIT Department of Electrical Engineering and Information Technology
Part of: Specialization in Mechatronics (Compulsary Elective Modules: Electrical Engineering and Information Technology, Mechanical Engineering, Informatics, Economics and Management)
Specialization in Mechatronics (Supplementary Modules)

Credits	Grading scale	Recurrence	Duration	Language	Level	Version
6	Grade to a tenth	Each winter term	1 term	German	3	2

Mandatory			
T-ETIT-101936	Communications Engineering I	6 CR	Schmalen

Competence Certificate
Type of examination: written exam. Duration of Examination: approx. 180 minutes.

Prerequisites
none

M 10.26 Module: Communications Engineering II [M-ETIT-100440]

Responsible: Dr.-Ing. Holger Jäkel
Organisation: KIT Department of Electrical Engineering and Information Technology
Part of: Specialization in Mechatronics (Supplementary Modules)

Credits	Grading scale	Recurrence	Duration	Language	Level	Version
4	Grade to a tenth	Each winter term	1 term	German	3	2

Mandatory			
T-ETIT-100745	Communications Engineering II	4 CR	Jäkel

Prerequisites
None

M 10.27 Module: Complex Analysis and Integral Transformations [M-ETIT-104534]

Responsible: Prof. Dr.-Ing. Sören Hohmann
Dr.-Ing. Mathias Kluwe

Organisation: KIT Department of Electrical Engineering and Information Technology

Part of: Specialization in Mechatronics (Supplementary Modules)

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

Mandatory			
T-ETIT-109285	Complex Analysis and Integral Transformations	4 CR	Kluwe

10.28 Module: Computational Intelligence [M-MACH-105296]

Responsible: apl. Prof. Dr. Ralf Mikut
apl. Prof. Dr. Markus Reischl

Organisation: KIT Department of Mechanical Engineering

Part of: Master's Transfer Account (Usage from 4/2/2020)

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

Mandatory			
T-MACH-105314	Computational Intelligence	4 CR	Meisenbacher, Mikut, Reischl

Competence Certificate
A performance assessment is obligatory and can be oral, a written exam, or of another kind.

Prerequisites
None

Competence Goal
The students are able to apply the fundamental methods of computational intelligence (fuzzy logic, artificial neural networks, evolutionary algorithms) efficiently. They know the basic mathematical foundations and are able to transfer these methods to practical applications.

Content

- Terms and definitions Computational Intelligence, application fields and examples
- Fuzzy logic: fuzzy sets; fuzzification and membership functions; inference: T-norms and -conorms, operators, aggregation, activation, accumulation; defuzzification methods, structures for fuzzy control
- Artificial Neural Nets: biology of neurons, Multi-Layer-Perceptrons, Radial-Basis-Function nets, Kohonen maps, training strategies (Backpropagation, Levenberg-Marquardt)
- Evolutionary Algorithms: Basic algorithm, Genetic Algorithms and Evolution Strategies, Evolutionary Algorithm GLEAM, integration of local search strategies, memetic algorithms, application examples
- Deep Learning: History, Architectures, Training strategies, Interpretability and Explainable AI, Use Cases

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

Learning type
Lecture

M 10.29 Module: Computer Organization [M-INFO-103179]

Responsible: Prof. Dr. Wolfgang Karl
Organisation: KIT Department of Informatics
Part of: Specialization in Mechatronics (Compulsary Elective Modules: Electrical Engineering and Information Technology, Mechanical Engineering, Informatics, Economics and Management)
Specialization in Mechatronics (Supplementary Modules)

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

Mandatory			
T-INFO-103531	Computer Organization	6 CR	Karl

M 10.30 Module: Control of Linear Multivariable Systems [M-ETIT-100374]

Responsible: Prof. Dr.-Ing. Sören Hohmann
Organisation: KIT Department of Electrical Engineering and Information Technology
Part of: Master's Transfer Account

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

Mandatory			
T-ETIT-100666	Control of Linear Multivariable Systems	6 CR	Kluwe

Competence Certificate
Success is checked as part of a written overall test (120 minutes) of the course.

Prerequisites
none

Competence Goal
- The students first acquired basic knowledge of the various forms of description of linear multivariable systems in the frequency and time domain with both time-continuous and time-discrete models.

- In particular, they are able to transform multi-size systems in the state space to different normal forms depending on the requirements.

- The students have an understanding of fundamental properties such as Stability, trajectory profiles, controllability and observability as well as pole / zero configuration are achieved and the systems can analyze them accordingly.

- You master the basic principles for controlling linear multi-variable systems both in the frequency domain (series decoupling) and in the time domain (pole specification with pre-filter)

- In concrete terms, the students are familiar with the design procedures modal control, decoupling control in the time domain and the complete modal synthesis.

- You are familiar with the problem of state quantity determination by state observers and the design of complete and reduced observers.

- Students are able to use advanced concepts such as output feedback and dynamic controllers if necessary.

- You can continue to counter the problems of high model orders in the state space by reducing the order based on the dominance analysis.

Content
The aim is to impart basic and advanced methods for the treatment of linear multi-size systems, the focus being on the state space. In this way, the students are introduced to a model that allows more modern and, in particular, non-linear processes. On the one hand, the module provides a comprehensive overview of the most important aspects in the variable description of the systems and the analysis of their characteristic properties. On the other hand, all facets of the synthesis of regulations for initial and permanent disorders and the observers often required for this are conveyed.

Module grade calculation
The module grade is the grade of the written exam.

Workload
The workload includes:

Attendance time in lecture / exercise (3 + 1 SWS: 60h = 2 CP)

Preparation / follow-up lecture / exercise (90h = 3 CP)

Preparation / attendance time written exam (30h = 1 CP)

Recommendation
For a deeper understanding, basic knowledge of system dynamics and control technology is absolutely necessary, as taught in the ETIT Bachelor module "System Dynamics and Control Technology" M-ETIT-102181.

M 10.31 Module: Control Theory Laboratory [M-ETIT-105467]

Responsible: Prof. Dr.-Ing. Sören Hohmann
Organisation: KIT Department of Electrical Engineering and Information Technology
Part of: Master's Transfer Account (Usage from 10/1/2020)

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

Mandatory			
T-ETIT-111009	Control Theory Laboratory	6 CR	Hohmann

Prerequisites
None

M 10.32 Module: Decentrally Controlled Intralogistic Systems [M-MACH-102687]

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

Part of: Master's Transfer Account

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

Mandatory			
T-MACH-105230	Decentrally Controlled Intralogistic Systems	4 CR	Furmans, Hochstein

Competence Certificate
The success control takes place as a study achievement in the form of the presentation of the work results (Lego robot and code) as well as a presentation of five to ten minutes and following discussion.

Prerequisites
None

Competence Goal
Students are able to:

- Name and explain the basics of intralogistic conveyor systems
- Describe and explain communication types between decentralized systems
- Apply the basics of project management in subsequent projects
- Developing constructive solutions for mechanical problems
- Applying the theory learned to a practical problem
- Evaluate solutions developed through group discussions and presentations
- Use the ROS (Robot Operating System) software framework
- Evaluate the solutions developed using logistical key figures

Content
Hard skills

- Introduction to the basics of technical logistics
- Development of a heterogeneous, integrated, mechatronic, decentralised intralogistics system
- Evaluation of the technical realisation based on logistical key figures
- Practical application of the content using various industry-related hardware components
- Use of various sensor systems
- Prototyping of a mobile robot with LEGO Mindstorms
- Planning and implementation of a control system using the ROS software framework and the object-orientated programming language Python

Soft skills

- Presentation of the work results
  Hardware and software development in teamwork (including tools such as git, Scrum, ...)

Annotation
number of participants limited

participants will be selected

Workload
Attendance time: 90 hours (laboratory practical)

Self-study: 30 hours

Recommendation
Basic knowledge of Python programming and basic knowledge of technical logistics of advantage

Learning type
Seminar

M 10.33 Module: Deep Learning and Neural Networks [M-INFO-104460]

Responsible: Prof. Dr. Jan Niehues
Organisation: KIT Department of Informatics
Part of: Master's Transfer Account

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

Mandatory			
T-INFO-109124	Deep Learning and Neural Networks	6 CR	Niehues

10.34 Module: Digital Technology [M-ETIT-102102]

Responsible: Prof. Dr.-Ing. Jürgen Becker
Organisation: KIT Department of Electrical Engineering and Information Technology
Part of: Engineering Fundamentals

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

Mandatory			
T-ETIT-101918	Digital Technology	6 CR	Becker

Competence Certificate
The examination takes place in form of a written examination lasting 120 minutes.

Prerequisites
none

Competence Goal
Students will be able to name the basic methods of digital technology and digital information processing with a focus on digital circuits. They are able to apply and analyze coding to digital information. In addition, students know the mathematical basics and can apply graphical and algebraic methods for the design, analysis and optimization of digital circuits and automata.

Content
This lecture is an introduction to important theoretical principles of digital technology, which is intended for students of the 1st semester of electrical engineering. Since it therefore cannot build on knowledge of circuit technology, the focus is on abstract modeling of behavior and structures. In addition, the lecture is also intended to teach the basics that are required in other lectures

The lecture focuses on the formal, methodological and mathematical foundations for designing digital systems. Building on this, the technical realization of digital systems will be discussed, in particular the design and use of standard modules.

Module grade calculation
The module grade is the grade of the written examination.

Workload
1. attendance time in 23 lectures and 7 exercises: 45 h
2. preparation/follow-up: 90 h. (~2 h per unit)
3. preparation of and attendance in examination: 30 + 2 h

Total: 167 h = 6 LP

M 10.35 Module: Distributed Discrete Event Systems [M-ETIT-100361]

Responsible: Prof. Dr.-Ing. Michael Heizmann
Organisation: KIT Department of Electrical Engineering and Information Technology
Part of: Master's Transfer Account

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

Mandatory			
T-ETIT-100960	Distributed Discrete Event Systems	4 CR	Heizmann

Prerequisites
none

M 10.36 Module: Dynamics of the Automotive Drive Train [M-MACH-102700]

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

Part of: Master's Transfer Account

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

Mandatory			
T-MACH-105226	Dynamics of the Automotive Drive Train	5 CR	Fidlin

Competence Certificate
A performance assessment is an oral exam (approx. 30 minutes).

Prerequisites
none

Competence Goal
After having attended this lecture students will be able to understand typical vibration phenomena in a vehicle powertrain and to simulate the essential components of the vehicle powertrain including components of the engine steering. The method of the simulation-based concept choice and the necessary interaction between OEMs and the delivering industry is part of the taught knowledge. The students will also gain experience in the application of numerical simulation methods for solving practical problems of torsion vibrations in highly non-linear systems.

Content
Lectures: The concept of a simulation- based optimization of the vehicle powertrain and its components. Modelling of the components of the power system including internal-combustion engine, torsional vibration damper (two mass flywheel, centrifugal force pendulum, internal damper/torsion damped clutch disc), hydrodynamical transformer, gear, Kardan wave, differential, wheels, driving manoeuvre and its appraisal incl. start, neutral gear, approach, acceleration drive, load alteration, gear alteration, shearing force, stop, and different special manoeuvres like change of intentions or misuse.

Exercise: Elementary numerical proceedings to simulate nonlinear dynamic systems. Modelling of the powertrain in a simulation environment SimulationX or MapleSim.

Workload
Each credit point is equivalent to 25-30 hours of workload (per student). This refers to an average student who shows an average performance. The workload is as follows:

time of attendance lectures: 30 h

time of attendance exercise: 30h

self-study including exam preparation: 90 h

total 150 h - 5 credit points

Recommendation
Basic knowledge of the powertrain technology and elementary vibration knowledge are advantageous. The lectures refer to the book

H. Dresig, A. Fidlin: Schwingungen Mechanischer Antriebssysteme, 4. Auflage, Springer: Berlin - Heidelberg - New York, 2020, 655 S., ISBN: 978-3-662-59137-6

Especially chapter 6 and 7 are recommended.

Literature

- Dresig H. Schwingungen mechanischer Antriebssysteme, 2. Auflage, Springer, 2006
- Pfeiffer F., Mechanical System Dynamics, Springer, 2008
- Laschet A., Simulation von Antriebssystemen:Modellbildung der Schwingungssysteme und Beispiele aus der Antriebstechnik, Springer, 1988

M 10.37 Module: Electric Energy Systems [M-ETIT-102156]

Responsible: Prof. Dr.-Ing. Thomas Leibfried
Organisation: KIT Department of Electrical Engineering and Information Technology
Part of: Specialization in Mechatronics (Compulsary Elective Modules: Electrical Engineering and Information Technology, Mechanical Engineering, Informatics, Economics and Management)
Specialization in Mechatronics (Supplementary Modules)

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

Mandatory			
T-ETIT-101923	Electric Energy Systems	5 CR	Leibfried

Competence Certificate
Success is assessed by means of an overall written examination lasting 120 minutes on the selected course.

Prerequisites
none

Competence Goal
Students are able to calculate electrical circuits (passive or with controlled sources) in the time and frequency range. They are also familiar with the most important network equipment, its physical mode of operation and its electrical equivalent circuit.

Content
The first part of the lecture deals with the calculation of balancing processes in linear electrical networks using differential equations and the Laplace transformation. The second part of the lecture deals with electrical network resources.

Module grade calculation
The module grade is the grade of the written examination.

Annotation
The associated course "Elektroenergiesysteme" will be offered for the last time in summer semester 2024. From summer semester 2025, the content will be taught in the course "Elektrische Energietechnik".

Workload
Attendance time lecture: 30 h

Exercise attendance time: 15 h

Self-study time: 90 h

Exam preparation and attendance in the same: integrated in self-study time

Total 135 h = 5 LP

M 10.38 Module: Electric Energy Systems/Hybrid and Electric Vehicles [M-ETIT-105643]

Responsible: Prof. Dr. Martin Doppelbauer
Prof. Dr.-Ing. Thomas Leibfried

Organisation: KIT Department of Electrical Engineering and Information Technology

Part of: Specialization in Mechatronics (Compulsary Elective Modules: Electrical Engineering and Information Technology)

Credits	Grading scale	Recurrence	Duration	Language	Level	Version
9	Grade to a tenth	Each term	2 terms	German	3	1

Mandatory			
T-ETIT-100784	Hybrid and Electric Vehicles	4 CR	Doppelbauer
T-ETIT-101923	Electric Energy Systems	5 CR	Leibfried

Competence Certificate

1. Electric Energy Systems:
   Type of examination: written exam. Duration of examination: approx. 120 minutes
2. Hybrid and Electric Vehicles:
   Type of examination: written exam. Duration of examination: approx. 120 minutes

Prerequisites
none

Competence Goal

1. Electric Energy Systems:
   Students are able to calculate electrical circuits (passive or with controlled sources) in the time and frequency range. They are also familiar with the most important network equipment, its physical mode of operation and its electrical equivalent circuit.
2. Hybrid and Electric Vehicles:
   Students understand the technical function of all drive components of hybrid and electric vehicles and their interaction in the drivetrain. They have detailed knowledge of the drive components, in particular batteries and fuel cells, power electronic circuits and electrical machines including the associated transmissions. They are also familiar with the most important drive topologies and their specific advantages and disadvantages. Students will be able to assess and evaluate the technical, economic and ecological effects of alternative drive technologies for motor vehicles.

Content

1. Electrical Energy Systems:
   The first part of the lecture deals with the calculation of balancing processes in linear electrical networks using differential equations and the Laplace transformation. The second part of the lecture deals with electrical network resources.
2. Hybrids and Electric Vehicles:
   Based on the mobility needs of modern industrial society and the political framework conditions for climate protection, the different drive and charging concepts of battery-electric and hybrid-electric vehicles are presented and evaluated. The lecture gives an overview of the components of the electric drive train, in particular battery, charging circuit, DC/DC converter, inverter, electric machine and transmission. Outline:
   - Hybrid vehicle drives
   - Electric vehicle drives
   - Driving resistances and energy consumption
   - Operating strategy
   - Energy storage
   - Fundamentals of electrical machines
   - Asynchronous machines
   - Synchronous machines
   - Special machines
   - Power electronics
   - Charging
   - Environment
   - Vehicle examples

   Requirements and specifications

Module grade calculation

1. Electric Energy Systems:
   The module grade is the grade of the written examination.
2. Hybrid and Electric Vehicles:
   The module grade is the grade of the written examination.

Workload

1. Electric Energy Systems:
   Lecture attendance time: 30 h
   Exercise attendance time: 15 h
   Independent study time: 90 h
   Exam preparation and attendance in the same: offset in preparation/follow-up
   Total 135 h = 5 CP
2. Hybrid and Electric Vehicles:
   14x lectures and 7x exercises à 1.5 h: = 31.5 h
   14x follow-up lectures à 1 h = 14 h
   6x preparation for exercises à 2 h = 12 h
   Exam preparation: = 50 h
   Exam time = 2 h
   Total = 109.5 h = 4 CP

Recommendation

1. Electric Energy Systems: -
2. Hybrid and Electric Vehicles:
   To understand the module, basic knowledge of electrical engineering is recommended (acquired, for example, by attending the modules "Electrical Machines and Power Electronics", "Electrical Engineering for Industrial Engineers I+II" or "Electrical Engineering and Electronics for Mechanical Engineers").

10.39 Module: Electrical Machines and Power Electronics [M-ETIT-102124]

Responsible: Prof. Dr.-Ing. Marc Hiller
Organisation: KIT Department of Electrical Engineering and Information Technology
Part of: Engineering Fundamentals

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

Mandatory			
T-ETIT-101954	Electrical Machines and Power Electronics	6 CR	Hiller

Competence Certificate
Success is assessed in the form of a written examination lasting 120 minutes.

Prerequisites
none

Competence Goal
Students will be familiar with the main electrical machines and power electronics.

They are able to describe their behavior using characteristic curves and simple models.

They will be able to analyze the network feedback and the effect of power converters on the electrical machine using Fourier series descriptions.

You will be able to recognize the components of power transmission and drive systems and calculate their behavior by coupling the models of power converters and machines.

Content
Basic lecture on drive technology and power electronics. First, the mode of action and operating behavior of the most important electrical machines are explained.

The function and behavior of the most important power converter circuits are then described.

The mode of operation and areas of application of electrical machines and power electronic circuits are explained in more detail using examples.

Module grade calculation
The module grade is the grade of the written examination.

Annotation
valid until 30.09.2025 - Replacement: M-ETIT-106367 - Electric Drives, Power Electronics and Electrical Grids

Workload
14x lecture and 14x exercise 1.5 h each = 35 h

14x follow-up lecture à 1 h = 14 h

13x preparation for exercise à 2 h = 26 h

Exam preparation: = 80 h

Examination time = 2 h

Total approx. 157 h

(corresponds to 6 credit points)

10.40 Module: Electromagnetic Fields [M-ETIT-104428]

Responsible: Prof. Dr. Martin Doppelbauer
Organisation: KIT Department of Electrical Engineering and Information Technology
Part of: Engineering Fundamentals

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

Mandatory			
T-ETIT-109078	Electromagnetic Fields	6 CR	Doppelbauer

Competence Certificate
Success is assessed in the form of a written examination lasting 120 minutes.

Prerequisites
none

Competence Goal
The aim is to teach the theoretical fundamentals of electric, magnetic and electromagnetic fields based on Maxwell's equations. Students will be able to calculate electromagnetic fields of simple arrangements of charges and current-carrying conductors analytically using Maxwell's equations, sketch field diagrams and derive the forces and powers that occur. They can take into account the influence of dielectrics and ferromagnetic materials.

Content
This lecture is an introduction to electromagnetic field theory based on Maxwell's equations. It deals with electrostatic fields, electric current fields, magnetic fields and slowly changing fields:

- Mathematical foundations of field theory
- Fundamentals of electromagnetic fields
- Electrostatic fields
- Electric flow fields
- Magnetic fields
- Quasi-stationary (slowly changing in time) fields

The lecture is accompanied by exercises on the lecture material. These are discussed in a large classroom exercise and the corresponding solutions are presented in detail.

In addition, tutorials are offered in small groups.

The course materials (lecture notes and formulary) can be found online on the Institute's website. The required password will be announced in the first lecture.

Module grade calculation
The module grade is the grade of the written examination.

Annotation
The associated course "Elektromagnetische Felder" will be offered for the last time in SoSe2024. From winter semester 24/25, the content will be taught in the course "Elektromagnetische Felder und Wellen".

Attention:
The partial performance assigned to this module is part of the orientation examination for the following degree programs:

- Bachelor of Electrical Engineering and Information Technology (SPO 2018, §8)

The examination must be taken at the end of the 2nd semester. A repeat examination must be taken by the end of the 3rd semester.

Workload
6 credit points (ECTS) are awarded for the entire module, which are divided as follows:

- Attendance time in lectures (2 h per 15 dates) = 30 h
- Attendance time in exercises (1 h per 15 dates) = 15 h
- Attendance time in tutorials = 15 weeks per 2 h = 30 h
- Preparation/follow-up of the material: 15 weeks 3 h each = 45 h
- Exam preparation and presence in the exam: 1.5 weeks 40 h each = 60 h

Total workload approx. 180 hours = 6 ECTS.

Recommendation
General physical and mathematical basics from the basic courses of the first semester are strongly recommended.

M 10.41 Module: Electromagnetic Waves [M-ETIT-104515]

Responsible: Prof. Dr.-Ing. Sebastian Randel
Organisation: KIT Department of Electrical Engineering and Information Technology
Part of: Specialization in Mechatronics (Compulsary Elective Modules: Electrical Engineering and Information Technology, Mechanical Engineering, Informatics, Economics and Management)
Specialization in Mechatronics (Supplementary Modules)

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

Mandatory			
T-ETIT-109245	Electromagnetic Waves	6 CR	Randel

M 10.42 Module: Electromagnetic Waves/Fundamentals on High Frequency Techniques [M-ETIT-105647]

Responsible: Prof. Dr.-Ing. Sebastian Randel
Prof. Dr.-Ing. Thomas Zwick

Organisation: KIT Department of Electrical Engineering and Information Technology

Part of: Specialization in Mechatronics (Compulsary Elective Modules: Electrical Engineering and Information Technology)

Credits	Grading scale	Recurrence	Duration	Language	Level	Version
12	Grade to a tenth	Each term	2 terms	German	3	1

Mandatory			
T-ETIT-109245	Electromagnetic Waves	6 CR	Randel
T-ETIT-101955	Fundamentals on High Frequency Techniques	6 CR	Zwick

Competence Certificate

1. Electromagnetical Waves:
   Type of examination: written exam. Duration of examination: approx. 120 minutes
2. Fundamentals on High Frequency Techniques:
   Type of examination: handwritten reports and written exam. Duration of examination: approx. 120 minutes

Prerequisites
none

M 10.43 Module: Electronic Devices and Circuits [M-ETIT-104465]

Responsible: Prof. Dr.-Ing. Ahmet Cagri Ulusoy
Organisation: KIT Department of Electrical Engineering and Information Technology
Part of: Engineering Fundamentals

Credits	Grading scale	Recurrence	Duration	Language	Level	Version
7	Grade to a tenth	Each summer term	1 term	German	1	2

Mandatory			
T-ETIT-109318	Electronic Devices and Circuits	6 CR	Ulusoy
T-ETIT-109138	Electronic Devices and Circuits - Workshop	1 CR	Zwick

Competence Certificate
The assessment of the module consists of

1. a written examination of 120 minutes on the course Electronic Devices and Circuits (6 CP).
2. a written paper on the course Electronic Devices and Circuits - Workshop (1 CP). The written paper is corrected and awarded points. If the required number of points is achieved, the workshop is deemed to have been passed.

Prerequisites
None

Competence Goal
Students will be able to analyze and evaluate the functions and modes of operation of diodes, Z-diodes, bipolar and field-effect transistors, analog basic circuits, from single-stage amplifiers to operational amplifiers. The knowledge acquired about component parameters and the function of the components enables students to analyze and calculate various amplifier circuits. By acquiring knowledge of small signal models of the components, students can apply their theoretical knowledge to the practical design of circuits. In addition, students acquire advanced knowledge of the circuit design and applications of all basic digital elements (inverters, NAND, NOR, tri-state inverters and transmission gates) as well as circuits for use in sequential logic, such as flip-flops. This knowledge allows students to critically follow and analyze current trends in semiconductor development. In this way, students are enabled to analyze and, if necessary, independently optimize modern electrical systems from signal acquisition (sensor, detector) to signal conditioning (amplifier, filter, etc.).

In the workshop, students learn how to coordinate a project in small teams and how to present the results in the form of technical documentation. They will also be able to implement and characterize simple electronic transistor circuits.

Content
Basic lecture on passive and active electronic components and circuits for analog and digital applications.

The focus is on the design and circuit implementation of analog amplifier circuits with bipolar and field-effect transistors, the circuit design of simple logic elements for complex logic circuits. The following topics are covered in detail:

- Introduction (designations, terms)
- Passive components (R, C, L)
- Semiconductor components (diodes, transistors)
- Diodes
- Bipolar transistors
- Field-effect transistors (JFET, MOSFET, CMOS), properties and applications
- Amplifier circuits with transistors
- Properties of operational amplifiers
- Toggle circuits
- Sequential logic

The lecture is accompanied by exercises on the lecture material. These are discussed in a large classroom exercise and the corresponding solutions are presented in detail. Parallel to this, further exercises and lecture content will be set and solved in the form of dedicated tutorials in small groups to practice and deepen the course content.

The workshop takes up many of these focal points. Different sensors will be analyzed. In addition to the general functionality and theory of temperature, light or pressure sensors, suitable electronics are examined in order to convert the physical variables into a proportional, evaluable variable such as voltage or current. Simple sensor principles are dealt with in order to adapt the necessary prior knowledge for carrying out the experiment to the semester. Temperature-dependent resistors are used for temperature measurement or pn junctions are investigated. Applications for brightness measurement are realized with LEDs, photodiodes and phototransistors. Independent experiments are carried out as follows: Understanding sensor principle, design of evaluation circuits for the sensor signal, simulation of circuits in LTSpice, construction and comparison of circuits and evaluation with the µController board.

Module grade calculation
The module grade is made up of the grade of the written examination.

Workload
The preparation (0.5 h), attendance (1.5 h) and follow-up (2 h) of the weekly lecture, the 14-day tutorial and the six tutorial sessions as well as the preparation (82 h) and participation (2 h) in the written examination result in a total workload of approx. 180 h for the course Electronic Devices and Circuits, i.e. 6 CP.

The workload of the workshop is made up as follows:

1. Attendance time in the preparatory course incl. follow-up: 2 h
2. Working on the assignment: 23 h
3. Preparation of the written paper (protocol): 5 h

The time required for the workshop is approximately 30 hours. This corresponds to 1 CP.

Recommendation
Successful completion of the course "Linear Electrical Circuits" is recommended.

M 10.44 Module: Elements of Technical Logistics [M-MACH-102688]

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

Part of: Master's Transfer Account

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

Mandatory			
T-MACH-102159	Elements and Systems of Technical Logistics	4 CR	Fischer, Mittwollen

Competence Certificate
The assessment consists of an oral examination (approx. 20min) .

Prerequisites
none

Competence Goal
Students are able to:

- Describe elements and systems of technical logistics,
- Model and calculate structures and functions of special conveying machines,
- Describe interdependence of material flow systems and technique quantitatively and qualitatively and
- Equip material flow systems with appropriate machines.

Content
material flow systems and their (conveying) technical components

mechanical behaviour of conveyors;

structure and function of conveyor machines; elements of intralogistics (belt conveyor, racks, automatic guided vehicles, fan-in, bifurcation, and etc.)

sample applications and calculations in addition to the lectures inside practical lectures

Workload
Lecture and exercise: 4 LP = 120 h

1. Attendance time lecture: 28 h
2. Preparation/follow-up lecture: 56 h
3. Attendance time exercise: 12 h
4. Preparation/follow-up exercise: 24 h

M 10.45 Module: Elements of Technical Logistics incl. Project [M-MACH-105015]

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

Part of: Master's Transfer Account

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

Mandatory			
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

Competence Certificate
The assessment consists of an oral exam (20min) and presentation of performed project and defense (approx. 30min)

Prerequisites
none

Competence Goal
Students are able to:

- Describe elements and systems of technical logistics,
- Model and calculate structures and functions of special conveying machines,
- Describe interdependence of material flow systems and technique quantitatively and qualitatively and
- Equip material flow systems with appropriate machines.

Content
material flow systems and their (conveying) technical components

mechanical behaviour of conveyors;

structure and function of conveyor machines; elements of intralogistics (belt conveyor, racks, automatic guided vehicles, fan-in, bifurcation, and etc.)

sample applications and calculations in addition to the lectures inside practical lectures

Workload
Lecture and exercise: 6 LP = 180 h

1. Attendance time lecture: 28 h
2. Preparation/follow-up lecture: 56 h
3. Attendance time exercise: 12 h
4. Preparation/follow-up exercise: 24 h
5. Attendance time project: 4 h
6. Preparation/follow-up project: 56 h

Learning type
Lecture, tutorial, project

M 10.46 Module: Engineering Mechanics [M-MACH-102402]

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

Part of: Engineering Fundamentals

Credits	Grading scale	Recurrence	Duration	Language	Level	Version
18	Grade to a tenth	Each term	3 terms	German	2	1

Mandatory			
T-MACH-100282	Engineering Mechanics I	7 CR	Böhlke, Langhoff
T-MACH-100528	Tutorial Engineering Mechanics I *This item will not influence the grade calculation of this parent.*	0 CR	Böhlke, Langhoff
T-MACH-100283	Engineering Mechanics II	6 CR	Böhlke, Langhoff
T-MACH-100284	Tutorial Engineering Mechanics II *This item will not influence the grade calculation of this parent.*	0 CR	Böhlke, Langhoff
T-MACH-100299	Engineering Mechanics III	5 CR	Proppe
T-MACH-105202	Tutorial Engineering Mechanics III *This item will not influence the grade calculation of this parent.*	0 CR	N.N.

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

exam-prerequisites EM III (see T-MACH-105202 "Engineering Mechanics III Tutorial).They consist of solving problems of the work sheets.

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

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

Prerequisites
None

Competence Goal
After finishing the students can

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

In this lecture and tutorial students learn how to describe models of systems for a plain motion. They realize how to calculate speed and acceleration. The derivation of equations of motion for systems of particles and rigid bodies can be done. The students know the dependence of the kinetic energy on the kinetic quantities and the inertia parameters of the system and can apply the principle of work or the principle of the conservation of mechanical energy for conservative systems.

Content
Engineering Mechanics I:

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

Engineering Mechanics II:• bending• shear• torsion• stress and strain state in 3D• Hooke’s law in 3D• elasticity theors in 3D• energy methods in elastostatics• approximation methods• stability• inelastic material behaviour

Engineering Mechanics III:

Kinematics:Cartesian, cylindrical and natural coordinates. Time derivatives in moving reference frames, angular velocities of reference frames.Kinetics of a particle:Newton’s axiom, Principle of d’Alembert, work of a force, kinetic and potential energies, principle of linear momentum, principle of moment of momentum, kinetics in moving reference systemsSystems of particles:Principle of center of mass, Principle of moment of momentum, impacts between particles, systems with variable mass, applications.Plain motion of rigid bodies:Pure translation, pure rotation, general plain motion. Instantaneous center of rotation, Kinetics, moment of momentum, principle of work and principle of energy conservation for a rotation around a space-fixed axis. Mass moment of inertia, parallel-axis-theorem.Principle of linear momentum and principle of moment of momentum for arbitrary plain motion. Principle of d’Alembert for plain motion. Principles of linear and moment of momentum in integral form. Applications for impact problems.

Workload
regular attendance: 150,5 Stunden
self-study: 389,5 Stunden

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

M 10.47 Module: Engineering Mechanics [M-MACH-103205]

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

Organisation: KIT Department of Mechanical Engineering

Part of: Master's Transfer Account

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

Mechanical Engineering (Election: at least 5 credits)			
T-MACH-105209	Introduction to Multi-Body Dynamics	5 CR	Römer
T-MACH-105274	Engineering Mechanics IV	5 CR	Proppe
T-MACH-110375	Mathematical Methods in Continuum Mechanics	4 CR	Böhlke
T-MACH-110376	Tutorial Mathematical Methods in Continuum Mechanics	2 CR	Böhlke

Competence Certificate
A performance assessment in the bricks to be chosen is obligatory and can be an oral or a written exam. For details see eligible bricks

Prerequisites
none

Competence Goal
Introduction to multi-body dynamics: After completing this module, graduates will be able to describe the kinematics of a rigid body using rotational matrices, angular velocities and corresponding derivatives in various reference systems. They can specify holonomic and non-holonomic constraints for closed kinematic chains. In addition, the graduates can derive Newton-Euler's and ie Lagrangian equations and apply the principle of d'Alembert and the principle of virtual power. Finally, they can analyze the structure of the equations of motion.

Engineering Mechanics IV: The graduates can study the kinematics for movements of points and systems. Based on Newton-Euler's axioms they can derive the equations of motion. In addition to classical synthetic methods, graduates can efficiently apply analytical methods with energy expressions as a starting point.

Mathematical methods of continuum mechanics: After completing the module, graduates can perform the essential operations of tensor algebra and tensor analysis for both second and higher-level tensors, in oblique and curvilinear coordinate systems. They can then apply these operations in the description of infinitesimal and finite deformations of continuum mechanical systems. In addition, graduates can specify the transport theorem and balance equations for continuum mechanical systems and use material equations.

Content
Contents of "Introduction to Multi-Body Dynamics": 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 virtual power, Lagrange's equations, Kane's equations, structure of the equations of motion

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

Contents of "Mathematical Methods of Continuum Mechanics": Tensor algebra: vectors; Basis transformation; dyadic product; Tensors of second order and their properties, eigenvalue problems, Theorem of Cayley-Hamilton, invariants; Tensors of higher order, tensor analysis: tensor algebra and analysis in oblique coordinate systems, differentiation of tensor-valued functions. Application of tensor calculus in Continuum Mechanics: kinematics of infinitesimal and finite deformations, transport theorem, balance equations, stress tensor, constitutive equations, intial boundary value problems

Workload
Introduction to Multi-Body Dynamics: presence lecture: 15 * 2 h = 30 h, preparation and recap: 15 * 2 h = 30 h, exam preparation and presence during exam: 90 h

Eineering Mechanics IV: presence lecture and tutorial: 15 * 2 h + 15 * 2 h = 60 h, preparation and recap lecture and tutorial: 15 * 2 h + 15 * 2 h = 60 h, exam preparation and presence during exam: 30 h

Mathematical methods of continuum mechanics: presence lecture and tutorial: 15 * 2 h + 8 * 2 h = 46 h, preparation and recap lecture and tutorial: 15 * 2 h + 8 * 2 h = 46 h, exam preparation and presence during exam: 58 h

Learning type
Lecture, Tutorials, Lab Course, Consultation hours

M 10.48 Module: Engineering Mechanics IV (5) [M-MACH-102831]

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

Part of: Specialization in Mechatronics (Supplementary Modules)

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

Mandatory			
T-MACH-105274	Engineering Mechanics IV	5 CR	Proppe

Competence Certificate
written exam, 1,5 h

Prerequisites
None

Competence Goal
The students know some possibilities to describe the position and orientation of a rigid body for an arbitrary 3D motion. They realize that the rotational velocity is a vector which may change both magnitude and orientation. They can apply the principle of linear momentum and the principle of moment of momentum to a spatial motion of a rigid body and notice that this is much more complicated compared to a plain motion. The students can calculate the coordinates of the inertia tensor. They see that many effects which may be seen with gyroscopes can be explained by the principle of moment of momentum. For systems with many particles or bodies but only few degrees of freedom the students know that the application of analytical methods like the principle of D'Alembert in Lagrangian form or the Lagrange equations may be advantageous. They can apply these principles to simple problems. For vibration problems the students can interprete the most important expressions like eigenfrequency, resonance or eigenvalue problem. Forced vibration of systems with one degree of freedom can be investigated by the students.

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

Workload
time of attendance: 40h; self-study: 110h

Learning type
Lecture

M 10.49 Module: Engineering of Automation Systems [M-ETIT-106037]

Responsible: Prof. Dr.-Ing. Mike Barth

Organisation: KIT Department of Electrical Engineering and Information Technology
KIT Department of Mechanical Engineering

Part of: Specialization in Mechatronics (Compulsary Elective Modules: Electrical Engineering and Information Technology, Mechanical Engineering, Informatics, Economics and Management) (Usage from 10/1/2022)
Specialization in Mechatronics (Supplementary Modules) (Usage from 10/1/2022)

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

Mandatory			
T-ETIT-112221	Engineering of Automation Systems	4 CR	

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

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

Part of: Specialization in Mechatronics (Compulsary Elective Modules: Mechanical Engineering)
Specialization in Mechatronics (Compulsary Elective Modules: Electrical Engineering and Information Technology, Mechanical Engineering, Informatics, Economics and Management)
Specialization in Mechatronics (Supplementary Modules)

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

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

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

Prerequisites
none

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

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

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

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

Module grade calculation
result of exam

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

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

Workload
regular attendance: 64 hoursself-study: 176 hours

Learning type
Lectures + tutorials

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

Kuhlmann, H.: Strömungsmechanik, Pearson Studium

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

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

M 10.51 Module: Fundamentals in the Development of Commercial Vehicles [M-MACH-105824]

Responsible: Christof Weber
Organisation: KIT Department of Mechanical Engineering

Part of: Master's Transfer Account (Usage from 10/1/2021)

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

Mandatory			
T-MACH-111389	Fundamentals in the Development of Commercial Vehicles	4 CR	Weber

Competence Certificate
Oral exam; duration approximately 30 minutes

Prerequisites
None

Competence Goal
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 are able to plan, to steer, and to hanle this process. They can apply their knowledge effectively in actual practise. They know that the customer requirements, the technical realisability, the functionality and the economy are important drivers.

They 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.

They know the advantages and disadvantages of different drives. Furthermore they are familiar with components, such as transfer box, propeller shaft, powered and non-powered frontaxle etc. Beside other mechanical components, such as chassis, axle suspension and braking system, also electric and electronic systems are known. 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. They can apply their knowledge effectively in actual practise.

Content
The module provides an overview of:

1.1. Introduction, definitions, history

1.2. Development tools

1.3. Complete vehicle

1.4. Cab, bodyshell work

1.5. Cab, interior fitting

1.6. Alternative drive systems

1.7. Drive train

1.8. Drive system diesel engine

1.9. Intercooled diesel engines

2.1. Gear boxes of commercial vehicles

2.2. Intermediate elements of the drive train

2.3. Axle systems

2.4. Front axles and driving dynamics

2.5. Chassis and axle suspension

2.6. Braking System

2.7. Systems

2.8. Excursion

Workload

1. regular attendance lecture: 8 * 4 h = 32 h

2. pre and postprocessing lecture: 8 * 6 h = 48 h

3. examination preparation and presence in examnation: 40 h

In total: 120 h = 4 LP (2 semester)

Learning type

Tutorial

Literature

1. SPECKERT, M.; RUF, N.; DRESSLER, K.; MÜLLER, R.; WEBER, C.; WEIHE, S.: Ein neuer Ansatz zur Ermittlung von Erprobungslasten für sicherheitsrelevante Bauteile; Kaiserslautern: Fraunhofer ITWM, 2009, 27 pp.; Berichte des Fraunhofer ITWM, 177; ISSN: 1434-9973

2. SPECKERT, M.; DRESSLER, K.; RUF, N.; MÜLLER, R.; WEBER, C.: Customer Usage Profiles, Strength Requirements and Test Schedules in Truck Engineering, in: Schindler, C. et al. (Eds.): Proceedings of the 1st Commercial Vehicle Technology Symposium (CVT 2010), Shaker Verlag, 2010, S. 298-307

3. TEUTSCH, R. RITTER, J.; WEBER, C.; KOLB, G.; VILCENS, B.; LOPATTA, A.: Einsatz eines Fahrerleitsystems zur Qualitätssteigerung bei der Betriebsfestigkeitserprobung, Proceedings, 1st Commercial Vehicle Technology Symposium Kaiserslautern, 16. – 18. März 2010

4. WEBER, C.; MÜLLER, R.; TEUTSCH, R.; DRESSLER, K.; SPECKERT, M.: A New Way to Customer Loads Correlation and Testing in Truck Engineering of Daimler Trucks, Proceedings of the 1st International Munich Chassis Symposium, chassis.tech, Munich, Germany, 8th - 9th Juni 2010

5. TEUTSCH, R.; WEBER, C.; MÜLLER, R.; SCHON, U.; EPPLER, R.: Einsatzspezifische Erprobung als Baustein zur Verringerung des Fahrzeuggewichts von Lastkraftwagen, DVM-Berichtsband 138, S. 189 – 201, 20

M 10.52 Module: Fundamentals of Combustion I [M-MACH-102707]

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

Part of: Master's Transfer Account

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

Mandatory			
T-MACH-105213	Fundamentals of Combustion I	4 CR	Maas

Competence Certificate
Written exam, graded, approx. 3 h

Prerequisites
none

Competence Goal
After completing the course, the students are able to analyze the functionality of technical combustion systems (e.g. piston engines, gas turbines, furnaces). With regard to environmental pollution, students can name the mechanisms of combustion and pollutant formation and assess concepts for reducing pollutants. They can explain the fundamental chemical and physical processes of combustion and name experimental methods for investigating flames. Furthermore, the students can also describe the differences between laminar and turbulent flames and explain the principles of ignition processes.

Content
The lecture gives an overview of the basic terms and phenomena of technical combustion. In a basic chapter, experimental methods for investigating flames are taught. Conservation equations for laminar flames are derived based on scientific phenomena. In addition, the laminar premixed flame and the laminar non-premixed flame are treated as examples. Knowledge of chemical reactions and their description with reaction mechanisms is conveyed. Furthermore, ignition processes are taught. The content of the lecture is deepened in exercises and applied to specific problems and tasks.

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

Workload
General attendance: 30 h

Preparation time for the lecture: 30 h

General attendance (Tutorial): 30 h

Self-study: 30 h

Recommendation
none

Learning type
Lecture
Exercise course

Literature
Lecture notes,

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

10.53 Module: Fundamentals of Energy Technology [M-MACH-102690]

Responsible: Dr. Aurelian Florin Badea
Prof. Dr.-Ing. Xu Cheng

Organisation: KIT Department of Mechanical Engineering

Part of: Master's Transfer Account

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

Mandatory			
T-MACH-105220	Fundamentals of Energy Technology	8 CR	Badea, Cheng

Competence Certificate
A performance assessment will consist of a written examination of 90 minutes.

Prerequisites
none

Competence Goal
The objective of the module 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.

Content
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

Module grade calculation
The module grade is the grade of the written examination.

Workload
1. lectures: 15 * 3 h = 45 h
2. preparation for lectures: 15 * 2 h = 30 h
3. tutorials: 15 * 2 h = 30 h
4. preparation for tutorials: 15 * 1 h = 15 h
5. preparation for exam: 120 h

Total: 240 h = 8 LP

M 10.54 Module: Fundamentals on High Frequency Techniques [M-ETIT-102129]

Responsible: Prof. Dr.-Ing. Thomas Zwick
Organisation: KIT Department of Electrical Engineering and Information Technology
Part of: Specialization in Mechatronics (Compulsary Elective Modules: Electrical Engineering and Information Technology, Mechanical Engineering, Informatics, Economics and Management)
Specialization in Mechatronics (Supplementary Modules)

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

Mandatory			
T-ETIT-101955	Fundamentals on High Frequency Techniques	6 CR	Zwick

Competence Certificate
Success control is carried out as part of a written overall examination (120 minutes) of the selected courses, with which the minimum requirement for CP is met and the assessment of homework. Students can work on the homework exercises during the semester and submit them for correction. The handover is in handwritten form.

Prerequisites
None

Competence Goal
he students have basic knowledge and understanding in the field of radio frequency technology and can transfer this knowledge to other areas of the course. These include, in particular, line theory, microwave network analysis and the basics of more complex microwave systems (receiver noise, non-linearity, compression, antennas, amplifiers, mixers, oscillators, radio systems, FMCW radar, S parameters). The methods learned enable simple or basic high-frequency technical problems to be solved (e.g. impedance matching, standing waves).

Content
Basic lecture on high frequency technology: The main focus of the lecture is to provide a basic understanding of high frequency technology as well as the methodological and mathematical foundations for the design of microwave systems. The main topics are passive components and linear circuits at higher frequencies, line theory, microwave network analysis and an overview of microwave systems.

Accompanying the lecture, exercises are given on the lecture material. These are discussed in a large hall exercise and the associated solutions are presented in detail. In addition, the most important connections from the lecture are repeated again in the exercise.

In addition to the exercise in the hall, a tutorial is used to independently work on typical high-frequency technology tasks. The students work on the tasks in small groups and receive help from a student tutor.

Module grade calculation
The module grade is the grade of the written exam. If at least 50% of the total points of the homework are achieved, the student receives a grade bonus of 0.3 or 0.4 grade points on passing the written exam. If the grade of the written exam is between 4.0 and 1.3, the bonus improves the grade of the written exam by one grade (0.3 or 0.4). The exact criteria for awarding a bonus will be announced at the beginning of the course.

The grade bonus once acquired will remain for a possible written examination in a later semester. The homework is a voluntary additional service, i.e. Even without the grade bonus, the full score or top grade can be achieved in the exam.

Workload
The workload includes:

Attendance study time lecture / exercise: 60 h

Classroom study time: 15 h

Self-study time including exam preparation: 105 h

A total of 180 h = 6 LP

Recommendation
Knowledge of the basics of high frequency technology is helpful.

M 10.55 Module: Further Examinations [M-MACH-104332]

Organisation: KIT Department of Mechanical Engineering
Part of: Additional Examinations

Credits	Grading scale	Recurrence	Duration	Language	Level	Version
30	pass/fail	Each term	2 terms	German	3	1

Further Examinations (Election: at most 30 credits)			
T-MACH-106638	Wildcard Additional Examinations 1	3 CR	
T-MACH-106639	Wildcard Additional Examinations 2	3 CR	
T-MACH-106640	Wildcard Additional Examinations 3	3 CR	
T-MACH-113345	Wildcard Additional Examinations 11	3 CR	
T-MACH-106641	Wildcard Additional Examinations 4	3 CR	
T-MACH-106643	Wildcard Additional Examinations 5	3 CR	
T-MACH-106646	Wildcard Additional Examinations 6	3 CR	
T-MACH-106647	Wildcard Additional Examinations 7	3 CR	
T-MACH-106648	Wildcard Additional Examinations 8	3 CR	
T-MACH-106649	Wildcard Additional Examinations 9	3 CR	
T-MACH-106650	Wildcard Additional Examinations 10	3 CR	

Prerequisites
None

M 10.56 Module: Fuzzy Sets (24611) [M-INFO-100839]

Responsible: Prof. Dr.-Ing. Uwe Hanebeck
Organisation: KIT Department of Informatics
Part of: Master's Transfer Account

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

Mandatory			
T-INFO-101376	Fuzzy Sets	6 CR	Hanebeck

M 10.57 Module: Handling Characteristics of Motor Vehicles I [M-MACH-105288]

Responsible: Dr.-Ing. Martin Gießler
Dr.-Ing. Hans-Joachim Unrau

Organisation: KIT Department of Mechanical Engineering

Part of: Master's Transfer Account

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

Mandatory			
T-MACH-105152	Handling Characteristics of Motor Vehicles I	4 CR	Unrau

Competence Certificate
Oral examination, duration: approximately 30 minutes.

Competence Goal
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.

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

Workload
The total work load for this module is about 120 Hours (4 Credits). The partition of the work load is carried out according to the credit points of the courses of the module. The work load for courses with 4 credit points is about 120 hours

Learning type
Lecture

M 10.58 Module: Heat and Mass Transfer [M-MACH-102717]

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

Part of: Master's Transfer Account

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

Mandatory			
T-MACH-105292	Heat and Mass Transfer	4 CR	Maas, Yu

Competence Certificate
Written exam, graded, approx. 3 hours

Prerequisites
none

Competence Goal
The students will have knowledge of the basic processes, laws and calculation methods of heat and mass transfer based on dimension analysis. Further, they can use it to analyze and derive application systems of industrial importance in the fields of mechanical engineering, energy and process engineering.

Content
The lecture gives an overview of stationary and unsteady heat conduction phenomena in homogeneous and composite bodies; such as plates, pipe shells and spherical shells. Molecular diffusion in gases and the analogy between diffusion and heat conduction are thought. The lecture provides an overview of convective, forced heat transfer in pipes / channels with a flow, as well as plates and profiles that are flown over. In addition, the module conveys knowledge of the mass / heat transfer analogy and the multiphase, convective heat transfer (condensation, evaporation), as well as the convective mass transfer is taught. This module is intended to convey to students the theoretical and practical aspects of the radiant heat transport of solids and gases. The content of the lecture is deepened in exercises and applied to specific problems and tasks.

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

Workload
General attendance: 30 h

Preparation time for the lecture: 30 h

General attendance (Tutorial): 30 h

Self-study: 30 h

Recommendation
none

Learning type
Lecture
Exercise course

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

M 10.59 Module: Human Computer Interaction (24659) [M-INFO-100729]

Responsible: Prof. Dr.-Ing. Michael Beigl
Organisation: KIT Department of Informatics
Part of: Specialization in Mechatronics (Supplementary Modules)

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

Mandatory			
T-INFO-101266	Human-Machine-Interaction	6 CR	Beigl
T-INFO-106257	Human-Machine-Interaction Pass	0 CR	Beigl

M 10.60 Module: Human-Machine-Interaction in Anthropomatics: Basics (24100) [M-INFO-100824]

Responsible: Prof. Dr.-Ing. Jürgen Beyerer
Organisation: KIT Department of Informatics
Part of: Specialization in Mechatronics (Supplementary Modules)

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

Mandatory			
T-INFO-101361	Human-Machine-Interaction in Anthropomatics: Basics	3 CR	Beyerer, van de Camp

M 10.61 Module: Hybrid and Electric Vehicles [M-ETIT-100514]

Responsible: Prof. Dr. Martin Doppelbauer
Organisation: KIT Department of Electrical Engineering and Information Technology
Part of: Specialization in Mechatronics (Compulsary Elective Modules: Electrical Engineering and Information Technology, Mechanical Engineering, Informatics, Economics and Management)
Specialization in Mechatronics (Supplementary Modules)

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

Mandatory			
T-ETIT-100784	Hybrid and Electric Vehicles	4 CR	Doppelbauer

Competence Certificate
Success is assessed in the form of a written examination lasting 120 minutes.

Prerequisites
none

Competence Goal
Students understand the technical function of all drive components of hybrid and electric vehicles and their interaction in the drivetrain. They have detailed knowledge of the drive components, in particular batteries and fuel cells, power electronic circuits and electrical machines including the associated transmissions. They are also familiar with the most important drive topologies and their specific advantages and disadvantages. Students will be able to assess and evaluate the technical, economic and ecological effects of alternative drive technologies for motor vehicles.

Content
Based on the mobility needs of modern industrial society and the political framework conditions for climate protection, the different drive and charging concepts of battery-electric and hybrid-electric vehicles are presented and evaluated. The lecture gives an overview of the components of the electric drive train, in particular battery, charging circuit, DC/DC converter, inverter, electric machine and transmission. Outline:

- Hybrid vehicle drives
- Electric vehicle drives
- Driving resistances and energy consumption
- Operating strategy
- Energy storage
- Fundamentals of electrical machines
- Asynchronous machines
- Synchronous machines
- Special machines
- Power electronics
- Charging
- Environment
- Vehicle examples

Requirements and specifications

Module grade calculation
The module grade is the grade of the written examination.

Workload
14x lecture and 7x exercise 1.5 h each = 31.5 h

14x follow-up lecture à 1 h = 14 h

6x preparation for exercise à 2 h = 12 h

Exam preparation: = 50 h

Examination time = 2 h

Total = 109.5 h

(corresponds to 4 credit points)

Recommendation
To understand the module, basic knowledge of electrical engineering is recommended (acquired, for example, by attending the modules "Electrical Machines and Power Electronics", "Electrical Engineering for Industrial Engineers I+II" or "Electrical Engineering and Electronics for Mechanical Engineers").

M 10.62 Module: Image Processing [M-ETIT-102651]

Responsible: Prof. Dr.-Ing. Michael Heizmann
Organisation: KIT Department of Electrical Engineering and Information Technology
Part of: Specialization in Mechatronics (Supplementary Modules)

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

Mandatory			
T-ETIT-105566	Image Processing	3 CR	Heizmann

Prerequisites
none

M 10.63 Module: Information and Automation Technology II/Laboratory for Machine Learning Algorithms [M-ETIT-105644]

Responsible: Prof. Dr.-Ing. Jürgen Becker
Prof. Dr.-Ing. Eric Sax
Prof. Dr. Wilhelm Stork

Organisation: KIT Department of Electrical Engineering and Information Technology

Part of: Specialization in Mechatronics (Compulsary Elective Modules: Electrical Engineering and Information Technology)

Credits	Grading scale	Recurrence	Duration	Language	Level	Version
10	Grade to a tenth	Each term	2 terms	German	3	1

Mandatory			
T-ETIT-109319	Information Technology II and Automation Technology	4 CR	Sax
T-ETIT-109839	Laboratory for Applied Machine Learning Algorithms	6 CR	Becker, Sax, Stork

Competence Certificate

1. Information Technology II and Automation Technology:
   Type of examination: written exam. Duration of examination: approx. 120 minutes. Content: lecture and excercise.
2. Laboratory for applied Machine Learning Algorithms:
   Type of examination: alternative exam assessment
   The examination consists of written reports, assement of team work, an oral presentation, and an oral exam at the end of the lecture period. The overall impression is rated.

Prerequisites
none

10.64 Module: Information and Automation Technology II/Seminar Embedded Systems [M-ETIT-105645]

Responsible: Prof. Dr.-Ing. Jürgen Becker
Prof. Dr.-Ing. Eric Sax
Prof. Dr. Wilhelm Stork

Organisation: KIT Department of Electrical Engineering and Information Technology

Part of: Specialization in Mechatronics (Compulsary Elective Modules: Electrical Engineering and Information Technology)

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

Mandatory			
T-ETIT-109319	Information Technology II and Automation Technology	4 CR	Sax
T-ETIT-110832	Seminar: Fundamentals of Embedded Systems	4 CR	Becker, Sax, Stork

Competence Certificate

1. Information Technology II and Automation Technology:
   Type of examination: written exam. Duration of examination: approx. 120 minutes. Content: lecture and excercise.
2. Seminar: Fundamentals of Embedded Systems:
   Type of examination: alternative exam assessment
   The examination consists of a written report and an oral presentation. The overall impression is rated.

Prerequisites

none

M 10.65 Module: Information Processing in Sensor Networks [M-INFO-100895]

Responsible: Prof. Dr.-Ing. Uwe Hanebeck
Organisation: KIT Department of Informatics
Part of: Specialization in Mechatronics (Supplementary Modules)
Master's Transfer Account

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

Mandatory			
T-INFO-101466	Information Processing in Sensor Networks	6 CR	Hanebeck

M 10.66 Module: Information Systems and Supply Chain Management [M-MACH-105281]

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

Part of: Master's Transfer Account (Usage from 4/1/2020)

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

Mandatory			
T-MACH-102128	Information Systems and Supply Chain Management	3 CR	Kilger

Competence Certificate
The assessment consists of an oral exam according to §4 (2), 2 of the examination regulation. It may be a written exam (according to §4 (2), 1 of the examination regulation) in the case of large number of participants.

Prerequisites
none

Competence Goal
Students are able to:

- Describe requirements of logistical processes regarding IT systems,
- Choose information systems to support logistical processes and use them according to the requirements of a supply chain.

Content
1) Overview of logistics systems and processes

2) Basic concepts of information systems and information technology

3) Introduction to IS in logistics: Overview and applications

4) Detailed discussion of selected SAP modules for logistics support

Workload
regular attendance: 21 hours
self-study: 69 hours

Learning type
Lectures

Literature
Stadtler, Kilger: Supply Chain Management and Advanced Planning, Springer, 4th edition 2008

10.67 Module: Information Technology I [M-ETIT-104539]

Responsible: Prof. Dr.-Ing. Eric Sax
Organisation: KIT Department of Electrical Engineering and Information Technology
Part of: Engineering Fundamentals

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

Mandatory			
T-ETIT-109300	Information Technology I	4 CR	Sax
T-ETIT-109301	Information Technology I - Practical Course	2 CR	Sax

Competence Certificate
The module grade is the grade of the written exam. Successful completion of the internship is a prerequisite for passing the module.

The success control of the module consists of:

1. A "written exam" of 120 minutes for the courses lecture, exercise (4 CP)

2. A success control in the form of project documentation and control of the source code in the course of the practical course (2 CP)

Prerequisites
None

Competence Goal
The students get to know the structure and functioning of information technology systems and their use.

Students can

differentiate the characteristics of embedded systems.
name different programming languages ??and paradigms and compare their differences.
explain the basic components of the C ++ programming language and create programs in this language.
list the components required to create an executable program and describe their interaction.
Represent program structures with the help of graphical description means.
Differentiate the object-oriented programming paradigm from traditional approaches and create object-oriented programs.
graphically depict the structure of object-oriented programs
Describe general computer architectures, compare their advantages and disadvantages, and explain options for increasing performance.
describe different levels of abstraction for data storage. There are various ways to store, organize, name and evaluate data in a structured manner.
Describe the tasks of an operating system and reflect the basic functions of processes and threads.
explain the phases and processes of project management and outline the planning of small projects.

By participating in the information technology internship, students can break down complex programming problems into simple and clear modules and develop suitable algorithms and data structures, and convert them into an executable program using a programming language.

Content
Lecture Information Technology I:

Basic lecture on information technology. The focus of the event is:

Programming languages, program creation and program structures
object orientation
Computer architectures and embedded systems
Data structures and databases
project management
Operating systems and processes

Exercise Information Technology I:

Accompanying the lecture, the basics of the programming language C ++ are taught in the exercise. For this purpose, exercises with reference to the lecture material are given, and the solutions to this are explained in detail. The focus is on the construction and analysis of programs and their creation.

Internship information technology:

In the implementation into a structured and executable source code, in compliance with given quality criteria, the writing of complex C / C ++ code sections and the handling of an integrated development environment are trained. The implementation takes place on a microcontroller board, which is already known from other courses.

The project is processed in small teams, which break the entire project down into individual tasks and process them independently. Here, contents from lectures and exercises are taken up again and applied to specific problems. At the end of the internship, each project team should demonstrate the successful completion of their work on the "TivSeg platform".

Module grade calculation
The module grade is the grade of the written exam. Successful completion of the internship is a prerequisite for passing the module.

Annotation
From summer semester 2024, the content will be taught in the course "Informations- und Automatisierungstechnik".

Workload
The workload includes:

Attendance time in 14 lectures and 7 exercises (21.5 hours)
Preparation / follow-up of lecture and exercise (41 hours)
Exam preparation and attendance in the same (40 hours)
Information technology internship 5 appointments (7.5 hours)
Preparation / follow-up of the internship (40 hours)

Recommendation
Knowledge of the basics of programming is recommended (attendance of the MINT course C ++).
The contents of the module digital technology are helpful.

M 10.68 Module: Information Technology II and Automation Technology [M-ETIT-104547]

Responsible: Prof. Dr.-Ing. Eric Sax
Organisation: KIT Department of Electrical Engineering and Information Technology
Part of: Specialization in Mechatronics (Compulsary Elective Modules: Electrical Engineering and Information Technology, Mechanical Engineering, Informatics, Economics and Management)
Specialization in Mechatronics (Supplementary Modules)

Credits	Grading scale	Recurrence	Duration	Language	Level	Version
4	Grade to a tenth	Each summer term	1 term	German	3	2

Mandatory			
T-ETIT-109319	Information Technology II and Automation Technology	4 CR	Sax

Competence Certificate
Type of examination: written exam. Duration of Examination: approx. 120 minutes. Content: lecture and excercise.

Prerequisites
None

M 10.69 Module: Innovation and Project Management in Rail Vehicle Engineering [M-MACH-106514]

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

Part of: Master's Transfer Account (Usage from 10/1/2023)

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

Mandatory			
T-MACH-113068	Innovation and Project Management in Rail Vehicle Engineering	4 CR	Cichon

Competence Certificate
Presentation (duration approx. 20 minutes) and colloquium

Prerequisites
none

Competence Goal
Students will learn the basics of innovation and project management in the context of rail vehicle development. Using the case study of a practical vehicle development in the context of the "European Railway Challenge" competition, students will experience the various organizational, systemic, economic and technological challenges of an innovation project, namely the new construction of a prototype rail vehicle.

Content

- Basics of innovation management
- Creativity techniques and idea selection
- Basics and methods of project management
- Practical challenges in project management
- Product development processes
- Team organization
- Case study "innovative rail vehicle" based on the Railway Challenge requirements

Annotation
A bibliography is available for students to download from the Ilias platform.

Workload
Attendance time: 21 hours
Preparation / wrap-up: 21 hours
Exam and exam preparation: 78 hours
Total time: 120 hours = 4 LP

Learning type
Lecture

10.70 Module: Innovative Concepts for Programming Industrial Robots (24179) [M-INFO-100791]

Responsible: Prof. Dr.-Ing. Björn Hein
Organisation: KIT Department of Informatics
Part of: Master's Transfer Account

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

Mandatory			
T-INFO-101328	Innovative Concepts for Programming Industrial Robots	4 CR	Hein

M 10.71 Module: Internship [M-MACH-104265]

Responsible: Prof. Dr. Martin Doppelbauer
Prof. Dr.-Ing. Sven Matthiesen

Organisation: KIT Department of Mechanical Engineering

Part of: Internship

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

Mandatory			
T-MACH-108803	Internship	15 CR	Doppelbauer, Geimer

Competence Certificate
An internship of at least thirteen weeks has to be fulfilled, which is suitable to provide the student an insight into the professionell work in the area of mechatronics and information technology. 15 ECTS are allocated to the intership.

Original certificates and reports about the internship has to be provided to the appropriate internship office.

The reports have to contain a compilation of activities during the internship with the following content:
company, area of production, workshop or department, instruction period in each workshop or department with start and end date and one detailed report per week or project. The report hast to consist of at least one DIN A4 page per week and should have the format of a scientific report. The reports should give evidence, that the author has done all reported activities by himself, for example by describing the work flow or reflecting the gained experience. Sketches, drawings, schematics etc. can save a long report.

The reports have to be checked by the supervisor in the company and have to be approved by stamp and signature. Periods which are not verified by a report cannot be accredited.

Prerequisites
None

Competence Goal
The aim of the intership is, that the student will be lead to the typical activities of an engineer by contributing to specific technical tasks. He/she shall acquire knowhow related to his/her discipline and collect further impressions about his/her later professional enviroment and his/her position and responibility within a company. As far as possible he/she shoukd also get insights into organization and managment of a company.

Content
It is recommended, to select one out of the following fields with respect of the intended area of specialization in the master course:

1. calculation, simulation, development and design
2. production and assembly (planning, preparation, controlling, calculation) of units, assembly parts, devices, apparats, tools, machines of the entire mechatronics
3. planning of measurements, measurement and testing technology, quality control
4. planning, planning of service, maintenance and repair
5. assembly and commissioning, tools and jig manufacturing
6. heat treatment and surface engineering
7. operation and maintenance (field support) of complete sites of mechatronics (power plants, switchboard plants, grids, drives, equipment of information and data systems technology, high frequency equipment, equipment of measurement, control, process technology and so on)
8. research laboratories
9. test areas and proving grounds, planning of assembly/deassembly
10. computing centers and software engineering

Annotation
Further information are provided by the internship guidlines for the BSc-course in Mechatronics and Information Technology.

Workload
450 hours

Learning type
Internship

10.72 Module: Introduction into Energy Economics [M-WIWI-100498]

Responsible: Prof. Dr. Wolf Fichtner
Organisation: KIT Department of Economics and Management
Part of: Master's Transfer Account

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

Mandatory			
T-WIWI-102746	Introduction to Energy Economics	5 CR	Fichtner

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

Prerequisites
None

Competence Goal
The student is able to

- characterize and judge the different energy carriers and their peculiarities,
- understand contexts related to energy economics.

Content
1. Introduction: terms, units, conversions
2. The energy carrier gas (reserves, resources, technologies)
3. The energy carrier oil (reserves, resources, technologies)
4. The energy carrier hard coal (reserves, resources, technologies)
5. The energy carrier lignite (reserves, resources, technologies)
6. The energy carrier uranium (reserves, resources, technologies)
7. The final carrier source electricity
8. The final carrier source heat
9. Other final energy carriers (cooling energy, hydrogen, compressed air)

Workload
The total workload for this course is approximately 165.0 hours. For further information see German version.

M 10.73 Module: Introduction to High Voltage Engineering [M-ETIT-105276]

Responsible: Dr.-Ing. Michael Suriyah
Organisation: KIT Department of Electrical Engineering and Information Technology
Part of: Specialization in Mechatronics (Supplementary Modules)

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

Mandatory			
T-ETIT-110702	Introduction to High Voltage Engineering	3 CR	Suriyah

Competence Certificate
Oral exam approx. 20 minutes.

Competence Goal
The students know the causes of overvoltages in electric power systems.

The students are familiar with the main components and measuring equipments used in high voltage systems.

The students are able to differentiate between the various methods to measure high voltages.

The students know the necessary steps to construct and build up a high voltage test circuit.

The students are familiar with relevant methods used to diagnose electrical insulating materials and systems.

Content
The integration of renewable energies into the existing grid is a huge challenge in terms of ensuring a stable and secure energy supply. High-voltage technology is a key technology to make the energy transition a success. In addition to the conventional three-phase transmission, high-voltage direct current (HVDC) transmission is becoming more and more important in Germany as part of network expansion of transmission grids. The aim of this event is to comprehensively convey and discuss new findings in the field of high voltage engineering. New materials and test methods for insulation systems and products are of particular importance.

Topics:

1. Materials of high voltage engineering
2. Equipment of electrical power engineering
3. Methods of high-voltage measurement technology
4. Monitoring, diagnostics and condition assessment of resources
5. Guest lecture from the industry

Module grade calculation
The module grade is the grade of the oral exam.

Workload
The workload includes:

Presence time in lecture (30 h = 1 LP)

Self-study time (60 h = 2 LP)

Total (90 h = 3 LP)

Recommendation
Basic knowledge in network theory, field theory and electrical metrology

M 10.74 Module: Introduction to Microsystem Technology I [M-MACH-102691]

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

Part of: Master's Transfer Account

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

Mandatory			
T-MACH-105182	Introduction to Microsystem Technology I	4 CR	Badilita, Jouda, Korvink

Competence Certificate
Written exam: 60 min

Prerequisites
None

Competence Goal
The lecture gives an introduction into the basics of microsystems technology. In analogy to processes employed in fabrication of microelectronics circuits the core technologies as well as materials for producing microstructures and components are presented. Finally, various techniques for Silicon micromachining are explained and illustrated with examples for micro-components and micro-systems.

Content
- Introduction in Nano- and Microtechnologies
- Silicon and processes for fabricating microelectronics circuits
- Basic physics background and crystal structure
- Materials for micromachining
- Processing technologies for microfabrication
- Silicon micromachining
- Examples

Workload
Time of attendance: 15 * 1,5 h = 22,5 h

Preparation and follow up: 15 * 5,5 h = 82,5 h

Exam Preaparation and Exam: 15 h

Total: 120 h = 4 LP

Literature
M. Madou
Fundamentals of Microfabrication
Taylor & Francis Ltd.; Auflage: 3. Auflage. 2011

10.75 Module: Introduction to Microsystem Technology II [M-MACH-102706]

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

Part of: Master's Transfer Account

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

Mandatory			
T-MACH-105183	Introduction to Microsystem Technology II	4 CR	Jouda, Korvink

Competence Certificate
Written exam: 60 min

Prerequisites
none

Competence Goal
The lecture gives an introduction into the basics of microsystems technology. In the first part, methods for lithographic pattern transfer are summarized. Then specific techniques such as the LIGA process, micro-machining, and laser-patterning are explained and examples are given. Finally assembly and packaging methods are presented leading into a discussion of entire microsystems.

Content
- Introduction in Nano- and Microtechnologies
- Lithography
- LIGA-technique
- Mechanical microfabrication
- Patterning with lasers
- Assembly and packaging
- Microsystems

Workload
Time of attendance: 15 * 1,5 h = 22,5 h

Preparation and follow up: 15 * 5,5 h = 82,5 h

Exam Preaparation and Exam: 15 h

Total: 120 h = 4 LP

Literature
M. Madou
Fundamentals of Microfabrication
Taylor & Francis Ltd.; Auflage: 3. Auflage. 2011

M 10.76 Module: Introduction to Operations Research (WW1OR) [M-WIWI-101418]

Responsible: Prof. Dr. Stefan Nickel
Prof. Dr. Steffen Rebennack
Prof. Dr. Oliver Stein

Organisation: KIT Department of Economics and Management

Part of: Specialization in Mechatronics (Compulsary Elective Modules: Electrical Engineering and Information Technology, Mechanical Engineering, Informatics, Economics and Management)
Specialization in Mechatronics (Supplementary Modules)

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

Mandatory			
T-WIWI-102758	Introduction to Operations Research I and II	9 CR	Nickel, Rebennack, Stein

Competence Certificate
The assessment of the module is carried out by a written examination (120 minutes).
In each term (usually in March and August), one examination is held for both courses.

Prerequisites
None

Competence Goal
The student

- names and describes basic notions of the essential topics in Operations Research (Linear programming, graphs and networks, integer and combinatorial optimization, nonlinear programming, dynamic programming and stochastic models),
- knows the indispensable methods and models for quantitative analysis,
- models and classifies optimization problems and chooses the appropriate solution methods to solve optimization problems independently,
- validates, illustrates and interprets the obtained solutions.

Content
This module treats the following topics: linear programming, network models, integer programming, nonlinear programming, dynamic programming, queuing theory, heuristic models.

This module forms the basis of a series of advanced lectures with a focus on both theoretical and practical aspects of Operations Research.

Module grade calculation
The overall grade of the module is the grade of the written examination.

Workload
The total workload for this module is approx. 270 hours (attendance time: 85 hours, other time for preparation and follow-up as well as exam preparation: 185 hours, 9 credit points). The total number of hours per course results from the time spent attending the lectures and exercises, as well as the examination times and the time required for an average student to achieve the learning objectives of the module.

M 10.77 Module: Introduction to Video Analysis (24684) [M-INFO-100736]

Responsible: Prof. Dr.-Ing. Jürgen Beyerer
Organisation: KIT Department of Informatics
Part of: Specialization in Mechatronics (Supplementary Modules)

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

Mandatory			
T-INFO-101273	Introduction to Video Analysis	3 CR	Beyerer

M 10.78 Module: IT-Fundamentals of Logistics: Opportunities for Digital Transformation [M-MACH-105282]

Responsible: Prof. Dr.-Ing. Kai Furmans
Prof. Dr.-Ing. Frank Thomas

Organisation: KIT Department of Mechanical Engineering

Part of: Master's Transfer Account (Usage from 4/1/2020)

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

Mandatory			
T-MACH-105187	IT-Fundamentals of Logistics	4 CR	Thomas

Competence Certificate
The assessment consists of an oral exam (30 min.) or an written exam (60min.) taking place in the recess period according to § 4 paragraph 2 Nr. 1/2 of the examination regulation.

Prerequisites
none

Competence Goal
The students …

- can describe the business process models from goods-inbound to goods-outbound based on sound basic knowledge, and derive the corresponding analysis models.
- will learn through the modularisation of the business process elements to think in reusable, adaptive IT components.
- will accomplish excellent work as a highly-motivated employee together in interdisciplinary teams (responses from the industry).

Content
The rapid development of information technology influences business processes drastically.
A strategic IT-orientation for an enterprise without a critical appreciation of worldwide IT-development (where the half-life value of IT for logistic systems knowledge is less than 3 years) is dangerous. The pressure of costs is always in focus. For this purpose the contents of this course, as well as the detailed script will be continuously revised, and the influences on business processes will be shown in practical examples.

Focuses:

System architecture in Material Flow Control Systems (MFCS)

A guiding principle for a new system architecture for MFC systems is the consideration of making new standardized, functional groups available for re-usability.

Design and application of innovative Material Flow Control Systems (MFCS)

The most important task of the MFCS is the commissioning of conveying systems with driving commands in a way that optimally utilizes the facility and serves the logistics processes on schedule.

Identification of goods – Application in Logistics

Along with business processes, coded information is the link between the flow of information and the flow of materials, and contributes to error prevention in the communication between people and machines.

Data communication in Intra-logistics

Information describes the content of a message that is of value to the recipient.
The recipient can be both a human and a machine.

Business processes for Intra-logistics – Software follows function!

If the business processes from Goods Incoming to Goods Outgoing are adapted with reusable building blocks then capabilities become visible. Against this background the consideration becomes apparent, how, through an innovative software architecture,
a reusable building-block based framework can be made.
Therefore applies: Software follows function. And only if all project requirements are documented in the planing phase, and supported together in an inter-disciplinary team - consisting of logistics planners, the customers (users) and the implementation leader (IL).

Software development in accordance with industrial standards

Today's development of object-oriented software, and the increasing penetration of industrial software production with this technology, makes it possible to create system designs that already offer these opportunities in their facility - both for a high degree of reuse and for easier adaptability.
In software development, object-oriented methods are used to improve the productivity, maintainability and software quality. An important aspect of object-orientation is: the objects used are primarily intended to depict the real world.

Workload
regular attendance: 21 hours
self-study: 69 hours

Learning type
Lectures

M 10.79 Module: Lab Computer-Aided Methods for Measurement and Control [M-MACH-105291]

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

Organisation:

Part of: Master's Transfer Account

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

Mandatory			
T-MACH-105341	Lab Computer-Aided Methods for Measurement and Control	4 CR	Klemp, Stiller

Competence Certificate
Successful passed Colloquia

Prerequisites
none

Competence Goal
Powerful and cheap computation resources have led to major changes in the domain of measurement
and control. Engineers in various fields are nowadays confronted with the application of computer-aided methods. This lab tries to give an insight into the modern domain of measurement and control by means of practically oriented and flexible experiments. Based on experiments
on measurement instrumentation and digital signal processing, elementary knowledge in the domain of visual inspection and image processing will be taught. Thereby, commonly used software like MATLAB/Simulink will be used in both simulation and realization of control loops. The lab closes with selected applications, like control of a robot or supersonic computer
tomography.

Content

1. Digital technology
2. Digital storage oscilloscope and digital spectrum analyzer
3. Supersonic computer tomography
4. Lighting and image acquisition
5. Digital image processing
6. Image interpretation
7. Control synthesis and simulation
8. Robot: Sensors
9 Robot: Actuating elements and path planning
The lab comprises 9 experiments.

Workload
120 hours

Recommendation
Basic studies and preliminary examination; basic lectures in automatic control

Learning type
Tutorial

Literature
Instructions to the experiments are available on the institute's website

M 10.80 Module: Lab Course Electrical Drives and Power Electronics [M-ETIT-100401]

Responsible: Prof. Dr. Martin Doppelbauer
Organisation: KIT Department of Electrical Engineering and Information Technology
Part of: Master's Transfer Account

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

Mandatory			
T-ETIT-100718	Lab Course Electrical Drives and Power Electronics	6 CR	Doppelbauer

Prerequisites
none

M 10.81 Module: Lab Course Electrical Power Engineering [M-ETIT-100419]

Responsible: Prof. Dr. Martin Doppelbauer
Prof. Dr.-Ing. Thomas Leibfried

Organisation: KIT Department of Electrical Engineering and Information Technology

Part of: Master's Transfer Account

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

Mandatory			
T-ETIT-100728	Lab Course Electrical Power Engineering	6 CR	Badent, Doppelbauer, Leibfried

Prerequisites
none

M 10.82 Module: Laboratory Biomedical Engineering [M-ETIT-100389]

Responsible: Prof. Dr. Werner Nahm
Organisation: KIT Department of Electrical Engineering and Information Technology
Part of: Master's Transfer Account

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

Mandatory			
T-ETIT-101934	Laboratory Biomedical Engineering	6 CR	Nahm

Prerequisites
Passed exam of the module "Biomedizinische Messtechnik I".

Modeled Conditions
The following conditions have to be fulfilled:

1. The module M-ETIT-100387 - Biomedical Measurement Techniques I must have been passed.

M 10.83 Module: Laboratory Circuit Design [M-ETIT-100518]

Responsible: Prof. Dr.-Ing. Jürgen Becker
Organisation: KIT Department of Electrical Engineering and Information Technology
Part of: Specialization in Mechatronics (Supplementary Modules)

Credits	Grading scale	Recurrence	Duration	Language	Level	Version
6	Grade to a tenth	Each winter term	1 term	German	3	2

Mandatory			
T-ETIT-100788	Laboratory Circuit Design	6 CR	Becker, Sander

Prerequisites
none

Competence Goal
The practical course teaches necessary knowledge and abilities to design electric circuits as used to interface microcontrollers/ FPGAs with sensors and actors. At the end of this course the participants are capable of selecting electronic components based on relevant criteria, combining them to basic building blocks, and setting up a working system for a given problem. In addition to circuit design, basic methods and abilities for the creation of PCB layouts are taught. Finally, the participants are enabled to assemble and test their designed circuits in real setups.

Content
This course is a three-week practical block event. Its goal is the development and setup of the complete electronics used to run a self-balancing single-axis transportation device.

The first part of the course covers commonly used electric circuits which are presented in interactive lecture style. This covers circuits for voltage supply, clock generation, sensor signal pre-processing, power drivers, and display control, among others. Real-world components are presented based on their datasheets. To consolidate this knowledge, the lecture is interwoven with small practical exercises where students set up and experiment with the presented circuits. This first part aims at refreshing basic knowledge from previous courses as well as imparting knowledge on often-used basic circuits.

After presenting the basic circuits there is a short presentation on PCB layout design. This part comprises an introduction of the PCB layout tool used in the course, followed by tips on placement and wiring of components on the PCB. It covers the topics of noise and crosstalk reduction, placement of bypass capacitors, and ground design.

During the third and longest part of the course, the participants work in teams to create a concept, schematics, and layouts of circuit parts to run the transportation device. Requirements are given concerning the functionality of the circuit parts as well as interfaces to neighboring parts only. All further development steps are carried out by the students themselves, based on the knowledge from the first two parts of the course.

Workload
The workload includes

1. presence in the laboratory: 15 days of 8h each = 120h
2. course preparation/recapitulation: 15 days of 2h each = 30h
3. exam preparation and attendance: 15h

Recommendation
Basic knowledge on basic electrical circuits (e.g. courses LEN, Nr. 2305256, ES, Nr. 2312655 and EMS, Nr. 2306387)

M 10.84 Module: Laboratory for Applied Machine Learning Algorithms [M-ETIT-104823]

Responsible: Prof. Dr.-Ing. Jürgen Becker
Prof. Dr.-Ing. Eric Sax
Prof. Dr. Wilhelm Stork

Organisation: KIT Department of Electrical Engineering and Information Technology

Part of: Specialization in Mechatronics (Supplementary Modules)

Credits	Grading scale	Recurrence	Duration	Language	Level	Version
6	Grade to a tenth	Each winter term	1 term	German	3	2

Mandatory			
T-ETIT-109839	Laboratory for Applied Machine Learning Algorithms	6 CR	Becker, Sax, Stork

Competence Certificate
Type of examination: alternative exam assessment
The examination consists of written reports, assement of team work, an oral presentation, and an oral exam at the end of the lecture period. The overall impression is rated.

M 10.85 Module: Laboratory Hardware and Software in Power Electronic Systems [M-ETIT-103263]

Responsible: Prof. Dr.-Ing. Marc Hiller
Organisation: KIT Department of Electrical Engineering and Information Technology
Part of: Specialization in Mechatronics (Supplementary Modules)

Credits	Grading scale	Recurrence	Duration	Language	Level	Version
6	Grade to a tenth	Each term	1 term	German	3	2

Mandatory			
T-ETIT-106498	Laboratory Hardware and Software in Power Electronic Systems	6 CR	Hiller

Prerequisites
The moduls "M-ETIT-100402 - Workshop Schaltungstechnik in der Leistungselektronik" and "M-ETIT-100404 - Workshop Mikrocontroller in der Leistungselektronik" may neither be started nor completed.

10.86 Module: Laboratory Mechatronic Measurement Systems [M-ETIT-103448]

Responsible: Prof. Dr.-Ing. Michael Heizmann
Organisation: KIT Department of Electrical Engineering and Information Technology
Part of: Master's Transfer Account

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

Mandatory			
T-ETIT-106854	Laboratory Mechatronic Measurement Systems	6 CR	Heizmann

Competence Certificate
The success control is carried out in the form of a written test of 120 minutes. If there are fewer than 20 candidates, an oral exam of around 20 minutes can alternatively take place. The module grade is the grade of the written or oral exam.

Prerequisites
none

Competence Goal

- Students have in-depth knowledge of different methods for measuring objects, especially surfaces.
- Students master different procedures for the metrological recording of objects and know the relevant requirements, procedures and results.
- Students are able to implement procedures for evaluating sensor data from (surface) measuring devices and to evaluate the quality of the measurement result.

Content
A large number of different measuring methods and systems can be used for the quality inspection of technically manufactured objects and their surfaces. Examples are white light interferometry, confocal microscopy and systems based on focus variation. The measurement methods and systems naturally differ in terms of the physical measurement principle used, but also in terms of the evaluation of the raw sensor data recorded.

In this internship, different systems for the metrological recording of (technical) surfaces are presented and their properties are characterized. In the test dates, the students themselves create procedures and algorithms for processing the sensor data in order to obtain information about the desired geometric and / or optical properties of the examined surface. The algorithms obtained are evaluated on the basis of sensor data from exemplary objects and characterized in terms of the quality of the measurement statements achieved.

Module grade calculation
The module grade is the grade of the written or oral exam.

Annotation
The submission of the protocols of all experiments is required for admission to the examination. The quality of the protocols is assessed; for the admission to the exam, the quality must be acceptable. Attendance of all laboratory dates including the introductory event is required. Already in the event of a single unexcused absence, admission to the examination will not be granted.

Workload
Total: approx. 160 hours, of which

1. Attendance time in introductory session: 1.5 hours
2. Preparation of the test dates: 32 h
3. Attendance time in test appointments (8 appointments of 4 hours each): 32 hours
4. Follow-up of the test dates, Creation of the minutes: 32 h
5. Exam preparation and attendance in the same: 60 h

Recommendation
Knowledge from the lectures "Metrology" or "Metrology in Mechatronics" and "Manufacturing Metrology" as well as basic knowledge of programming (e.g. in Matlab, C / C ++) are helpful.

M 10.87 Module: Laboratory Mechatronics [M-MACH-102699]

Responsible: Prof. Dr. Veit Hagenmeyer
Prof. Dr.-Ing. Wolfgang Seemann
Prof. Dr.-Ing. Christoph Stiller

Organisation: KIT Department of Mechanical Engineering

Part of: Master's Transfer Account

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

Mandatory			
T-MACH-105370	Laboratory Mechatronics	4 CR	Hagenmeyer, Stiller

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

Competence Goal
The students are able to put the knowledge from the specialization in mechatronics and microsystems technology into practice on an exemplary mechatronic system, a handling system. The students can create an automated object recognition, calculate kinematic systems and realize a communication between different systems (PC, CAN, USB).

Furthermore, the students can integrate the individual parts of a manipulator in teamwork to a functioning overall system.

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

Part II
In a group work, a kinematic system has to be programmed so that it is able to recognize and grip objects fully automatically.

Module grade calculation
The module is not graded. Passing the module is 100% tied to the performance assessment of the partial performance.

Workload

1. Attendance time Lecture: 15 * 2 h = 30h
2. self-study: 15 * 6 h = 90h

Total: 120h = 4 LP

Learning type
Seminar

M 10.88 Module: Lightweight Engineering Design [M-MACH-102696]

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

Part of: Master's Transfer Account

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

Mandatory			
T-MACH-105221	Lightweight Engineering Design	4 CR	Düser, Ott

Competence Certificate
Written examination (90 min)

Prerequisites
none

Competence Goal
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.

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.

Workload
1. Time of presence lecture: 15 * 2 h = 30 h

2. Prepare/follow-up lecture: 15 * 2 h = 30 h

3. Exam preparation and time of presence: 60 h
Total: 120 h = 4 LP

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

M 10.89 Module: Linear Electric Circuits [M-ETIT-104519]

Responsible: Prof. Dr.-Ing. John Jelonnek
Prof. Dr. Sebastian Kempf

Organisation: KIT Department of Electrical Engineering and Information Technology

Part of: Engineering Fundamentals

Credits	Grading scale	Recurrence	Duration	Language	Level	Version
9	Grade to a tenth	Each winter term	1 term	German	1	2

Mandatory			
T-ETIT-109316	Linear Electronic Networks	7 CR	Jelonnek, Kempf
T-ETIT-109317	Linear Electronic Networks - Workshop A	1 CR	Leibfried, Lemmer
T-ETIT-109811	Linear Electronic Networks - Workshop B	1 CR	Nahm

Competence Certificate
The assessment of the entire module consists of three independent parts:

1. the contents of the Linear Electrical Circuits course (7 CP) are examined in a written examination lasting 120 minutes. Students who pass the examination can receive a grade bonus of up to 0.4 grade points if they have successfully completed two project tasks during the semester. Proof of completion of the project tasks is provided by submitting documentation or the project code within the processing period.

2. written report for the course Linear Electrical Circuits - Workshop A, (1 CP)

3. written report for the course Linear Electrical Circuits - Workshop B, (1 CP)

The following applies to both workshops: The written papers are corrected and awarded points. If the required number of points is achieved, the workshop is deemed to have been passed.

Competence Goal
In the module Linear Electrical Circuits, students acquire skills in the analysis and design of electrical circuits with linear components with direct current and alternating current. They will be able to recall and understand the topics and apply the methods covered in order to analyze electrical circuits with linear components and assess their relevance, correct function and properties.

In the workshop, students learn how to coordinate a project in small teams and how to present the results in the form of technical documentation. Furthermore, they are able to recognize basic simple problems from electrical engineering (e.g. measurement technology, analog circuit technology) and to develop practical and decision-relevant solutions.

Content
The following topics are covered in the course Linear Electrical Circuits:

- Methods for analyzing complex linear electrical circuits
- Definitions of U, I, R, L, C, independent sources, dependent sources
- Kirchhoff's equations, junction potential method, mesh current method
- Substitute current source, substitute voltage source, star-delta transformation, power matching
- Operational amplifier, inverting amplifier, adder, voltage follower, non-inverting amplifier, differential amplifier
- Sinusoidal currents and voltages, differential equations for L and C, complex numbers
- Description of RLC circuits with complex numbers, impedance, complex power, power matching
- Bridge circuits, Wheatstone, Maxwell-Wien and Wien bridge circuits
- Series and parallel resonant circuits
- Four-pole theory, Z, Y and A matrix, impedance transformation, locus curves and Bode diagrams
- Transformer, mutual inductance, transformer equations, equivalent circuit diagrams of the transformer
- Three-phase current, power transmission and symmetrical load

In Workshop A, students are introduced to the current topic of renewable energy sources. For this purpose, a solar cell is used and various practical scenarios are realized with guidance in order to get to know the properties of photovoltaics and the advantages of an energy storage system. The task is to investigate the optimal utilization of renewable energy sources or the effects of shading on solar modules. In addition, a long-term experiment will introduce students to the basic functions of MATLAB and demonstrate the possibilities of a data logger.

In Workshop B, the students will be introduced to various circuits with operational amplifiers. The task ranges from literature research, simulation and experimental setup to measuring the real circuit and discussing the results. Simple basic circuits are considered, such as inverting and non-inverting amplifiers, differential amplifiers or RC and RL elements. In addition, active filters with operational amplifiers (low-pass/high-pass of higher order, RLC element) are constructed and characteristic curves such as the amplitude or phase response are evaluated.

Module grade calculation

The module grade corresponds to the grade for the Linear Electrical Circuits course. As described in the section "Competence Certificate", this is made up of the grade for the written examination Linear Electrical Circuits and any grade bonus received. In addition, passing both workshops is a prerequisite for passing the module.

Annotation

Attention:

The courses assigned to this module are part of the orientation examination for the following degree programs:

- Bachelor of Electrical Engineering and Information Technology (SPO 2018, §8)
- Bachelor of Biomedical Engineering (SPO 2022, §8)

The examination must be taken at the end of the 2nd semester. A repeat examination must be taken by the end of the 3rd semester.

Workload

The workload of the Linear Electrical Circuits course includes

1. Attendance time in lectures, exercises
2. Preparation/follow-up work
3. Exam preparation and attendance in the same

The workload for point 1 corresponds to about 60 hours, for points 2-3 about 115 -150 hours. The total workload for the course Linear Electrical Circuits is 175-210 hours. This corresponds to 7 CP.

The workload of a workshop is made up as follows:

1. Attendance time in the preparatory event incl. follow-up: 2h
2. Working on the assignment: 23h
3. Preparation of the written paper (minutes): 5h

The time required per workshop is approximately 30 hours. This corresponds to 1 CP each.

10.90 Module: Localization of Mobile Agents (24613) [M-INFO-100840]

Responsible: Prof. Dr.-Ing. Uwe Hanebeck
Organisation: KIT Department of Informatics
Part of: Master's Transfer Account

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

Mandatory			
T-INFO-101377	Localization of Mobile Agents	6 CR	Hanebeck

M 10.91 Module: Logistics and Supply Chain Management [M-MACH-105298]

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

Part of: Master's Transfer Account (Usage from 4/1/2020)

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

Mandatory			
T-MACH-110771	Logistics and Supply Chain Management	9 CR	Furmans

Competence Certificate
The assessment consists of a 120 minutes written examination (according to §4(2), 1 of the examination regulation).

Prerequisites
None

Competence Goal
The student

- has comprehensive and well-founded knowledge of the central challenges in logistics and supply chain management, an overview of various practical issues and the decision-making requirements and models in supply chains,
- can model supply chains and logistics systems using simple models with sufficient accuracy,
- identifies cause-effect relationships in supply chains,
- is able to evaluate supply chains and logistics systems based on the methods they have mastered.

Content
Logistics and Supply Chain Management provides comprehensive and well-founded fundamentals for the crucial issues in logistics and supply chain management. Within the scope of the lectures, the interaction of different design elements of supply chains is emphasized. For this purpose, qualitative and quantitative description models are used. Methods for mapping and evaluating logistics systems and supply chains are also covered. The lecture contents are enriched by exercises and case studies and partially the comprehension of the contents is provided by case studies. The interacting of the elements will be shown, among other things, in the supply chain of the automotive industry.

Module grade calculation
grade of the module is grades of the exam

Workload
contact hours (1 HpW = 1 h x 15 weeks):

- lecture: 60 h

independent study:

- preparation and follow-up lectures: 90 h
- preparation of case studies: 60 h
- examination preparation: 60 h

total: 270 h

Recommendation
none

Learning type
Lectures, tutorials, case studies.

Literature
Knut Alicke: Planung und Betrieb von Logistiknetzwerken: Unternehmensübergreifendes Supply Chain Management, 2003

Dieter Arnold et. al.: Handbuch Logistik, 2008

Marc Goetschalkx: Supply Chain Engineering, 2011

M 10.92 Module: Machine Dynamics [M-MACH-102694]

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

Part of: Master's Transfer Account

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

Mandatory			
T-MACH-105210	Machine Dynamics	5 CR	Proppe

Competence Certificate
Written examination

Prerequisites
none

Competence Goal
Students are able to apply engineering-oriented calculation methods in order to model and to understand dynamic effects in rotating machinery. This includes the investigation of runup, stationary operation of rigid rotors including balancing, transient and stationary behavior of flexible rotors, critical speeds, dynamics of slider-crank mechanisms, torsional oscillations.

Content
1. Introduction

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

Workload
Lectures and exercices: 32 h

Studies: 118 h

Learning type
Lecture, tutorial

M 10.93 Module: Machine Learning 1 [M-WIWI-105003]

Responsible: Prof. Dr.-Ing. Johann Marius Zöllner
Organisation: KIT Department of Economics and Management
Part of: Master's Transfer Account

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

Mandatory			
T-WIWI-106340	Machine Learning 1 - Basic Methods	5 CR	Zöllner

Competence Certificate
The assessment of this course is a written examination (60 min) according to §4(2), 1 of the examination regulation or an oral exam (20 min) following §4, Abs. 2, 2 of the examination regulation.

The exam takes place every semester and can be repeated at every regular examination date.

Prerequisites
None

Competence Goal

- Students gain knowledge of the basic methods in the field of machine learning.
- Students understand advanced concepts of machine learning and their application.
- Students can classify, formally describe and evaluate methods of machine learning.
- Students can use their knowledge to select suitable models and methods for selected problems in the field of machine learning.

Content
The course prepares students for the rapidly evolving field of machine learning by providing a solid foundation, covering core concepts and techniques to get started in the field. Students delve into different methods in supervised, unsupervised, and reinforcement learning, as well as various model types, ranging from basic linear classifiers to more complex methods, such as deep neural networks. Topics include general learning theory, support vector machines, decision trees, neural network fundamentals, convolutional neural networks, recurrent neural networks, unsupervised learning, reinforcement learning, and Bayesian learning.

The course is accompanied by a corresponding exercise, where students gain hands-on experience by implementing and experimenting with different machine learning algorithms, helping them to apply machine learning algorithms on real world problems.

By the end of the course, students will have acquired a solid foundation in machine learning, enabling them to apply state-of-the-art algorithms to solve complex problems, contribute to research efforts, and explore advanced topics in the field.

Workload
The total workload for this module is approximately 150 hours.

Literature
Further reading

- Machine Learning - Tom Mitchell
- Deep Learning - Ian Goodfellow, Yoshua Bengio, Aaron Courville
- Pattern Recognition and Machine Learning - Christopher M. Bishop
- Artificial Intelligence: A Modern Approach - Peter Norvig and Stuart J. Russell
- Reinforcement Learning: An Introduction - Richard S. Sutton and Andrew G. Barto

Further (specific) literature on individual topics will be given in the lecture.

M 10.94 Module: Machine Learning 2 [M-WIWI-105006]

Responsible: Prof. Dr.-Ing. Johann Marius Zöllner
Organisation: KIT Department of Economics and Management
Part of: Master's Transfer Account

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

Mandatory			
T-WIWI-106341	Machine Learning 2 – Advanced Methods	5 CR	Zöllner

Competence Certificate
The assessment of this course is a written examination (60 min) according to §4(2), 1 of the examination regulation or an oral exam (20 min) following §4, Abs. 2, 2 of the examination regulation.

The exam takes place every semester and can be repeated at every regular examination date.

Prerequisites
None

Competence Goal

- Students gain knowledge of the basic methods in the field of machine learning.
- Students understand advanced concepts of machine learning and their application.
- Students can classify, formally describe and evaluate methods of machine learning.
- Students can use their knowledge to select suitable models and methods for selected problems in the field of machine learning.

Content
The subject area of machine intelligence and, in particular, machine learning, taking into account real challenges of complex application domains, is a rapidly expanding field of knowledge and the subject of numerous research and development projects.

The lecture "Machine Learning 2" deals with modern advanced methods of machine learning such as semi-supervised and active learning, deep neural networks (deep learning, CNNs, GANs, diffusion models, transformer, adversarial attacks) and hierarchical approaches, e.g. reinforcement learning. Another focus is the embedding and application of machine learning methods in real systems.

The lecture introduces the latest basic principles as well as extended basic structures and elucidates previously developed algorithms. The structure and the mode of operation of the methods and methods are presented and explained by means of some application scenarios, especially in the field of technical (sub) autonomous systems (vehicles, robotics, neurorobotics, image processing, etc.).

Workload
The total workload for this module is approximately 150 hours.

Literature

- Deep Learning - Ian Goodfellow
- Artificial Intelligence: A Modern Approach - Peter Norvig and Stuart J. Russell
- Machine Learning - Tom Mitchell
- Pattern Recognition and Machine Learning - Christopher M. Bishop
- Reinforcement Learning: An Introduction - Richard S. Sutton and Andrew G. Barto
- Deep Learning - Ian Goodfellow, Yoshua Bengio, Aaron Courville

10.95 Module: Machine Learning for Robotic Systems 1 [M-MACH-106457]

Responsible: Jun.-Prof. Dr. Rania Rayyes
Organisation: KIT Department of Mechanical Engineering
Part of: Master's Transfer Account (Usage from 10/1/2023)

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

Mandatory			
T-MACH-113064	Machine Learning for Robotic Systems 1	5 CR	Rayyes

Competence Certificate
The assessment of this course is a written examination (90 min) according to §4(2), 1 of the examination regulation or an oral exam (20 min) following §4, Abs. 2, 2 of the examination regulation.

Prerequisites
None

Competence Goal

- Students acquire knowledge of the basic methods and concepts of Machine Learning
- Students can select suitable models and methods for learning problem in robotic systems
- Students can evaluate, compare and judge different machine learning models
- Student can implement and apply Machine Learning methods for Robotic Applications

Content
This lecture provides an overview of essential and current methods and concepts of Machine Learning for different robotic applications. It covers also their underlying mathematical and statistical methods. Important fundamental terminology, concepts and methods are presented for various topics including:

- Model selection, machine learning bias vs. parameter optimization
- Training, test, validation, generalization, overfitting, regularization
- Supervised vs unsupervised learning
- Regression
- Classifications
- Neural Networks
- Gaussian mixtures, Gaussian mixture regression

And other interesting topics

Annotation
None

Workload
150h

- approx 25h lecture attendance
- approx 25h attendance of exercises
- approx 70h studying and completing of the exercise sheets
- approx 30h exam preparation

Recommendation
None

Learning type
Lecture, exercise

Literature
None

M 10.96 Module: Machine Learning for Robotic Systems 2 [M-MACH-106652]

Responsible: Jun.-Prof. Dr. Rania Rayyes
Organisation: KIT Department of Mechanical Engineering
Part of: Master's Transfer Account (Usage from 4/1/2024)

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

Mandatory			
T-MACH-113403	Machine Learning for Robotic Systems 2	5 CR	Rayyes

Competence Certificate
The assessment of this course is a written examination (90 min) according to §4(2), 1 of the examination regulation or an oral exam (20 min) following §4, Abs. 2, 2 of the examination regulation.

Prerequisites
None

Competence Goal
- Students acquire knowledge of the basic methods and concepts of Machine Learning
- Students can select suitable models and methods for learning problems in robotic systems
- Students can evaluate, compare, and judge different machine learning models
- Students can implement and apply Machine Learning methods for Robotic Applications

Content
This lecture provides an overview of current advanced machine learning for different robotic applications. Important fundamental terminology, concepts, and methods are presented for various topics including:
- Active Learning
- Transformers
- Adversarial learning, GANs
- Deep Reinforcement Learning
- Goal-Directed Exploration
- Recurrent Neural Network

And other interesting topics

The course also includes hands-on sessions for programming and implementing the methods.

M 10.97 Module: Machine Tools and Industrial Handling [M-MACH-105107]

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

Part of: Master's Transfer Account (Usage from 4/1/2020)

Credits	Grading scale	Recurrence	Duration	Language	Level	Version
8	Grade to a tenth	Each winter term	1 term	German	4	2

Mandatory			
T-MACH-110962	Machine Tools and High-Precision Manufacturing Systems	8 CR	Fleischer

Competence Certificate
Oral exam (40 minutes)

Competence Goal
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.

Content
The module gives an overview of the construction, use and application of machine tools and high-precision manufacturing systems. In the course of the module 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 module 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

Workload
1. Presence time lecture/exercise: 15 * 6 h = 90 h
2. Pre- and post-processing time lecture/exercise: 15 * 9 h = 135 h
3. Exam preparation and presence in the same: 15 h
In total: 240 h = 8 LP

Learning type
Lecture, exercise, field trip

M 10.98 Module: Machine Vision (Sp-MV) [M-MACH-101923]

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

Organisation: KIT Department of Mechanical Engineering

Part of: Master's Transfer Account (Usage from 10/1/2021)

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

Mandatory			
T-MACH-105223	Machine Vision	8 CR	Lauer, Stiller

Competence Certificate
Type of Examination: written exam
Duration of Examination: 60 minutes

Prerequisites
None

Competence Goal
After having participated in th lecture the participants have gained knowledge on modern techniques of machine vision and pattern recognition which can be used to evaluatecamera images. This especially includes techniques in the areas of gray level image analysis, analysis of color images, segementation of images, describing the geometrical relationship between the image and the 3-dimensional world, and pattern recognition with various classification techniques. The participants have learned to analyze the algorithms mathematically, to implement them in software, and to apply them to tasks in video analysis. The participants are able to analyze real-world problems and to develop appropriate solutions.

Content
The lecture on machine vision covers basic techniques of machine vision. It focuses on the following topics:

image preprocessing

edge and corner detection

curve and parameter fitting

color processing

image segmentation

camera optics

pattern recognition

deep learning

Image preprocessing:

The chapter on image processing discusses techniques and algorithms to filter and enhance the image quality. Starting from an analysis of the typical phenomena of digital camera based image capturing the lecture introduces the Fourier transform and the Shannon-Nyquist sampling theorem. Furthermore, it introduces gray level histogram based techniques including high dynamic range imaging. The disussion of image convolution and typical filters for image enhancement concludes the chapter.

Edge and corner detection:

Gray level edges and gray level corners play an important role in machine vision since gray level edges often reveal valueable information about the boundaries and shape of objects. Gray level corners can be used as feature points since they can be identified easily in other images. This chapter introduces filters and algorithms to reveal gray level edges and gray level corners like the Canny edge detector and the Harris corner detector.

Curve and parameter fitting:

In order to describe an image by means of geometric primitives (e.g. lines, circles, ellipses) instead of just pixels robust curve and parameter fitting algorithms are necessary. The lecture introduces and discusses the Hough transform, total least sum of squares parameter fitting as well as robust alternatives (M-estimators, least trimmed sum of squares, RANSAC)

Color processing:

The short chapter on color processing discusses the role of color information in machine vision and introduces various models for color understanding and color representation. It concludes with the topic of color consistency.

Image Segmentation:

Image segmentation belongs to the core techniques of machine vision. The goal of image segmentation is to subdivide the image into several areas. Each area shares common properties, i.e. similar color, similar hatching, or similar semantic interpretation. Various ideas for image segmentation exist which can be used to create more or less complex algorithms. The lecture introduces the most important approaches ranging from the simpler algorithms like region growing, connected components labeling, and morphological operations up to highly flexible and powerful methods like level set approaches and random fields.

Camera optics:

The content of an image is related by the optics of the camera to the 3-dimensional world. In this chapter the lecture introduces optical models that describe the relationship between the world and the image including the pinhole camera model, the thin lens model, telecentric cameras, and catadioptric sensors. Furthermore, the lecture introduces camera calibration methods that can be used to determine the optical mapping of a real camera.

Pattern recognition:

Pattern recognition aims at recognizing semantic information in an image, i.e. not just analyzing gray values or colors of pixels but revealing which kind of object is shown by the pixels. This task goes beyond classical measurement theory and enters the large field of artificial intelligence. Rather than just being developped and optimized by a programmer, the algorithms are adapting themselves to their specific task using training algorithms that are based on large collections of sample images.

The chapter of pattern recognition introduces standard techniques of pattern recognition in the context of image understanding like the support vector machine (SVM), decision trees, ensemble and boosting techniques. It combines those classifiers with powerful feature representation techniques like the histogram of oriented gradients (HOG) features, locally binary patterns (LBP), and Haar features.

Deep learning:

Throughout recent years standard pattern recognition technqiues have more and more been outperformed by deep learning techniques. Deep learning is based on artificial neural networks, a very generic and powerful form of a classifier. The lecture introduces multi layer perceptrons as the most relevant form of artificial neural networks, discusses training algorithms and strategies to achieve powerful classifiers based on deep learning including deep auto encoders, convolutional networks, and multi task learning, among others.

Workload
240 hours, omposed out of

hours of lecture: 15*4 h = 60 h

preparation time prior to and after lecture: 15*6 h = 90 h

exam preparation and exam: 90 h

Learning type
Lecture

Literature
Main results are summarized in the slides that are made available as pdf-files. Further recommendations will be presented in the lecture.

M 10.99 Module: Manufacturing Measurement Technology [M-ETIT-103043]

Responsible: Prof. Dr.-Ing. Michael Heizmann
Organisation: KIT Department of Electrical Engineering and Information Technology
Part of: Specialization in Mechatronics (Supplementary Modules)

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

Mandatory			
T-ETIT-106057	Manufacturing Measurement Technology	3 CR	Heizmann

Prerequisites
none

M 10.100 Module: Manufacturing Processes [M-MACH-102549]

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

Part of: Engineering Fundamentals

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

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

Competence Certificate
written exam (duration: 60 min)

Prerequisites
none

Competence Goal
The students …

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

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

The following topics will be covered:

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

Workload
regular attendance: 21 hours
self-study: 99 hours

Learning type
Lecture

M 10.101 Module: Material Flow in Logistic Systems [M-MACH-104984]

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

Part of: Master's Transfer Account

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

Mandatory			
T-MACH-102151	Material Flow in Logistic Systems	9 CR	Furmans

Competence Certificate
The assessment (Prüfungsleistung anderer Art) consists of the following assignments:

- 40% assessment of the final case study as individual performance,
- 60% semester evaluation which includes working on 5 case studies and defending those (For both assessment types, the best 4 of 5 tries count for the final grade.):
  - 40% assessment of the result of the case studies as group work,
  - 20% assessment of the oral examination during the case study colloquiums as individual performance.

A detailed description of the learning control can be found under Annotations.

Prerequisites
none

Competence Goal
The student

- acquires 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,
- is able to illustrate logistic systems with adequate accuracy by using simple models,
- is able to realize coherences within logistic systems,
- is able to evaluate logistic systems by using the learnt methods.

Content
The module *Material Flow in Logistic Systems* 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. To gain a deeper understanding, the course is accompanied by exercises and case studies.

Annotation
Students are divided into groups for this course. Five case studies are carried out in these groups. The results of the group work during the lecture period are presented and evaluated in writing. In the oral examination during the case study colloquiums, the understanding of the result of the group work and the models dealt with in the course is tested. The participation in the oral defenses is compulsory and will be controlled. For the written submission the group receives a common grade, in the oral defense each group member is evaluated individually.

After the lecture period, there is the final case study. This case study contains the curriculum of the whole semester. The students work individually on this case study which takes place at a predefined place and time (duration: 4h).

Recommendation
Recommended elective subject: Probability Theory and Statistics

Learning type
Lecture, tutorial

M 10.102 Module: Material Science and Engineering (CIW-MACH-01) [M-MACH-102567]

Responsible: Dr.-Ing. Johannes Schneider
Organisation: KIT Department of Mechanical Engineering

Part of: Specialization in Mechatronics (Compulsary Elective Modules: Mechanical Engineering)
Specialization in Mechatronics (Compulsary Elective Modules: Electrical Engineering and Information Technology, Mechanical Engineering, Informatics, Economics and Management)
Specialization in Mechatronics (Supplementary Modules)

Credits	Grading scale	Recurrence	Duration	Language	Level	Version
9	Grade to a tenth	Each term	2 terms	German	3	1

Mandatory			
T-MACH-105148	Examination Material Science I & II	9 CR	Schneider

Competence Certificate
oral exam

Prerequisites
None

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

The students can describe the typical property profiles and can name applications for the most important engineering materials.

The students are able to describe standard materials characterization methods and can explain the evaluation of these methods. They can judge materials on base of the data obtained by these methods.

The students are able to describe the basic mechanisms of hardening for ferrous and non-ferrous materials and reflect these mechanisms using phase and TTT diagrams.

The students can interpret given phase, TTT or other diagrams relevant for materials science, gather information from them and can correlate them regarding the microstructure evolution.

The students can describe the phenomena correlated with materials science in polymers, metals and ceramics and depict differences.

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

Content
Atomic structure and atomic bonds

Structures of crystalline and amorphous solids

Defects in crystalline solids

Alloys

Transport and transformation phenomena in the solid state
Corrosion

Wear

Mechanical properties
Testing of materials
Ferrous materials

Non-ferrous metals and alloys

Polymers

Engineering ceramics
Composites

Module grade calculation
grade of the oral exam

Workload
regular attendance: 90 hours
self-study: 180 hours

Learning type
lectures and exercices

Literature
W. Bergmann: Werkstofftechnik I + II, Hanser Verlag, München, 2008/9
M. Merkel: Taschenbuch der Werkstoffe, Hanser Verlag, München, 2008
R. Schwab: Werkstoffkunde und Werkstoffprüfung für Dummies, Wiley VCH, Weinheim, 2011
J.F. Shackelford; Werkstofftechnologie für Ingenieure, Pearson Studium, München, 2008 (E-Book)
J.F. Shackelford,: Introduction to Materials Science for Engineers. Prentice Hall, 2008
lecture notes and lab script

M 10.103 Module: Materials [M-ETIT-102734]

Responsible: Prof. Dr. Martin Doppelbauer
Organisation: KIT Department of Electrical Engineering and Information Technology
Part of: Master's Transfer Account

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

Materials (Election: 1 item)			
T-MACH-100531	Systematic Materials Selection	5 CR	Dietrich, Schulze
T-MACH-105535	Composite Manufacturing - Polymers, Fibers, Semi-Finished Products, Manufacturing Technologies	4 CR	Henning
T-ETIT-109292	Electrical Engineering Components	6 CR	Kempf

Prerequisites
none

Annotation
The three parts of the module "M-ETIT-102734 - Materials" are mutually exclusive

Course „Passive Bauelemente“ will be taught in Wintersemester 2020/21 for the last time.Replacement will be "Bauelemente der Elektrotechnik".

10.104 Module: Measurement Technology [M-ETIT-105982]

Responsible: Prof. Dr.-Ing. Michael Heizmann
Organisation: KIT Department of Electrical Engineering and Information Technology
Part of: Master's Transfer Account (Usage from 10/1/2022)

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

Mandatory			
T-ETIT-112147	Measurement Technology	5 CR	Heizmann

Competence Certificate
The examination takes place in form of a written examination lasting 120 minutes.

Prerequisites
M-ETIT-102652 - Messtechnik (German version) must not have started.

Competence Goal

- Students have a sound knowledge of the theoretical foundations of measurement technology, including modeling of measurement systems, consideration of nonlinearities, stochastic deviations and stochastic signals, acquisition of analog signals, and frequency and rotational speed measurement.
- Students are proficient in the approaches to measurement system design in terms of model assumptions, methods, and achievable results.
- Students are able to analyze and formally describe measurement technology tasks, synthesize possible solutions for measurement systems and assess the properties of the solution obtained.

Content
The module deals with the formal, methodical and mathematical fundamentals for the analysis and design of measurement systems. Focal points of the course are

- Measurement systems and deviations (including scales, the SI systems, modeling of measurement systems)
- Curve fitting (approximation, interpolation)
- Stationary behavior of measurement systems (characteristic curve, errors of the characteristic curve, nonlinearities, adjustment)
- Stochastic measurement errors (probabilistic analysis, samples, statistical test methods, statistic process control, error propagation)
- Stochastic processes (correlational measurements, spectral description of stochastic signals, system identification, matched filter, Wiener filter)
- Digitization of analog signals (sampling, quantization, analog-digital converters, digital-analog converters)
- Frequency and rotational speed measurement (generalized frequency concept, digital speed measurement, detection of direction)

Module grade calculation
The module grade is the grade of the written examination.

Annotation
In the module a lecture, an exercise and an examination are offered.

Workload
The workload includes:

1. attendance in lectures and exercises: 34 h
2. preparation / follow-up of lectures and exercises: 51 h
3. preparation of and attendance in examination: 65 h

total: 150 h = 5 CR

Recommendation
Basic knowledge in the fields of “Probability Theory” as well as “Signals and Systems” is helpful.

M 10.105 Module: Mechanical Design (CIW-MACH-02) [M-MACH-101299]

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

Part of: Engineering Fundamentals

Credits	Grading scale	Recurrence	Duration	Language	Level	Version
8	Grade to a tenth	Each winter term	2 terms	German	1	4

Mandatory			
T-MACH-112225	Mechanical Design I and II	6 CR	Matthiesen
T-MACH-112226	Mechanical Design I, Tutorial	1 CR	Matthiesen
T-MACH-112227	Mechanical Design II, Tutorial	1 CR	Matthiesen

Competence Certificate
Written examination on the contents of Mechanical Design I&II

Duration: 90 min plus reading time

Preliminary examination: Successful participation in the preliminary work in the field of Mechanical Design I&II

Prerequisites
None

Competence Goal
Learning object springs:

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

Learning objects Technical Systems:

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

Learning objects Visualization:

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

Learning objects Bearings:

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

Learning objectives seals:

The students…

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

Learning design:

The students…

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

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

Learning bolted connections:

The students…

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

Content
MKL I:

Introduction to product development

Tools for visualization (technical drawing)

Product creation as a problem solution

Technical Systems Product Development

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

Basics of selected construction and machine elements

- Federn
- bearings and fence
- sealings

The lecture is accompanied by exercises with the following content:

gear workshop

Tools for visualization (technical drawing)

Technical Systems Product Development

- Systemtheorie
- Contact amd Channel Approach C&C²-A

Exercises for springs

Exercises for bearings and fence

MKL II:

- sealings
- design
- dimensioning
- component connections
- bolts

Workload
MKL1:

presence: 33,5 h

Attendance in lectures: 15 * 1.5 h = 22.5 h

Presence in exercises: 8 * 1.5 h = 12 h

self-study: 56,5 h

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

Total: 90 h = 3 LP

MKL2:

Presence: 33 h

Attendance in lectures: 15 * 1.5 h = 22.5 h

Presence in exercises: 7 * 1.5 h = 10.5 h

Self study: 87 h

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

Total: 150 h = 5 LP

Additional expenditure for degree programs from other disciplines MKL1 + MKL2 in total: 30 h = 1 LP

Learning type
Lecture

Tutorial

Project work during the semester

Online-test

M 10.106 Module: Mechanical Design III and IV (13 LP) [M-MACH-102829]

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

Organisation: KIT Department of Mechanical Engineering

Part of: Specialization in Mechatronics (Compulsary Elective Modules: Mechanical Engineering)
Specialization in Mechatronics (Compulsary Elective Modules: Electrical Engineering and Information Technology, Mechanical Engineering, Informatics, Economics and Management)
Specialization in Mechatronics (Supplementary Modules)

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

Mandatory			
T-MACH-104810	Mechanical Design III and IV	11 CR	Matthiesen
T-MACH-110955	Mechanical Design III, Tutorial	1 CR	Matthiesen
T-MACH-110956	Mechanical Design IV, Tutorial	1 CR	Matthiesen

Competence Certificate
Written examination, consisting of theoretical and constructive part.
The theoretical examination lasts 1 hour plus reading time
The constructional examination takes 3 hours plus reading time.
Both parts of the examination must be passed in order to pass the overall examination for machine design apprenticeship III+IV.

Prerequisites
None

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

Content
tolerances and fits

component connections

gears

basics of component dimensioning

shaft clutches

fundamentals of fluid technology

electrical machines

Workload
MKL 3:

Presence: 45 h

Attendance time lecture (15 L): 22,5h

Attendance time exercises (7 exercises): 10,5h

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

Self-study: 135h

Project work in a team: 90h

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

MKL 4:

Presence: 40,5 h

Attendance lectures (13 L): 19,5h

Attendance time exercises (6 exercises): 9h

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

Self-study: 169,5 h

Project work in a team: 105h

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

Total: 390 h = 13 LP

Learning type
Lecture

Tutorial

Project work during the semester

M 10.107 Module: Mechanics in Microtechnology [M-MACH-102713]

Responsible: Prof. Dr. Christian Greiner
Dr. Patric Gruber

Organisation: KIT Department of Mechanical Engineering

Part of: Master's Transfer Account

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

Mandatory			
T-MACH-105334	Mechanics in Microtechnology	4 CR	Greiner, Gruber

Competence Certificate
oral exam ca. 30 minutes

Prerequisites
none

Competence Goal
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.

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,…

Workload
regular attendance: 22,5 hours
self-study: 97,5 hours

Learning type
lecture

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

10.108 Module: Mechano-Informatics and Robotics [M-INFO-100757]

Responsible: Prof. Dr.-Ing. Tamim Asfour
Organisation: KIT Department of Informatics
Part of: Specialization in Mechatronics (Compulsary Elective Modules: Electrical Engineering and Information Technology, Mechanical Engineering, Informatics, Economics and Management)
Specialization in Mechatronics (Supplementary Modules)

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

Mandatory			
T-INFO-101294	Mechano-Informatics and Robotics	4 CR	Asfour

Competence Certificate
See partial achievements (Teilleistung)

Prerequisites
See partial achievements (Teilleistung)

Competence Goal
Students understand the basics of the synergistic integration of methods from mechatronics, computer science and artificial intelligence using the example of humanoid robotics. They are acquainted with the basic concepts and methods of machine learning, the description of robot movements and actions as well as artificial neural networks and their application in robotics.

In particular, they are able to apply basic methods to problems and know relevant tools. Using research-oriented examples from humanoid robotics, students have learned – in an interactive way – to think analytically and to proceed in a structured and goal-oriented way when analyzing, formalizing and solving tasks.

Content
The lecture addresses topics at the interface between robotics and artificial intelligence, which are illustrated and explained based on examples from current research in the area of humanoid robotics. The lecture introduces fundamental algorithms in robotics and machine learning as well as methods for describing dynamical systems and representing robot motions and actions. This includes an introduction to artificial neural networks, the description of dynamical systems in state space as well as the learning of movement primitives. The topics and content are illustrated by practical examples from humanoid robotics.

Workload
Lecture with 2 SWS, 4 CP.

4 LP corresponds to approx. 120 hours, of which

approx. 40 hours of lecture attendance,

approx. 30 hours of follow-up work on the lecture

approx. 50 hours exam preparation

Recommendation
Attendance at the *Basispraktikums Mobile Roboter* is recommended.

M 10.109 Module: Mechatronical Systems and Products [M-MACH-102749]

Responsible: Prof. Dr.-Ing. Sören Hohmann
Prof. Dr.-Ing. Sven Matthiesen

Organisation: KIT Department of Mechanical Engineering

Part of: Engineering Fundamentals

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

Mandatory			
T-MACH-105574	Mechatronical Systems and Products	3 CR	Hohmann, Matthiesen
T-MACH-108680	Workshop Mechatronical Systems and Products	4 CR	Hohmann, Matthiesen

Competence Certificate
Success is monitored within the framework of an written examination (60 minutes) and an alternative academic achievement

Prerequisites
None

Competence Goal
The students

- are able to describe the difficulties of interdisciplinary projects.
- are able to coordinate processes, structures, responsibilities and interfaces within a project
- know different solutions for mechanic/electric problems
- know the elements of the treated product development processes, are able to describe different views onto them and execute them
- know the model based systems engineering approaches
- know the basic principles of virtual design and are able to apply the methods of virtual system design
- are able to identify the differences between virtuality and reality
- are able to recognize the advantages of early validation
- Students are able to understand and apply model description with Bond graphs and generalized system elements
- Students are able to synthesize and analyze multi-domain models
- Students are able to apply parameter identification methods

Content
The lecture provides the theoretic basics, which will be applied and enhanced in development project during the semester. The project will take part in small groups, where the students have to organize and distribute the tasks on their own. In the project work - the workshop Mechatronic Systems and Products - they work on a development task in teams. This involves various development phases, from the development of technical solution concepts to the development and validation of virtual prototypes and physical functional prototypes.

Module grade calculation
The module grade is composed in equal parts of the grades of the module's sub-services.

Annotation
All relevant content (scripts, exercise sheets, etc.) for the course can be obtained via the eLearning platform ILIAS. To participate in the course, please complete the survey " Anmeldung und Gruppeneinteilung " in ILIAS before the start of the semester.

Workload
1. Time of presence lecture: 17 * 1.5 h= 25,5 h

2. Prepare/follow-up lecture: 17 * 1.5 h= 25,5 h

3. Time of presence exercise + workshop: 4 * 1,5h + 12 * 7h = 90 h

4. Prepare/follow-up exercise: 4 * 1.5h = 6 h

5. Exam preparation and time of presence: 33 h
Total: 180 h = 6 LP

Recommendation
It is recommended not to take this module with other time-consuming workshops, such as MD, at the same time.

Learning type
Lecture, exercise and project work

Literature

Janschek, Klaus (2010): Systementwurf mechatronischer Systeme. Methoden - Modelle - Konzepte. Berlin, Heidelberg: Springer.

Weilkiens, Tim (2008): Systems engineering mit SysML/UML. Modellierung, Analyse, Design. 2., aktualisierte u. erw. Aufl. Heidelberg: Dpunkt-Verl.

M 10.110 Module: Medical Imaging Technology I [M-ETIT-106449]

Responsible: Prof. Dr. Maria Francesca Spadea
Organisation: KIT Department of Electrical Engineering and Information Technology
Part of: Specialization in Mechatronics (Supplementary Modules) (Usage from 10/1/2023)
Master's Transfer Account (Usage from 10/1/2023)

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

Mandatory			
T-ETIT-113048	Medical Imaging Technology I	3 CR	Spadea

Competence Certificate
The examination takes place in form of a written examination lasting 60 minutes.

Prerequisites
none

Competence Goal
For each imaging modality students will be able to:

- identify required energy source;
- analyze the interactions between the form of energy and biological tissue distinguishing desired signal from noise contribution;
- critically interpret the image content to derive knowledge
- evaluate image quality and implementing strategies to improve it.

Moreover, the students will be able to communicate in technical and clinical English languange.

Content
The module Medical Imaging Technology I provides knowledge on

- the basic knowledge of mathematical and physical principles of medical imaging formation, including X-ray based modalities, nuclear medicine imaging, magnetic resonance imaging and ultrasound
- the component of medical imaging devices.
- assessment of image quality in terms of signal-to-noise-ratio, presence of artifact, spatial, spectral and temporal resolution
- safety and protection for patients and workers.

Module grade calculation
The module grade is the grade of the written exam.

Workload

1. attendance in lectures an exercises: 2SWS = 30 h
2. preparation / follow-up: 15*2 h = 30 h
3. preparation of and attendance in examination: 30 h

A total of 90 h = 3 CR

Recommendation
Basic knowledge in the field of physics and signal processing is helpful.

M 10.111 Module: Medical Imaging Technology II [M-ETIT-106670]

Responsible: Prof. Dr. Maria Francesca Spadea
Organisation: KIT Department of Electrical Engineering and Information Technology
Part of: Master's Transfer Account (Usage from 4/1/2024)

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

Mandatory			
T-ETIT-113421	Medical Imaging Technology II	3 CR	Spadea

Competence Certificate
The examination takes place in form of a written examination lasting 60 minutes.

Prerequisites
none

Competence Goal
For each imaging modality students will be able to:

- identify required energy source;
- analyze the interactions between the form of energy and biological tissue
- distinguishing desired signal from noise contribution;
- critically interpret the image content to derive knowledge
- evaluate image quality and implementing strategies to improve it.

Moreover, the student will be able to communicate in technical and clinical English language.

Content

- the basic knowledge of mathematical and physical principles of medical imaging formation, including nuclear medicine imaging and magnetic resonance imaging.
- the component of medical imaging devices.
- assessment of image quality in terms of signal-to-noise-ratio, presence of artifact, spatial, spectral and temporal resolution
- safety and protection for patients and workers.

Module grade calculation
The module grade is the grade of the written exam.

Workload

- attendance in class: 15*2h = 30h
- preparation / follow-up: 15*2h = 30h
- exam preparation / attendance: 30h = 90h

A total of 90h = 3 CR

Recommendation

- Basic knowledge in the field of physics and signal processing is helpful.
- The contents of the module "Medical Imaging Technology I" are recommended.

10.112 Module: Microactuators [M-MACH-100487]

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

Part of: Master's Transfer Account

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

Mandatory			
T-MACH-101910	Microactuators	4 CR	Kohl

Competence Certificate
Written exam: 60 min

Prerequisites
none

Competence Goal
- Knowledge of the actuation principles including pros and cons
- Knowledge of important fabrication technologies
- Explanation of layout and function of the microactuators
- Calculation of important properties (time constants, forces, displacements, etc.)
- Development of a layout based on specifications

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

Workload
lTime of attendance: 15 * 1,5 h = 22,5 h
Preparation and follow up: 15 * 5,5 h = 82,5 h
Exam Preaparation and Exam: 15 h
Total: 120 h = 4 LP

Literature
- Lecture notes
- 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

10.113 Module: Microenergy Technologies [M-MACH-102714]

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

Part of: Master's Transfer Account

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

Mandatory			
T-MACH-105557	Microenergy Technologies	4 CR	Kohl

Competence Certificate
Oral exam: 45 min

Prerequisites
none

Competence Goal
The students can:

- describe the energy conversion principles and exemplify them
- explain the underlying concepts of thermodynamics and materials science
- illustrate the layout, fabrication and function of the treated devices
- calculate important properties (time constants, power output, efficiency, etc.)
- develop a layout based on specifications

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)

Module grade calculation
Module grade calculation
The module grade is the grade of the written exam.

Workload
Time of attendance: 15 * 1,5 h = 22,5 h

Preparation and follow up: 15 * 5,5 h = 82,5 h

Exam Preaparation and Exam: 15 h

Total: 120 h = 4 LP

Literature
- Lecture notes (overhead transparencies) „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

M 10.114 Module: Mobile Computing and Internet of Things (IN3INMC) [M-INFO-101249]

Responsible: Prof. Dr.-Ing. Michael Beigl
Organisation: KIT Department of Informatics
Part of: Specialization in Mechatronics (Supplementary Modules)

Credits	Grading scale	Recurrence	Duration	Language	Level	Version
5	Grade to a tenth	Each winter term	1 term	German	3	2

Mandatory			
T-INFO-102061	Mobile Computing and Internet of Things	2,5 CR	Beigl
T-INFO-113119	Mobile Computing and Internet of Things - Exercise	2,5 CR	Beigl

Prerequisites
None

M 10.115 Module: Motor Vehicle Laboratory [M-MACH-102695]

Responsible: Dr.-Ing. Michael Frey
Organisation: KIT Department of Mechanical Engineering

Part of: Master's Transfer Account

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

Mandatory			
T-MACH-105222	Motor Vehicle Labor	4 CR	Frey

Competence Certificate
After completion of the experiments: written examination

Duration: 90 minutes

Auxiliary means: none

Prerequisites
None

Competence Goal
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.

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

Annotation
The admission is limited to 12 persons per group.

Workload
regular attendance: 31,5 hours
self-study: 103,5 hours

Literature
1. Matschinsky, W: Radführungen der Straßenfahrzeuge, Verlag TÜV Rheinland, 1998

2. Reimpell, J.: Fahrwerktechnik: Fahrzeugmechanik, Vogel Verlag, 1992

3. Gnadler, R.: Documents to the Motor Vehicle Laboratory

M 10.116 Module: Novel Actuators and Sensors [M-MACH-105292]

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

Part of: Master's Transfer Account

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

Mandatory			
T-MACH-102152	Novel Actuators and Sensors	4 CR	Kohl, Sommer

Competence Certificate
Written exam, 60 min

Prerequisites
None

Competence Goal
- Knowledge of the actuation and sensing principles including pros and cons
- Knowledge of important fabrication technologies
- Explanation of layout and function of the actuators and sensors
- Calculation of important properties (time constants, forces, displacements, sensitivity etc.)
- Development of a layout based on specifications

Content
The content of the lecture is among others:

- Piezo actuators
- Magnetostriktive actuators
- Shape memory actuators
- Electro-/Magnetorheologicical actuators
- Sensors: Concepts, materials, fabrication
- Micromechanical sensors: Pressure, force, inertial sensors
- Temperature sensors
- Sensors for bioanalytics
- Mechano-magnetic sensors

Workload
lecture time 18 h

self preparation: 102 h

Learning type
Lecture

Literature
- Vorlesungsskript "Neue Aktoren" und Folienskript "Sensoren"
- Micro Mechatronics, K. Uchino, 2nd ed., CRC Press, Taylor & Francis Group, 2019.
- 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

M 10.117 Module: Numerical Methods [M-MATH-105831]

Responsible: Prof. Dr. Wolfgang Reichel
Organisation: KIT Department of Mathematics
Part of: Master's Transfer Account (Usage from 10/1/2021)

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

Mandatory			
T-MATH-111700	Numerical Methods - Exam	5 CR	Kunstmann, Plum, Reichel

Competence Certificate
Success control takes the form of a written examination (120 minutes).

Prerequisites
none

Competence Goal
Students who pass the module are familiar with basic concepts and ways of thinking on the topic of numerical mathematics. They know different procedures for solving linear and nonlinear problems in numerical mathematics. They are furthermore able to use numerical methods for solving problems from applications in an independent, critical, and needs-based way.

Content
In the lecture basic ideas and numerical methods for the following topics will be presented:

- systems of linear equations, Gauss-algorithm, LR-decomposition, Cholesky decomposition
- eigenvalue problems, von-Mises iteration
- linear optimization (also called linear programming)
- error analysis
- Newton’s method
- quadrature, Newton-Cotes formulas
- numerical solution of initial value problems, Runge-Kutta methods
- finite difference method for solving boundary value problems
- finite elements

Module grade calculation
The module grade is the grade of the written exam.

Workload
Approximately 150h workload. The workload includes:

45h - attendance in lectures, exercises and examination

105h – self studies:

- follow-up and deepening of the course content
- solving problem sheets
- literature study and internet research on the course content
- preparation for the module examination

M 10.118 Module: Optics and Solid State Electronics [M-ETIT-105005]

Responsible: Prof. Dr. Ulrich Lemmer
Organisation: KIT Department of Electrical Engineering and Information Technology
Part of: Specialization in Mechatronics (Supplementary Modules) (Usage from 10/1/2021)

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

Mandatory			
T-ETIT-110275	Optics and Solid State Electronics	6 CR	Lemmer

M 10.119 Module: Optoelectronic Components [M-ETIT-100509]

Responsible: Prof. Dr. Wolfgang Freude
Organisation: KIT Department of Electrical Engineering and Information Technology
Part of: Specialization in Mechatronics (Supplementary Modules)

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

Mandatory			
T-ETIT-101907	Optoelectronic Components	4 CR	Freude

Competence Certificate
Type of Examination: oral exam

Duration of Examination: approx. 30 minutes

Modality of Exam: Oral examination, usually one examination day per month during the Summer and Winter terms. An extra questions-and-answers session will be held if students wish so.

Prerequisites
none

Competence Goal
Comprehending the physical layer of optical communication systems. Developing a basic understanding which enables a designer to read a device´s data sheet, to make most of its properties, and to avoid hitting its limitations.

The students

- understand the components of the physical layer of optical communication systems
- acquire the knowledge of operation principles and impairments of optical waveguides
- know the basics of laser diodes, luminescence diodes and semiconductor optical amplifiers
- understand pin-photodiodes
- know the systems´sesitivity limits, which are caused by optical and electrical noise

Content
The course concentrates on the most basic optical communication components. Emphasis is on physical understanding, exploiting results from electromagnetic field theory, (light waveguides), solid-state physics (laser diodes, LED, and photodiodes), and communication theory (receivers, noise). The following components are discussed:

- Light waveguides: Wave propagation, slab waveguides, strip wave-guides, integrated optical waveguides, fibre waveguides
- Light sources and amplifiers: Luminescence and laser radiation, luminescent diodes, laser diodes, stationary and dynamic behavior, semiconductor optical amplifiers
- Receivers: pin photodiodes, electronic amplifiers, noise

Module grade calculation
The module grade is the grade of the oral exam.

Annotation
There are no prerequisites, but solution of the problems on the exercise sheet, which can be downloaded as homework each week, is highly recommended. Also, active participation in the problem classes and studying in learning groups are strongly advised.

Workload
total 120 h, hereof 45 h contact hours (30 h lecture, 15 h problem class), and 75 h homework and self-studies

Recommendation
Minimal background required: Calculus, differential equations, Fourier transforms and p-n junction physics.

Literature
Detailed textbook-style lecture notes as well as the presentation slides can be downloaded from the IPQ lecture pages.

Agrawal, G.P.: Lightwave technology. Hoboken: John Wiley & Sons 2004

Iizuka, K.: Elements of photonics. Vol. I, especially Vol. II. Hoboken: John Wiley & Sons 2002

Further textbooks in German (also in electronic form) can be named on request.

M 10.120 Module: Optoelectronics [M-ETIT-100480]

Responsible: Prof. Dr. Ulrich Lemmer
Organisation: KIT Department of Electrical Engineering and Information Technology
Part of: Specialization in Mechatronics (Supplementary Modules)

Credits	Grading scale	Recurrence	Duration	Language	Level	Version
4	Grade to a tenth	Each winter term	1 term	German	3	2

Mandatory			
T-ETIT-100767	Optoelectronics	4 CR	Lemmer

Competence Certificate
The success check is carried out in the context of a written exam (90 minutes).

Prerequisites
none

Module grade calculation
The module grade is the grade of the written exam.

Workload
1. Presence time in lectures, exercises: 32 h
2. Preparation / Post-processing of the same: 48 h
3. Exam preparation and presence in same: 40 h

M 10.121 Module: Organ Support Systems [M-MACH-102702]

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

Part of: Master's Transfer Account

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

Mandatory			
T-MACH-105228	Organ Support Systems	4 CR	Pylatiuk

Competence Certificate
A performance assessment is held in form of a written examination of 45 minutes.

Prerequisites
none

Competence Goal
Students have comprehensive knowledge of the functioning of support systems and their components (e.g. sensors, actuators) for different human organs (e.g. heart, kidney, liver, eye, ear, locomotor system). They know the physical basics, the technical solutions and the essential aspects of these medical technology systems and their current limitations. Furthermore, they know bioreactors and other methods of using the body's own cells to support organs (tissue engineering). Furthermore, they have comprehensive knowledge of organ transplantation and its limitations.

Content
Hemodialysis, liver dialysis, heart-lung machine, artificial hearts, biomaterials, definition and classification of organ support and organ replacement, hearing prostheses, visual prostheses, exoskeletons, neuroprostheses, endoprostheses, tissue engineering.

Module grade calculation
The module grade is the grade of the written exam.

Workload

1. Attendance time Lecture: 15 * 2h = 30h
2. Pre- and postprocessing time Lecture: 15 * 3h= 45h
3. Exam preparation and attendance exam: 45h

Total: 120h = 4 LP

Recommendation
The content of module MMACH-105235 complements this lecture.

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.

M 10.122 Module: Orientation Exam [M-MACH-104333]

Organisation: University
Part of: Orientation Exam

Credits	Grading scale	Recurrence	Duration	Language	Level	Version
0	pass/fail	Each term	2 terms	German	1	1

Mandatory			
T-MACH-100282	Engineering Mechanics I	7 CR	Böhlke, Langhoff
T-ETIT-109316	Linear Electronic Networks	7 CR	Jelonnek, Kempf
T-ETIT-109317	Linear Electronic Networks - Workshop A	1 CR	Leibfried, Lemmer
T-ETIT-109811	Linear Electronic Networks - Workshop B	1 CR	Nahm

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

Prerequisites
None

10.123 Module: Photovoltaic System Design [M-ETIT-100411]

Responsible: Dipl.-Ing. Robin Grab
Organisation: KIT Department of Electrical Engineering and Information Technology
Part of: Specialization in Mechatronics (Supplementary Modules)

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

Mandatory			
T-ETIT-100724	Photovoltaic System Design	3 CR	Grab

Prerequisites
none

10.124 Module: Physiology and Anatomy for Engineers I [M-ETIT-100390]

Responsible: Prof. Dr. Werner Nahm
Organisation: KIT Department of Electrical Engineering and Information Technology
Part of: Specialization in Mechatronics (Supplementary Modules)

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

Mandatory			
T-ETIT-101932	Physiology and Anatomy for Engineers I	3 CR	Nahm

Competence Certificate
Success control is carried out in the form of a written test of 60 minutes.

Prerequisites
The module "M-ETIT-105874 – Physiologie und Anatomie für die Medizintechnik" must not been started.

Content
The lecture provides basic knowledge about the essential organ systems of humans and medical terminology. It is aimed at students of technical courses who are interested in physiological issues.

Thematic blocks:

- Organizational levels of the organism
- Building blocks of life
  - Proteins
  - Lipids
  - Carbohydrates
  - Lipids
  - Nuleic acids
- Cells
  - Structure
  - Membrane transport processes
  - Protein biosynthesis
  - Cell respiration
  - Nerve cells
  - Muscle cells
- Tissue
  - Tissue types
  - Cell connections
- Sensory organs
  - Eye
  - Hearing

Module grade calculation
The module grade is the grade of the written exam.

Workload
Each credit point corresponds to approximately 25-30 hours of work (of the student). This is based on the average student who achieves an average performance. The workload includes:

- Attendance time in lectures (2 h, 15 appointments each) = 30 h
- Self-study (3 h, 15 appointments each) = 45 h
- Preparation / post-processing = 15 h

Total effort approx. 90 hours = 3 LP

M 10.125 Module: Power Electronic Systems in Energy Technology [M-ETIT-106067]

Responsible: Prof. Dr.-Ing. Marc Hiller
Organisation: KIT Department of Electrical Engineering and Information Technology
Part of: Master's Transfer Account (Usage from 10/1/2022)

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

Mandatory			
T-ETIT-112286	Power Electronic Systems in Energy Technology	6 CR	Hiller

Prerequisites
none

10.126 Module: Power Electronics [M-ETIT-104567]

Responsible: Prof. Dr.-Ing. Marc Hiller
Organisation: KIT Department of Electrical Engineering and Information Technology
Part of: Master's Transfer Account (Usage from 10/1/2022)

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

Mandatory			
T-ETIT-109360	Power Electronics	6 CR	Hiller

Competence Certificate
The examination takes place in form of a written examination lasting 120 minutes.

Prerequisites
None

Competence Goal
Students will be familiar with state-of-the-art power semiconductors including their application related features. Furthermore students will be familiar with the circuit topologies for DC/DC and DC/AC power conversion. They know the associated modulation and control methods and characteristics. They are able to analyze the circuit topologies with regard to harmonics and power losses. This also includes the thermal design of power electronic circuits. In addition, they are able to select and combine suitable circuits for given electrical energy conversion requirements.

Content
In the lecture, power electronic circuits for DC/DC and DC/AC power conversion using IGBTs and MOSFETs are presented and analyzed. First, the basic properties of self-commutated circuits under idealized
conditions are elaborated using the DC/DC converter as an example. Then, self-commutated power converters for three-phase applications are presented and analyzed with respect to modulation and their AC
and DC terminal behavior. Based on the real power semiconductor behavior in on- and off-state the device losses are calculated. Furthermore the thermal design of power converters is explained using thermal equivalent circuits of power devices and cooling equipment. The voltage and current stress on the power
semiconductors in switching operation is explained as well as protective snubber circuits allowing a reliable operation within the safe operating area of the devices.

In detail, the following topics are treated:

- Power Semiconductors
- Commutation principles
- DC/DC converters
- Self-commutated 1ph and 3ph DC/AC inverters
- Modulation methods (Fundamental frequency modulation, Pulse width modulation with 3rd harmonic injection, Space vector modulation)
- Multilevel inverters
- Switching behavior in hard and soft switching applications
- Loss calculation
- Thermal equivalent circuits, thermal design
- Snubber circuits.

The lecturer reserves the right to adapt the contents of the lecture to current needs without prior notice.

Module grade calculation
The module grade is the grade of the written exam.

Workload
14x lecture and 14x exercise à 2 h = 56 h
14x wrap-up of the lecture à 1 h = 14 h
14x preparation of the exercise à 2 h = 28 h
Preparation for the exam = 75 h
Examination time = 2 h
Total = approx. 175 h (corresponds to 6 LP)

M 10.127 Module: Power Generation [M-ETIT-100407]

Responsible: Dr.-Ing. Bernd Hoferer
Organisation: KIT Department of Electrical Engineering and Information Technology
Part of: Specialization in Mechatronics (Supplementary Modules)

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

Mandatory			
T-ETIT-101924	Power Generation	3 CR	Hoferer

Competence Certificate
Success is assessed in an overall oral examination (approx. 20 minutes) on the selected course.

Competence Goal
Students are able to recognize energy technology problems and develop solutions. They have gained an understanding of the physical and theoretical relationships in energy technology. They are also able to describe, analyze and explain the developed solutions in a scientific format.

Content
Basic lecture on the generation of electrical energy. From the conversion of the earth's primary energy resources in coal-fired power plants and in nuclear power plants to the use of renewable energies, the lecture covers the entire spectrum of generation. The lecture provides an overview of the physical principles, the technical and economic aspects and the development potential of generating electrical energy from both conventional and renewable sources.

Module grade calculation
The module grade is the grade of the oral examination.

Workload
Attendance time: 30 h

Self-study time: 60 h

Total 90 h = 3 LP

10.128 Module: Power Transmission and Power Network Control [M-ETIT-100534]

Responsible: Prof. Dr.-Ing. Thomas Leibfried
Organisation: KIT Department of Electrical Engineering and Information Technology
Part of: Master's Transfer Account

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

Mandatory			
T-ETIT-101941	Power Transmission and Power Network Control	5 CR	Leibfried

Prerequisites
none

M 10.129 Module: Practical Aspects of Electrical Drives [M-ETIT-100394]

Responsible: Prof. Dr. Martin Doppelbauer
Organisation: KIT Department of Electrical Engineering and Information Technology
Part of: Master's Transfer Account

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

Mandatory			
T-ETIT-100711	Practical Aspects of Electrical Drives	4 CR	Doppelbauer

Competence Certificate
Success is assessed in a written examination lasting 120 minutes.

Prerequisites
none

Competence Goal
Students understand the function of all components of modern electrical drive systems. They have detailed knowledge of the basic electrical machine types and know the function and physical behavior of loads and other drive components. Students will be able to design electrical drive systems for an application-specific use, taking into account all boundary conditions, and calculate their mechanical and electrical behavior.

Content
The lecture is divided into the following areas

- Drive systems
- electric motors
- Transmission elements
- Drive and load
- Starting, braking, positioning
- Thermal and protection
- Variable speed drives
- Electromagnetic compatibility
- Small drives
- Noise
- Drives with limited movement

Module grade calculation
The module grade is the grade of the written examination.

Workload
14x lecture + 7x exercises of 1.5 h each = 31.5 h

14x post-processing of lectures à 1 h = 14 h

6x preparation of exercises à 2 h = 12 h

Preparation for the exam = 50 h

Total = 107.5 h (corresponds to 4 CP)

Recommendation
To understand the module, basic knowledge in the field of electrical machines is recommended (acquired, for example, by attending the modules "Electrical Machines and Power Electronics"

M 10.130 Module: Practical Project Robotics and Automation I (Software) [M-INFO-102224]

Responsible: Prof. Dr.-Ing. Björn Hein
Prof. Dr.-Ing. Thomas Längle

Organisation: KIT Department of Informatics

Part of: Master's Transfer Account

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

Mandatory			
T-INFO-104545	Practical Project Robotics and Automation I (Software)	6 CR	Hein, Längle

M 10.131 Module: Practical Project Robotics and Automation II (Hardware) [M-INFO-102230]

Responsible: Prof. Dr.-Ing. Björn Hein
Prof. Dr.-Ing. Thomas Längle

Organisation: KIT Department of Informatics

Part of: Master's Transfer Account

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

Mandatory			
T-INFO-104552	Practical Project Robotics and Automation II (Hardware)	6 CR	Hein, Längle

M 10.132 Module: Principles of Medicine for Engineers [M-MACH-102720]

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

Part of: Master's Transfer Account

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

Mandatory			
T-MACH-105235	Principles of Medicine for Engineers	4 CR	Pylatiuk

Competence Certificate
A performance assessment is held in form of a written examination of 45 minutes.

Prerequisites
none

Competence Goal
Students have a comprehensive understanding of the functioning and anatomical construction of organs, which are assigned to different medical disciplines. Furthermore, they know the physical basics, the technical solutions and the essential aspects of the application of medical technology procedures in diagnostics and therapy. They are familiar with common clinical pictures in the different medical disciplines and their relevance in health care. Through their acquired knowledge, students can communicate with physicians about medical-technical procedures and assess mutual expectations more realistically.

Content
Definition of disease and health and history of medicine, evidence-based medicine" and personalized medicine, nervous system, conduction, musculoskeletal system, cardiovascular system, anesthesia, respiratory system, sensory organs, gynecology, digestive organs, surgery, nephrology, orthopedics, immune system, genetics.

Module grade calculation
The module grade is the grade of the written exam.

Workload

1. Attendance time Lecture: 15 * 2h = 30h
2. Pre- and postprocessing time Lecture: 15 * 3h= 45h
3. Exam preparation and attendance exam: 45h

Total: 120h = 4 LP

Recommendation
The content of module MMACH-105228 complements this lecture.

Literature

- Adolf Faller, Michael Schünke: Der Körper des Menschen. Thieme Verlag.
- Renate Huch, Klaus D. Jürgens: Mensch Körper Krankheit. Elsevier Verlag.

M 10.133 Module: Principles of Whole Vehicle Engineering I [M-MACH-105289]

Responsible: Prof.Dipl.-Ing. Rolf Frech
Dr.-Ing. Martin Gießler
Dr.-Ing. Hans-Joachim Unrau

Organisation: KIT Department of Mechanical Engineering

Part of: Master's Transfer Account

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

Mandatory			
T-MACH-105162	Fundamentals of Automobile Development I	2 CR	Frech

Competence Certificate
Written exam, duration approximately 90 minutes.

Auxiliary means: none

Competence Goal
The students have an overview of the entire development process of a passenger car. In addition to the chronological sequence of passenger car development, they also know the national and international legal requirements. They have knowledge of the conflict of objectives between aerodynamics, thermal management and design. They will be able to assess conflicting goals in the area of passenger car development and work out possible solutions.

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

Workload
The total work load for this module is about 60 Hours (2 Credits). The partition of the work load is carried out according to the credit points of the courses of the module. The work load for courses with 2 credit points is about 60 hours.

Learning type
Lecture

M 10.134 Module: Principles of Whole Vehicle Engineering II [M-MACH-105290]

Responsible: Prof.Dipl.-Ing. Rolf Frech
Dr.-Ing. Hans-Joachim Unrau

Organisation: KIT Department of Mechanical Engineering

Part of: Master's Transfer Account

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

Mandatory			
T-MACH-105163	Fundamentals of Automobile Development II	2 CR	Frech

Competence Certificate
Written exam, duration: approximately 90 minutes.

Auxiliary means: none

Competence Goal
Students are familiar with the selection of suitable materials and with various manufacturing techniques. They have an overview of the acoustics of the vehicle. They are familiar with both the aspects of acoustics in the interior of the vehicle and the aspects of exterior noise. They are familiar with testing the vehicle and assessing the overall vehicle characteristics. They are able to participate competently in the development process of the entire vehicle.

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

Workload
The total work load for this module is about 60 Hours (2 Credits). The partition of the work load is carried out according to the credit points of the courses of the module. The work load for courses with 2 credit points is about 60 hours.

Learning type
Lecture

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

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

Part of: Master's Transfer Account

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

M 10.136 Module: Production Techniques Laboratory [M-MACH-102711]

Responsible: Prof. Dr.-Ing. Barbara Deml
Prof. Dr.-Ing. Kai Furmans
Prof. Dr.-Ing. Jivka Ovtcharova
Prof. Dr.-Ing. Volker Schulze

Organisation: KIT Department of Mechanical Engineering

Part of: Master's Transfer Account

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

Mandatory			
T-MACH-105346	Production Techniques Laboratory	4 CR	Deml, Fleischer, Furmans, Ovtcharova

Competence Certificate
A performance assessment (non-graded) is obligatory and can be oral, a written exam, or of another kind.

Prerequisites
None

Competence Goal
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.

Content
The production technique laboratory (PTL) is a collaboration of the institutes wbk, IFL, IMI and ifab.

1. Computer Aided Product Development (IMI)
2. Computer communication in factory (IMI)
3. Production of parts with CNC turning machines (wbk)
4. Controlling of production systems using PLCs (wbk)
5. Automated assembly systems (wbk)
6. Optical identification in production and logistics (IFL)
7. RFID identification systems (IFL)
8. Storage and order-picking systems (IFL)
9. Design of workstations (ifab)
10. Time study (ifab)
11. Accomplishment of workplace design (ifab)

Workload
Present time: 20 h

Self study: 100 h

Learning type
Seminar

Literature
Handout and literature online ILIAS.

M 10.137 Module: Programming (IN1INPROG) [M-INFO-101174]

Responsible: Prof. Dr.-Ing. Anne Koziolek
Prof. Dr. Ralf Reussner

Organisation: KIT Department of Informatics

Part of: Specialization in Mechatronics (Compulsary Elective Modules: Electrical Engineering and Information Technology, Mechanical Engineering, Informatics, Economics and Management)
Specialization in Mechatronics (Supplementary Modules)

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

Mandatory			
T-INFO-101967	Programming Pass	0 CR	Koziolek, Reussner
T-INFO-101531	Programming	6 CR	Koziolek, Reussner

Competence Goal
Students should learn

- basic structures of the programming language Java and how to apply them; in particular control and simple data structures, object orientation and implementation of basic algorithms
- basics of programming methodology and the ability to autonomously write executable small to medium sized Java programs

Content

- objects and classes
- types, values and variables
- methods
- control structures
- recursion
- references, lists
- inheritance
- input and output
- exceptions
- programming methodology
- implementation of basic algorithms in Java (such as sorting algorithms)

M 10.138 Module: Project Management in the Development of Products for Safety-Critical Applications [M-ETIT-104475]

Responsible: Dr.-Ing. Manfred Nolle
Prof. Dr.-Ing. Eric Sax

Organisation: KIT Department of Electrical Engineering and Information Technology

Part of: Master's Transfer Account

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

Mandatory			
T-ETIT-109148	Project Management in the Development of Products for Safety-Critical Applications	4 CR	Nolle

M 10.139 Module: Quality Management [M-MACH-105332]

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

Part of: Master's Transfer Account

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

Mandatory			
T-MACH-102107	Quality Management	4 CR	Lanza

Competence Certificate
Written Exam (60 min)

Prerequisites
None

Competence Goal
The students …

- are capable to comment on the content covered by the module.
- are capable of substantially quality philosophies.
- are able to apply the QM tools and methods they have learned about in the module to new problems from the context of the module.
- are able to analyze and evaluate the suitability of the methods, procedures and techniques they have learned about in the module for a specific problem.

Content
Based on the quality philosophies Total Quality Management (TQM) and Six-Sigma, the module will specifically address the needs of a modern quality management. The process orientation in a modern company and the process-specific fields of quality assurance are presented in detail. Preventive as well as non-preventive quality management methods, which are state of the art in operational practice today, are content of the module. The use of suitable measurement techniques in production engineering (production measurement technology) as well as their potential levels of integration in the production system are discussed. The use of suitable statistical methods for data analysis and their modern extension by methods of artificial intelligence are be discussed. The contents are complemented by legal aspects in the field of quality management.

Main topics of the module:

- The term "Quality"
- Total Quality Management (TQM)
- Six-Sigma and universal methods and tools within the DMAIC cycle
- QM in early product stages – Determination and realization of customer requirements
- QM in product development
- Production measurement Technology
- QM in production - statistical Methods
- Artificial intelligence and machine learning in quality Management
- Operating behaviour and reliability
- Legal aspects in QM

Workload
1. Presence time lecture: 15 * 2 h = 30 h
2. Pre- and post-processing time lecture: 15 * 3 h = 45 h
3. Exam preparation and presence in the same: 45 h
In total: 120 h = 4 LP

Learning type
Lecture

10.140 Module: Radiation Protection [M-ETIT-100562]

Responsible: PD Dr. Bastian Breustedt
Prof. Dr. Werner Nahm

Organisation: KIT Department of Electrical Engineering and Information Technology

Part of: Specialization in Mechatronics (Supplementary Modules)

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

Mandatory			
T-ETIT-100825	Radiation Protection	3 CR	Breustedt, Nahm

Competence Certificate
Success control is carried out as part of an overall written examination (2 h).

Prerequisites
none

Competence Goal

- The students understand the terminology used in radiation protection and apply it correctly.
- The students are able to describe the types of ionizing radiation, their properties and the principles for their measurement.
- The students are able to describe the biological risks associated to exposures to ionizing radiation.
- The students are able to describe the basic principles of radiation protection and their implementation in national and international law.
- Based on a basic understanding of the scientific foundations of radiation protection the students are able to critically evaluate radiation protection measures for a given situation, which involves the use of ionizing radiation.

Content
The module covers the basics of radiation protection for ionizing radiation and provides an overview of the subject.

The topics which will be covered are:

- Ionizing Radiation and its applications,
- Interaction of Radiation with Matter,
- Biological Effects of Radiation,
- Measurement of Radiation – Principles and detector designs,
- Measurement of Radiation – Applications and Examples
- Dosimetry for external + internal Exposures,
- Legal Aspects (Regulation, Ethics) and
- Radiation Protection – Principles and Application

The students will gain insight on ionizing radiation, it's applications and the biological risks associated with exposures to ionizing radiation. The scientific foundations of radiation protection (natural sciences, engineering, medicine as well as sociological and legal basics) are summarized. The pricinclples, standards and practice of radiation protection in applications of ionizing radiaition are derived and demonstrated.

Module grade calculation
The module grade is the grade of the written exam.

Workload
Each credit point corresponds to approximately 25-30 hours of work (of the student). This is based on the average student who achieves an average performance. The workload includes:

Attendance time in lectures (2 h * 15 appointments each) = 30 h

Self-study (3 h * 15 appointments each) = 45 h

Preparation / post-processing = 20 h

Total effort approx. 95 hours = 3 LP

Recommendation
Basic knowledge in the field of physics is helpful.

M 10.141 Module: Radio-Frequency Electronics [M-ETIT-105124]

Responsible: Prof. Dr.-Ing. Ahmet Cagri Ulusoy
Organisation: KIT Department of Electrical Engineering and Information Technology
Part of: Specialization in Mechatronics (Supplementary Modules)

Credits	Grading scale	Recurrence	Duration	Language	Level	Version
5	Grade to a tenth	Each winter term	1 term	English	3	2

Mandatory			
T-ETIT-110359	Radio-Frequency Electronics	5 CR	Ulusoy

Competence Certificate
The success criteria will be determined by a written examination of 120 min.

Prerequisites
none

Competence Goal
* The students have a comprehensive understanding of the theory and the basic design methodology of electronic circuits at high frequencies.

* They understand the limitations of active and passive circuit elements including various transistor technologies and their impact on the applications.

* They understand the limitations and how linear network theory is applied for advanced electronic circuits.

* The students can apply the acquired theoretical knowledge using modern design tools.

Content
In this module, the theory and design methodology of high-frequency electronic circuits will be studied in detail. The focus of the module is on the fundamentals of active linear circuits. The important topics are phasor analysis, resonance, impedance matching networks, two-port parameters of transistors, high-frequency behavior of basic amplifier circuits, practical design methodology of high-frequency amplifiers, and introduction to the design of non-linear circuits using the linear design methodology. In the tutorial the student will have the possibility to apply their theoretical knowledge by designing, assembling and testing a radio-frequency amplifier in the framework of a design challeng

Module grade calculation
The module grade is the grade of the written examination.

Workload
1. Attendance to the lectures (15*(2)=30h)

2. Attendance to the exercises and workshop (15*(2)=30h)

3. Preparation to the lectures, exercises and workshop (15*(1+1)=30h)

4. Preparation of homework assignments and to the oral exam (20+40h)

Total: 150h = 5L

Recommendation
Contents of the modules "Linear electrical networks" and "Electronic circuits".

M 10.142 Module: Rail System Technology [M-MACH-103232]

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

Part of: Master's Transfer Account

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

Mandatory			
T-MACH-106424	Rail System Technology	4 CR	Cichon

Competence Certificate
written examination in German language
Duration: 60 minutes
No tools or reference materials may be used during the exam except calculator and dictionary

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.

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

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

Workload
Regular attendance: 21 hours

Self-study: 21 hours

Exam and preparation: 78 hours

total: 120 hours = 4 ECTS

Learning type
Lecture

M 10.143 Module: Rail Vehicle Technology [M-MACH-102683]

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

Part of: Master's Transfer Account

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

Mandatory			
T-MACH-105353	Rail Vehicle Technology	4 CR	Cichon

Competence Certificate
written examination in German language
Duration: 60 minutes
No tools or reference materials may be used during the exam except calculator and dictionary
.

Prerequisites
none

Competence Goal

- 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.

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

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

Workload
Regular attendance: 21 hours

Self-study: 21 hours

Exam and preparation: 78 hours

total: 120 hours = 4 ECTS

Learning type
Lecture

M 10.144 Module: Railway System Digitalisation [M-MACH-106513]

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

Part of: Master's Transfer Account (Usage from 10/1/2023)

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

Mandatory			
T-MACH-113016	Digitization in the Railway System	4 CR	Cichon

Competence Certificate
Examination performance oral
Duration approx. 20 minutes
Auxiliary means: none

Prerequisites
none

Competence Goal
The students have a basic understanding of train control and its technical implementation in Germany, the functioning of the European Train Control System (ETCS) and its planning, Automated Train Operation. They are able to explain the knowledge they have acquired (terms, interrelationships) in context and apply it to issues in practice. Furthermore, the students can classify the operational and technical advantages and disadvantages in the context of the digitalization of the rail network in Germany and take future challenges into account.
The students can discuss the technical aspects and areas of application of ETCS in the different levels and reproduce the main features of balise planning for ETCS Level 2. Digital planning approaches such as PlanPro as well as measurement and test runs are known and can be classified.

Content
1. introduction and motivation: organizational aspects; current developments in Germany, Europe
2. Basics of the railroad system: terminology; interaction of rolling stock, infrastructure and operations
3. Securing train movements: overview of possibilities and areas of application; operational and technical aspects with a focus on Germany
4. Basics of interlockings, control and safety elements: Train protection in Germany with PZB, LZB
5. Safety and security: EN5012x, CENELEC, RAMS
6. European Train Control System (ETCS): specification; system components, braking curves; ETCS level and modes, train integrity; interface between vehicle and infrastructure, data exchange; infrastructure-side ETCS balise planning using the example of ETCS level 2; track surveying, commissioning; digitization of the planning process using the example of PlanPro
7. Automatic Train Operation (ATO), Communication-Based Train Control (CBTC): system architecture, Grade of Automation (GoA); advantages and challenges ATO; differences CTBC to ETCS
8. Future Developments: Future Railway Mobile Communication System (FRMCS) as successor to GSM-R.

Annotation
A bibliography is available for students to download from the Ilias platform.

Workload
Attendance time: 21 hours
Preparation / wrap-up: 21 hours
Exam and exam preparation: 78 hours
Total effort: 120 hours = 4 LP

Learning type
Lecture

Literature

- ETCS for Engineers, Stanley, 2011, ISBN 978-3-96245-034-2
- European Train Control System (ETCS), Schnieder, ISBN 978-3-662-66054-6
- Communications-Based Train Control (CBTC), Schnieder, ISBN 978-3-662-61012-1

M 10.145 Module: Real-Time Systems (24576) [M-INFO-100803]

Responsible: Prof. Dr.-Ing. Thomas Längle
Organisation: KIT Department of Informatics
Part of: Specialization in Mechatronics (Compulsary Elective Modules: Electrical Engineering and Information Technology, Mechanical Engineering, Informatics, Economics and Management)
Specialization in Mechatronics (Supplementary Modules)

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

Mandatory			
T-INFO-101340	Real-Time Systems	6 CR	Längle

M 10.146 Module: Robotics - Practical Course [M-INFO-102522]

Responsible: Prof. Dr.-Ing. Tamim Asfour
Organisation: KIT Department of Informatics
Part of: Master's Transfer Account

Credits	Grading scale	Recurrence	Duration	Language	Level	Version
6	Grade to a tenth	Each summer term	1 term	English	4	3

Mandatory			
T-INFO-105107	Robotics - Practical Course	6 CR	Asfour

Competence Certificate
See partial Achievements (Teilleistung)

Prerequisites
See partial Achievements (Teilleistung)

Competence Goal
The student knows concrete solutions for different problems in robotics. He/she uses methods of inverse kinematics, grasp and motion planning, and visual perception. The student can implement solutions in the programming languages C++ and Python with the help of suitable software frameworks.

Content
The practical course is offered as an accompanying course to the lectures Robotics I-III. Every week, a small team of students will work on solving a given robotics problem. The list of topics includes robot modeling and simulation, inverse kinematics, robot programming via state charts, collision-free motion planning, grasp planning, robot vision and robot learning.

Workload
Practical course with 4 SWS, 6 LP
6 LP corresponds to 180 hours, including
2 hours introductory event
18 hours initial familiarization with the software framework
120 hours group work
40 hours attendance time

Recommendation
Attending the lectures Robotics I – Introduction to Robotics, Robotics II: Humanoid Robotics, Robotics III - Sensors and Perception in Robotics and Mechano-Informatics and Robotics is recommended.

M 10.147 Module: Robotics I - Introduction to Robotics [M-INFO-100893]

Responsible: Prof. Dr.-Ing. Tamim Asfour
Organisation: KIT Department of Informatics
Part of: Specialization in Mechatronics (Compulsary Elective Modules: Electrical Engineering and Information Technology, Mechanical Engineering, Informatics, Economics and Management)
Specialization in Mechatronics (Supplementary Modules)
Master's Transfer Account

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

Mandatory			
T-INFO-108014	Robotics I - Introduction to Robotics	6 CR	Asfour

Competence Certificate
See partial achivements (Teilleistung)

Prerequisites
See partial achivements (Teilleistung)

Competence Goal
The student is 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 student masters the kinematic and dynamic modeling of robot systems, as well as the modeling and design of simple controllers. The student knows the algorithmic basics of motion and grasp planning and can apply these algorithms to problems in robotics. He/she knows algorithms from the field of image processing and is able to apply them to problems in robotics. He/she is able to model and solve tasks as a symbolic planning problem. The student has knowledge about intuitive programming procedures for robots and knows procedures for programming and learning by demonstration.

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

10.148 Module: Robotics II - Humanoid Robotics [M-INFO-102756]

Responsible: Prof. Dr.-Ing. Tamim Asfour
Organisation: KIT Department of Informatics
Part of: Master's Transfer Account

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

Mandatory			
T-INFO-105723	Robotics II - Humanoid Robotics	3 CR	Asfour

Competence Certificate
See partial achievements (Teilleistung)

Prerequisites
See partial achievements (Teilleistung)

Competence Goal
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.

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.

Workload
Lecture with 2 SWS, 3 CP.
3 LP corresponds to approx. 90 hours, thereof:
approx. 15 * 2h = 30 Std. Attendance time
approx. 15 * 2h = 30 Std. Self-study prior/after the lecture
approx. 30 Std. Preparation for the exam and exam itself

Recommendation
Having visited the lectures on Robotics I - Introduction to Robotics and Mechano-Informatics and Robotics is recommended.

M 10.149 Module: Robotics III - Sensors and Perception in Robotics (24635) [M-INFO-104897]

Responsible: Prof. Dr.-Ing. Tamim Asfour
Organisation: KIT Department of Informatics
Part of: Master's Transfer Account

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

Mandatory			
T-INFO-109931	Robotics III - Sensors and Perception in Robotics	3 CR	Asfour

Competence Certificate
See partial achivements (Teilleistung)

Prerequisites
See partial achivements (Teilleistung)

Competence Goal
Students can name the main sensor principles used in robotics.

Students can explain the data flow from physical measurement through digitization to the use of the recorded data for feature extraction, state estimation and semantic scene understanding.

Students are able to propose and justify suitable sensor concepts for common tasks in robotics.

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.

Workload
Lecture with 2 SWS, 3 LP
3 LP corresponds to 90 hours, including
15 * 2 = 30 hours attendance time
15 * 2 = 30 hours self-study
30 hours preparation for the exam

Recommendation
Attending the lecture Robotics I – Introduction to Robotics is recommended.

M 10.150 Module: Seamless Engineering [M-MACH-105725]

Responsible: Prof. Dr.-Ing. Kai Furmans
Prof. Dr.-Ing. Eric Sax

Organisation: KIT Department of Mechanical Engineering

Part of: Master's Transfer Account

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

Mandatory			
T-MACH-111401	Seamless Engineering	9 CR	Furmans, Sax

Competence Certificate
Examination of another type. The module grade is the grade of the brick. The description of the form of examination can be found in the description of the partial performance.

Prerequisites
None

Competence Goal
After successful completion of the course, the students are able to model and parameterise the requirements and boundary conditions for typical mechatronic systems. In addition, students learn the ability to select the appropriate procedures, processes, methods and tools for the development of a mechatronic system.

Important core competences in the areas of communication, problem solving and self-organisation are further essential components of the workshop, which enable the students to do reflected work independently and in a team.

Content
This module is designed to teach students how to develop a heterogeneous integrated mechatronic system. In the lecture, students are introduced to a system-oriented, higher-level approach to the description, assessment and development of a mechatronic system.

Parallel to this, the contents taught are applied and deepened in the practical part on hardware that is close to industry. The students learn the systematic development in a simulative environment as well as the transition from simulation to real hardware.

To achieve this, important components of software development in the robotics environment are taught. This includes, among other things, the basics of programming (Python) as well as the handling of the framework "Robot Operating System (ROS)". In addition, students gain insights into the use of sensors and actuators, image processing, autonomous navigation of automated guided vehicles and robotic grasping.

Annotation
None

Workload

1. attendance time lecture and exercise: 45 h
2. interdisciplinary qualification: 45 h
3. group work project: 130 h
4. colloquia and final event: 30 h
5. exam preparation and presence in the same: 20 h

In total: 270 = 9 LP

Recommendation
None

Learning type
Lecture, exercise, project.

Literature
None

10.151 Module: Seminar Battery I [M-ETIT-105319]

Responsible: Dr.-Ing. Andre Weber
Organisation: KIT Department of Electrical Engineering and Information Technology
Part of: Specialization in Mechatronics (Supplementary Modules) (Usage from 4/1/2020)

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

Mandatory			
T-ETIT-110800	Seminar Battery I	3 CR	

Competence Certificate
The performance review takes the form of a written paper and a seminar presentation. The overall impression will be evaluated.

Prerequisites
none

Competence Goal
After completion of the seminar the students are able to work independently on an engineering problem in the field of batteries, to analyze the related literature and to present it in the form of a written paper and a presentation.

Content
The seminar "Batteries I" is primarily aimed at bachelor students who are planning to write their bachelor thesis in the field of batteries. In this seminar the participants will work on a scientific topic in the field of batteries. This usually includes a literature study, the compilation of the methods, procedures and results described in the publications as well as a critical evaluation of the same. In individual cases, next to a literature study more practical topics can be in focus.

The results are summarized in a seminar paper and presented in a lecture during the seminar. The grading is based on the written paper as well as the presentation.

Module grade calculation
The assessment of the written paper and the seminar presentation will be included in the module grade. Further details will be given at the beginning of the course.

Workload
1. presence time seminar: 15 * 2 h = 30 h
2. preparation of seminar paper: 30 h
3. preparation of seminar presentation: 30 h

Total: 90 h = 3 LP

M 10.152 Module: Seminar Embedded Systems [M-ETIT-100455]

Responsible: Prof. Dr.-Ing. Jürgen Becker
Prof. Dr.-Ing. Eric Sax
Prof. Dr. Wilhelm Stork

Organisation: KIT Department of Electrical Engineering and Information Technology

Part of: Specialization in Mechatronics (Compulsary Elective Modules: Electrical Engineering and Information Technology, Mechanical Engineering, Informatics, Economics and Management)

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

Mandatory			
T-ETIT-100753	Seminar Embedded Systems	4 CR	Becker, Sax, Stork

Competence Certificate
Success is assessed in the form of a written paper, reviews and a presentation. The overall impression is assessed.

Prerequisites
none

Competence Goal
Seminar participants can independently familiarize themselves with a given technical topic, identify all relevant aspects and summarize the results. In this context, students can identify relevant literature in terms of the research question, assess the strengths and weaknesses of existing approaches and methods, and formally evaluate other works according to specified criteria. They can also suggest new aspects in line with the research question. They can present the results of their work concisely in the form of a short text (approx. 6-page paper, usually written in English) and an approx. 15-minute presentation in words and pictures (slides).

Content
In the "Embedded Systems" seminar, students work on a given topic from the field of information processing through literature and internet research under the guidance of research assistants and then present it to the other seminar participants in a short text (approx. 6-page paper, usually written in English) and a 15-minute presentation in words and pictures (slides). The students give each other feedback as part of a peer review and thus experience a part of the scientific publication process.

Module grade calculation
The grading is based on the elaboration, the mutual review and the presentation.

Workload
The workload includes:

1. Independent familiarization with a topic: 50h
2. Writing a scientific article: 40h
3. Preparing a peer review: 10h
4. Preparing and giving a presentation: 20h

Total: 120h = 4 LP

M 10.153 Module: Seminar Fuel Cell I [M-ETIT-105320]

Responsible: Dr.-Ing. Andre Weber
Organisation: KIT Department of Electrical Engineering and Information Technology
Part of: Specialization in Mechatronics (Compulsary Elective Modules: Electrical Engineering and Information Technology, Mechanical Engineering, Informatics, Economics and Management)
Specialization in Mechatronics (Supplementary Modules)

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

Mandatory			
T-ETIT-110798	Seminar Fuel Cell I	3 CR	Weber

Competence Certificate
The examination consists of a written paper and an oral presentation of the students work. The overall impression is rated.

Prerequisites
none

Competence Goal
After completing the seminar, the students are able to familiarize themselves independently with an engineering question in the field of fuel cells, analyze the associated literature and present it in the form of a written report and a presentation.

Content
The seminar “Fuel Cell Research Projects” is primarily aimed at students who are planning to carry out a scientific thesis in the fuel cell research area.
In this seminar the participants deal with scientific questions in the field of fuel cells. This includes a literature search, the compilation of the methods, processes and results described in the publications as well as a critical evaluation of the same.

The results are summarized in a seminar paper and presented in a lecture during the seminar. The written work and a lecture that has to be given during the event are included in the grading of the thesis.

Module grade calculation
The module grade results of the assessment of the written paper and the oral presentation. Details will be given during the lecture.

Workload
1. Presence seminar: 15 * 2 h = 30 h
2. Preparation of seminar paper and lecture: 30 h
3. Preparation of seminar lecture: 30 h

Total: 90 h = 3 LP

M 10.154 Module: Seminar on Selected Chapters of Biomedical Engineering [M-ETIT-100383]

Responsible: Dr.-Ing. Axel Loewe
Organisation: KIT Department of Electrical Engineering and Information Technology
Part of: Specialization in Mechatronics (Supplementary Modules)

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

Mandatory			
T-ETIT-100710	Seminar on Selected Chapters of Biomedical Engineering	3 CR	Loewe

Competence Certificate
Success monitoring is carried out in the context of a lecture (approx. 25 minutes) followed by a discussion (approx. 10 minutes).

Prerequisites
none

Competence Goal
The students are able to research a scientific topic from biomedical technology, work out essentials, process the content, prepare a lecture and finally present it.

Content
The seminar aims to enable students to independently work on and present a scientific topic in the field of biomedical engineering in order to improve their presentation skills. First, an introduction to presentation techniques and feedback rules is given. Then there is a test presentation to try out the techniques learned. Finally, the students select a topic of biomedical engineering for their presentation and prepare a specialist lecture on this topic.

Workload
Attendance time: 15 weeks * 2SWS = 30h

Development of the topic, exchange with supervisor, preparation of the lecture: 60h

M 10.155 Module: Seminar Power Electronics in Regenerative Energy Systems [M-ETIT-100397]

Responsible: Prof. Dr.-Ing. Marc Hiller

Organisation: KIT Department of Electrical Engineering and Information Technology
KIT Department of Informatics

Part of: Specialization in Mechatronics (Supplementary Modules)

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

Mandatory			
T-ETIT-100714	Seminar Power Electronics in Regenerative Energy Systems	4 CR	Hiller

Prerequisites
none

M 10.156 Module: Sensors [M-ETIT-100378]

Responsible: Dr. Wolfgang Menesklou
Organisation: KIT Department of Electrical Engineering and Information Technology
Part of: Master's Transfer Account

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

Mandatory			
T-ETIT-101911	Sensors	3 CR	Menesklou

10.157 Module: Signals and Systems [M-ETIT-104525]

Responsible: Prof. Dr.-Ing. Michael Heizmann
Organisation: KIT Department of Electrical Engineering and Information Technology
Part of: Engineering Fundamentals

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

Mandatory			
T-ETIT-109313	Signals and Systems	6 CR	Heizmann
T-ETIT-109314	Signals and Systems - Workshop	1 CR	Heizmann

Competence Certificate
The assessment of the module consists of

1. a written examination of 120 minutes on the course Signals and Systems (6 CP)
2. a written paper on the course Signals and Systems - Workshop, (1 CP)

Prerequisites
none

Competence Goal
After completing the module, students are familiar with the representation of signals and have mastered the basics of system theory.

By applying transformations to signals and systems, they will be able to describe and evaluate solution approaches for continuous-time and discrete-time problems in signal processing. The mathematical methods learned can be transferred to problems from other areas of study.

In the workshop, students learn how to coordinate a project in small teams and how to present the results in the form of technical documentation. Furthermore, they are able to apply the theory in the field of digital signal processing systems in practice.

Content
The module is a basic lecture on signal processing. The focus of the course is on

- Mathematical foundations (mathematical spaces, basis function systems, Bessel's inequality, projection theorem)
- Continuous-time signals (function spaces, Fourier transform, leakage effect, Gibbs phenomenon, duration-bandwidth product)
- Continuous-time systems (linearity, time invariance, causality, stability, Laplace transform, system function, filtering with window functions, Hilbert transform)
- Discrete-time signals (sampling theorem, reconstruction, oversampling, undersampling, discrete Fourier transform)
- Discrete-time systems (z-transform, system function, discrete-time representation of continuous systems, filtering with window functions)

The workshop takes up many of these focal points and shows the practical application of the sampling theorem, discrete-time signals and filtering. Audio signals, pulse-width modulated signals and filtering using moving averages are used as examples.

Module grade calculation
The module grade is the grade of the written examination. In addition, passing the workshop is a prerequisite for passing the module.

Annotation
The workshop is offered in the summer semester.

The module duration is therefore 2 semesters.

Workload
The preparation (0.5 h), attendance (1.5 h) and follow-up (2 h) of the weekly lecture and exercise as well as the preparation (50-60 h) and participation (2 h) in the written exam result in a total workload of 150-160 h for the course Signals and Systems, i.e. 6 CP.

The workload of the workshop is made up as follows:

1. Attendance time in the preparatory course incl. follow-up: 2h
2. Working on the assignment: 23h
3. Preparation of the written paper (protocol): 5h

The time required per workshop is approximately 30 hours. This corresponds to 1 CP.

Recommendation
Advanced Mathematics I + II

10.158 Module: Soft Skills [M-MACH-104355]

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

Part of: Interdisciplinary Qualifications

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

Mandatory			
T-MACH-105699	Cooperation in Interdisciplinary Teams	2 CR	Matthiesen

Competence Certificate
Accompanying the workshop, delivery services are required. In these the application of the knowledge of the students is examined.

Prerequisites
None

Competence Goal
The students:

- can apply the principles for ensuring good scientific practice
- can describe the difficulties of interdisciplinary project work
- can coordinate processes, structures, areas of responsibility and interfaces within a project
- know the elements of the treated product development processes (PEP) and can explain the different views of a PEP

Content
The students receive a semester-accompanying development task, which they must solve independently. The development task is handled in small groups in which the students organize themselves and divide the tasks independently. This involves various development phases, from the development of technical solution concepts to the development and validation of virtual prototypes and physical functional prototypes. At the end of the semester, the experiences of the development task are reflected upon.

Workload
60 h, thereof 5 h attendance time, 55 h self-study and study preparation

Learning type
Exercise and project work

10.159 Module: Software Engineering I (IN1INSWT1) [M-INFO-101175]

Responsible: Prof. Dr.-Ing. Ina Schaefer
Organisation: KIT Department of Informatics
Part of: Specialization in Mechatronics (Compulsary Elective Modules: Electrical Engineering and Information Technology, Mechanical Engineering, Informatics, Economics and Management)
Specialization in Mechatronics (Supplementary Modules)

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

Mandatory			
T-INFO-101968	Software Engineering I	6 CR	Schaefer
T-INFO-101995	Software Engineering I Pass	0 CR	Schaefer

Competence Goal
The students acquire basic knowledge about the principles, methods and tools of software engineering. They learn how to build and to maintain complex software systems in a systematic way.

Content
The content of the lecture is the entire lifecycle of software, spanning project planning, system analysis, cost estimation, design, implementation, validation, verification, and finally the maintaining of software. The covered topics include UML, design patterns, software tools, programming environments and configuration control/versioning systems.

Workload
approx. 180 h

M 10.160 Module: Software Engineering II (IN4INSWT2) [M-INFO-100833]

Responsible: Prof. Dr.-Ing. Anne Koziolek
Prof. Dr. Ralf Reussner

Organisation: KIT Department of Informatics

Part of: Specialization in Mechatronics (Supplementary Modules)

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

Mandatory			
T-INFO-101370	Software Engineering II	6 CR	Koziolek, Reussner

Content
Requirements engineering, software development processes, software quality, software architectures, MDD, Enterprise Software Patterns software maintainability, software security, dependability, embedded software, middleware, domain-driven design

M 10.161 Module: Stochastic Information Processing (24113) [M-INFO-100829]

Responsible: Prof. Dr.-Ing. Uwe Hanebeck
Organisation: KIT Department of Informatics
Part of: Master's Transfer Account

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

Mandatory			
T-INFO-101366	Stochastic Information Processing	6 CR	Hanebeck

M 10.162 Module: Superconducting Magnet Technology [M-ETIT-106684]

Responsible: Prof. Dr. Tabea Arndt
Organisation: KIT Department of Electrical Engineering and Information Technology
Part of: Specialization in Mechatronics (Supplementary Modules) (Usage from 4/1/2024)

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

Mandatory			
T-ETIT-113440	Superconducting Magnet Technology	4 CR	Arndt

Competence Certificate
The examination takes place in form of an oral exam (abt. 30 minutes).

Two timeslots (weeks) for examination dates will be announced (usually near end of lecture period & end of semester)

Prerequisites
none

Competence Goal

- The students have a solid knowledge of architecture and design aspects of applications in magnets, windings and coils in power engineering.
- For the most important magnet applications the students can apply the state of the art, choose between options and can reflect the main benefits.
- The students have a clear understanding of opportunities, benefits and limitations of superconducting windings and magnets.
- The students are able to perform the required design calculations and to solve fundamental design questions independently.

Content
As the materials become increasingly mature and powerful, using superconductivity in a variety of applications of electrical engineering is of rising interest and benefit, too. This module is focuses on Superconducting Magnet Technology:

Windings, coils and magnets may be used as a device by itself (providing high magnetic fields e.g. in MRI, NMR, accelerators, industry magnets, etc.) or as components for Power Systems.

This section will cover the following aspects:

- Unique selling points of superconducting windings.
- Basic approaches and tools to design superconducting windings.
- Discussion of winding architectures
- Criteria to design the appropriate operating temperatures, materials, conductors, cooling technology for the electromagnetic purpose.
- Limits and opportunities when preparing and operating superconducting windings.
- Measures for safe operation of superconducting magnets.
- High-Field Magnets
- Magnets for Fusion Technology
- 3D topologies (e.g. in dipole magnets or motors/ generators)
- New options potentially offered by widespread use of hydrogen.
- New winding topologies

In the exercises, selected magnets will be designed and calculated analytically and with some computational tools (e.g. dipole magnets and compact, cryogen free HTS-magnets)

The lecturer may change the details of the content without further notice. Materials will be offered on ILIAS.

Module grade calculation
The module grade is the grade of the oral exam.

Workload

1. attendance in lectures and exercises: 15*3 h = 45 h
2. preparation / follow-up: 15*3 h = 45 h
3. preparation of and attendance in examination: 30 h

A total of 120 h = 4 CR

Recommendation
Having knowledge in “Superconducting Materials” is beneficial, but not mandatory.

M 10.163 Module: Superconducting Power Systems [M-ETIT-106683]

Responsible: Prof. Dr. Mathias Noe
Organisation: KIT Department of Electrical Engineering and Information Technology
Part of: Specialization in Mechatronics (Supplementary Modules) (Usage from 4/1/2024)

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

Mandatory			
T-ETIT-113439	Superconducting Power Systems	4 CR	Noe

Competence Certificate
The examination takes place in form of an oral exam (abt. 45 minutes).

Prerequisites
none

Competence Goal

- The students have a solid knowledge of architecture and design aspects of applications in windings and energy technology devices.
- For the most important power system applications the students can apply the state of the art and can reflect the main benefits.
- The students have a clear understanding of opportunities, benefits and limitations of superconducting components and devices.
- The students are able to perform the required design calculations and to solve fundamental design questions independently.

Content
As the materials become increasingly mature and powerful, using superconductivity in a variety of applications of electrical engineering is of rising interest and benefit, too. This module focuses on Superconducting Power Systems.

It will provide an overview of the state of the art, will give an insight into the basic setup, the design, the characteristic parameters and the specific operation behaviour of the following applications:

- Power Transmission Cables and Lines
- Motors and Generators
- Transformers
- Fault Current Limiters
- Magnetic Energy Storage
- Basics of Cryo Technology

For each application a design example is shown and the focus is given on the conceptual design of each application.

The lecturers may change the details of the content without further announcement.
Materials will be offered on ILIAS.

Module grade calculation
The module grade is the grade of the oral exam.

Workload

1. attendance in lectures and exercises: 15*3 h = 45 h
2. preparation / follow-up: 15*3 h = 45 h
3. preparation of and attendance in examination: 30 h

A total of 120 h = 4 CR

Recommendation
Having knowledge in „Superconducting Materials“ is beneficial.

Successful participation in „Superconductivity for Engineers“

M 10.164 Module: Superconductors for Energy Applications [M-ETIT-105299]

Responsible: apl. Prof. Dr. Francesco Grilli

Organisation: KIT Department of Chemical and Process Engineering
KIT Department of Electrical Engineering and Information Technology

KIT Department of Mechanical Engineering

Part of: Specialization in Mechatronics (Supplementary Modules)

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

Mandatory			
T-ETIT-110788	Superconductors for Energy Applications	5 CR	Grilli

Competence Certificate
oral exam approx. 30 minutes.

Prerequisites
The module “Superconducting Materials for Energy Applications” must not be taken.

Competence Goal
The students acquire a good knowledge of physical properties of superconductors including those currently employed in energy applications (niobium-based superconductors, cuprates, MgB2) and also promising recently discovered ones (pnictides)).

The students have a thorough understanding of the wide range of superconducting energy applications (magnets, cables, fault current limiters, motors, transformers, etc.). They can discuss the advantages they offer with respect to their conventional counterparts; they can al-so define the scientific and technical challenges involved in those ap-plications.

With the practical exercise, the students learn to use different software packages (Matlab, Comsol Multiphysics) and to model the electromagnetic and thermal behavior of superconducting wires and applications.

The students are able to talk about topic-related aspects in English using the technical terminology of the field of study.

Content
Superconductivity is one of the most important discoveries in physics in the twentieth century and has just celebrated its 100th birthday. Investigating the origins of the universe in particle accelerators or having detailed images of the human body with MRI would be impossible without employing technology based on superconductors. The near future will see superconductors enter our everyday life even more deeply, in the form of cables powering our cities, fault current limiters protecting our electric grids, and super-fast levitating trains reducing dramatically travel times.

The lecture provides an introduction to superconductivity with an overview of its main features and of the theories developed to explain it. Superconducting materials and their properties will be presented, especially materials currently employed in energy applications (niobium-based superconductors, uprates, MgB2) and promising recently discovered ones (pnictides). The wide range of superconducting energy applications (magnets, cables, fault current limiters, motors, transformers, etc.) will be covered as well as the advantages they offer with respect to their conventional counterparts.

The practical exercises are based on using numerical models (e.g. finite-element method or network approach) to investigate the electromagnetic and thermal behavior of superconducting wires and applications such as cables and magnets.

Module grade calculation
The module grade is the grade of the oral exam.

Workload
Each credit point (LP) corresponds to approximately 30 hours of work (by the student). This is based on the average student who achieves an average performance.

The workload in hours is broken down as follows:

1. Presence time in lectures, exercises 45 h
2. Preparation / Post-processing of the same 30 h
3. Exam preparation and presence in the same 75 h

Recommendation
A basic knowledge of electromagnetism and thermodynamics is the only requirement. Previous knowledge of superconductivity is not necessary.

M 10.165 Module: Supplementary Studies on Culture and Society [M-ZAK-106235]

Responsible: Dr. Christine Mielke
Christine Myglas

Organisation:

Part of: Additional Examinations (Usage from 4/1/2023)

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

Election notes
With the exception of the final oral exam and the practice module, students have to self-record the achievements obtained in the Supplementary Studies on Culture and Society in their study plan. 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 ZAK homepage at https://www.zak.kit.edu/begleitstudium-bak.php. The title of the examination and the amount of credits override the modules placeholders.

If you want to use ZAK achievements **both for your interdisciplinary qualifications and for the supplementary studies**, please record them in the interdisciplinary qualifications first. You can then get in contact with the ZAK study services (stg@zak.kit.edu) to also record them in your supplementary studies.

In the in-depth module, achievements have to be obtained in three different areas. The areas are as follows:

- Technology & Responsibility
- Doing Culture
- Media & Aesthetics
- Spheres of Life
- Global Cultures

You have to obtain two achievements with 3 credits each and one achievement with 5 credits. To self-record achievements in the in-depth module, you first have to elect the matching partial achievement.

Note: If you registered for the Supplementary Studies on Sustainable Development before April 1st, 2023, self-recording an achievement in this module counts as a request in the sense of §20 (2) of the regulations for the Supplementary Studies on Culture and Society. Your overall grade for the supplementary studies will thus be calculated as the average of the examantion grades, not as the average of the module grades.

Mandatory			
T-ZAK-112653	Basics Module - Self Assignment BAK	3 CR	Mielke, Myglas
In-depth Module (Election: 3 items)			
T-ZAK-112654	In-depth Module - Technology & Responsibility - Self Assignment BAK	3 CR	Mielke, Myglas
T-ZAK-112655	In-depth Module - Doing Culture - Self Assignment BAK	3 CR	Mielke, Myglas
T-ZAK-112656	In-depth Module - Media & Aesthetics - Self Assignment BAK	3 CR	Mielke, Myglas
T-ZAK-112657	In-depth Module - Spheres of Life - Self Assignment BAK	3 CR	Mielke, Myglas
T-ZAK-112658	In-depth Module - Global Cultures - Self Assignment BAK	3 CR	Mielke, Myglas
Mandatory			
T-ZAK-112660	Practice Module	4 CR	Mielke, Myglas
T-ZAK-112659	Oral Exam - Supplementary Studies on Culture and Society	4 CR	Mielke, Myglas

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

They are composed of:

- minutes
- presentations
- a seminar paper
- an internship report
- an oral examination

After successful completion of the supplementary studies, the graduates receive a graded certificate and a KIT certificate.

Prerequisites
The offer is study-accompanying and does not have to be completed within a defined period of time. Enrolment or acceptance for graduation must be present when registering for the final examination.

KIT students register for the supplementary studies by selecting this module in the student portal and self-checking a performance. In addition, registration for the individual courses is necessary, which is possible shortly before the beginning of each semester.

The course catalogue, statutes (study regulations), registration form for the oral exam, and guides for preparing the various written performance requirements can be found as downloads on the ZAK homepage at www.zak.kit.edu/begleitstudium-bak.

Competence Goal
Graduates of the Supplementary Studies on Culture and Society demonstrate a sound basic knowledge of conditions, procedures and concepts for analysing and shaping fundamental social development tasks in connection with cultural topics. They have gained a well-founded theoretical and practical insight into various cultural studies and interdisciplinary topics in the field of tension between culture, technology and society in the sense of an expanded concept of culture.

They are able to place the contents selected from the specialization module in the basic context as well as to analyse and evaluate the contents of the selected courses independently and exemplarily and to communicate about them scientifically in written and oral form. Graduates are able to analyse social topics and problem areas and critically reflect on them in a socially responsible and sustainable perspective.

Content
The Supplementary Studies on Culture and Society can be started from the 1st semester and is not limited in time. It comprises at least 3 semesters. The supplementary studies are divided into 3 modules (basics, in-depth studies, practice). A total of 22 credit points (ECTS) are earned.

The thematic elective areas of the supplementary studies are divided into the following 5 modules and their sub-topics:

Block 1Technology & Responsibility

Value change / ethics of responsibility, technology development / history of technology, general ecology, sustainability

Block 2Doing Culture

Cultural studies, cultural management, creative industries, cultural institutions, cultural policy

Block 3Media & Aesthetics

Media communication, cultural aesthetics

Block 4Spheres of Life

Cultural sociology, cultural heritage, architecture and urban planning, industrial science

Block 5Global Cultures

Multiculturalism / interculturalism / transculturalism, science and culture

Module grade calculation
The overall grade of the supplementary studies is calculated as an average of the grades of the examination performances weighted with credit points.

In-depth Module

- presentation 1 (3 ECTS)
- presentation 2 (3 ECTS)
- seminar paper incl. presentation (5 ECTS)
- oral examination (4 ECTS)

Annotation
With the Supplementary Studies on Culture and Society, KIT provides a multidisciplinary study offer as an additional qualification, with which the respective specialized study program is supplemented by interdisciplinary basic knowledge and interdisciplinary orientation knowledge in the field of cultural studies, which is becoming increasingly important for all professions.

Within the framework of the supplementary studies, students acquire in-depth knowledge of various cultural studies and interdisciplinary subject areas in the field of tension between culture, technology and society. In addition to high culture in the classical sense, other cultural practices, common values and norms as well as historical perspectives of cultural developments and influences are considered.

In the courses, conditions, procedures and concepts for the analysis and design of fundamental social development tasks are acquired on the basis of an expanded concept of culture. This includes everything created by humans - also opinions, ideas, religious or other beliefs. The aim is to develop a modern concept of cultural diversity. This includes the cultural dimension of education, science and communication as well as the preservation of cultural heritage. (UNESCO, 1982)

According to § 16 of the statutes, a reference and a certificate are issued by the ZAK for the supplementary studies. The achievements are also shown in the transcript of records of the degree program and, upon request, in the certificate. They can also be recognized in the interdisciplinary qualifications (see elective information).

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

- basic module approx. 90 h
- in-depth module approx. 340 h
- practical module approx. 120 h

total: approx. 550 h

Learning type

- lectures
- seminars
- workshops
- practical course

Literature
Recommended reading of primary and specialized literature will be determined individually by each instructor.

M 10.166 Module: Supplementary Studies on Sustainable Development [M-ZAK-106099]

Responsible: Dr. Christine Mielke
Christine Myglas

Organisation:

Part of: Additional Examinations (Usage from 4/1/2023)

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

Election notes

With the exception of the final oral exam, students have to self-record the achievements obtained in the Supplementary Studies on Sustainable Development in their study plan. 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 ZAK homepage at https://www.zak.kit.edu/begleitstudium-bene. The title of the examination and the amount of credits override the modules placeholders.

If you want to use ZAK achievements **both for your interdisciplinary qualifications and for the supplementary studies**, please record them in the interdisciplinary qualifications first. You can then get in contact with the ZAK study services (stg@zak.kit.edu) to also record them in your supplementary studies.

In the elective module, you need to obtain 6 credits worth of achievements in two of the four areas:

- Sustainable Cities & Neighbourhoods
- Sustainable Assessment of Technology
- Subject, Body, Individual: The Other Side of Sustainability
- Sustainability in Culture, Economy & Society

Usually, two achievements with 3 credits each have to be obtained. To self-record achievements in the elective module, you first have to elect the matching partial achievement.

Note: If you registered for the Supplementary Studies on Sustainable Development before April 1st, 2023, self-recording an achievement in this module counts as a request in the sense of §19 (2) of the regulations for the Supplementary Studies on Sustainable Development. Your overall grade for the supplementary studies will thus be calculated as the average of the examantion grades, not as the average of the module grades.

Mandatory			
T-ZAK-112345	Basics Module - Self Assignment BeNe	3 CR	Myglas
Elective Module (Election: at least 6 credits)			
T-ZAK-112347	Elective Module - Sustainable Cities and Neighbourhoods - Self Assignment BeNe	3 CR	
T-ZAK-112348	Elective Module - Sustainability Assessment of Technology - Self Assignment BeNe	3 CR	
T-ZAK-112349	Elective Module - Subject, Body, Individual: the Other Side of Sustainability - Self Assignment BeNe	3 CR	
T-ZAK-112350	Elective Module - Sustainability in Culture, Economy and Society - Self Assignment BeNe	3 CR	
Mandatory			
T-ZAK-112346	Specialisation Module - Self Assignment BeNe	6 CR	Myglas
T-ZAK-112351	Oral Exam - Supplementary Studies on Sustainable Development	4 CR	

Competence Certificate

The monitoring is explained in the respective partial achievement .

They are composed of:

- protocols
- a reflection report
- presentations
- presentations
- the elaboration of a project work
- an individual term paper

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

Prerequisites
The course is offered during the course of study and does not have to be completed within a defined period of time. Enrolment is required for all performance assessments of the modules of 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 self-booking a performance. Registration for courses, performance assessments and examinations is regulated by § 6 of the Statutes and is usually possible shortly before the beginning of the semester.

The course catalogue, statutes (study regulations), registration form for the oral exam and guidelines for preparing the various written performance requirements can be found as downloads on the ZAK homepage at http://www.zak.kit.edu/begleitstudium-bene.

Competence Goal
Graduates of the supplementary studies in sustainable development acquire additional practical and professional competencies. Thus, the supplementary study program enables the acquisition of basics and initial experience in project management, trains teamwork skills, presentation skills and self-reflection, and also creates a fundamental understanding of sustainability that is relevant for all professional fields.

Graduates are able to analyse social topics and problem areas and critically reflect on them in a socially responsible and sustainable perspective. They are able to place the contents selected from the modules "Elective" and "Advanced" in the basic context as well as to independently and exemplarily analyse and evaluate the contents of the selected courses and to scientifically communicate about them in written and oral form.

Content
The supplementary study program Sustainable Development can be started from the 1st semester and is not limited in time. The wide range of courses offered by ZAK makes it possible to complete the program usually within three semesters. The supplementary studies comprise 19 credit points (LP). It consists of three modules: Basic Module, Elective Module and Advanced Module.

The thematic elective areas of the supplementary studies are divided into the following 4 modules and their subtopics in Module 2 (elective module):

Block 1 **Sustainable Cities and Neighbourhoods**

The courses provide an overview of the interaction of social, ecological, and economic dynamics in the microcosm of the city.

Block 2 **Sustainability Assessment of Technology**

Mostly based on ongoing research activities, methods and approaches of technology assessment are elaborated.

Block 3 **Subject, Body, Individual: The other Side of Sustainability**

Different approaches are presented to the individual perception, experience, shaping and responsibility of relationships to the environment and to oneself.

Block 4 **Sustainability in Culture, Economy & Society**

Courses usually have an interdisciplinary approach, but may also focus on one of the areas of culture, economics or society, both in application and in theory.

The core of the supplementary studies is a case study in the specialization area. In this project seminar, students conduct sustainability research with practical relevance themselves. The case study is supplemented by an oral examination with two topics from module 2 (elective module) and module 3 (in-depth module).

Module grade calculation
The overall grade of the supplementary studies is calculated as an average of the grades of the examination performances weighted with credit points.

Elective module

- Presentation 1 (3 ECTS)
- Presentation 2 (3 ECTS)

Advanced module

- individual term paper (6 ECTS)
- oral examination (4 ECTS)

Annotation
The Supplementary Studies on Sustainable Development at KIT is based on the conviction that a long-term socially and ecologically compatible coexistence in the global world is only possible if knowledge about necessary changes in science, economy and society is acquired and applied.

The interdisciplinary and transdisciplinary Studies on Sustainable Development enables diverse access to transformation knowledge as well as basic principles and application areas of sustainable development. According to the statutes § 16, a certificate is issued by the ZAK for the complementary studies.

The achievements are also shown in the transcript of records of the degree program and, upon request, in the certificate. They can also be recognized in the interdisciplinary qualifications (see elective information).
In the specialised studies, modules and partial achievements can be recognised within the framework of the additional achievements or e.g. the interdisciplinary qualifications. This must be regulated via the respective subject study programme.

The focus is on experience- and application-oriented knowledge and competences, but theories and methods are also learned. The aim is to be able to represent one's own actions as a student, researcher and later decision-maker as well as an individual and part of society under the aspect of sustainability.

Sustainability is understood as a guiding principle to which economic, scientific, social and individual actions should be oriented. According to this, the long-term and socially just use of natural resources and the material environment for a positive development of global society can only be addressed by means of integrative concepts. Therefore, "education for sustainable development" in the sense of the United Nations programme plays just as central a role as the goal of promoting "cultures of sustainability". For this purpose, practice-centred and research-based learning of sustainability is made possible and the broad concept of culture established at ZAK is used, which understands culture as habitual behaviour, lifestyle and changing context for social actions.

The supplementary study programme conveys the basics of project management, trains teamwork skills, presentation skills and self-reflection. Complementary to the specialised studies at KIT, it creates a fundamental understanding of sustainability, which is important for all professional fields. Integrative concepts and methods are essential: in order to use natural resources in the long term and to shape the global future in a socially just way, not only different disciplines, but also citizens, practitioners and institutions must work together.

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

- Basic module approx. 180 h
- Elective module approx. 150 h
- Consolidation module approx. 180 h

Total: approx. 510 h

Learning type

- lectures
- seminars
- workshops

Literature
Recommended reading of primary and specialist literature is determined individually by the respective lecturer.

M 10.167 Module: System Dynamics and Control Engineering [M-ETIT-102181]

Responsible: Prof. Dr.-Ing. Sören Hohmann
Organisation: KIT Department of Electrical Engineering and Information Technology
Part of: Engineering Fundamentals

Credits	Grading scale	Recurrence	Duration	Language	Level	Version
6	Grade to a tenth	Each winter term	1 term	German	3	2

Mandatory			
T-ETIT-101921	System Dynamics and Control Engineering	6 CR	Hohmann

Competence Certificate
Success is assessed in the form of a written examination lasting 120 minutes.

Prerequisites
none

Competence Goal
- The aim is to teach the theoretical fundamentals of control engineering, so students are able to recognize and work on basic control engineering problems.

- Students are able to formally describe real processes and derive requirements for control structures.

- They can analyze the dynamics of systems using graphical and algebraic methods.

- Students will be able to name control design methods for single-variable systems, select them on the basis of criteria, carry out the design steps and evaluate the designed control system; they will also be able to compensate for disturbances using suitable control loop structures.

- Students know relevant technical terms in control engineering and can evaluate and discuss proposed solutions in a goal-oriented manner.

- They are familiar with computer-aided tools for working on system-theoretical issues and can use them.

Content
The basic lecture System Dynamics and Control Engineering provides students with knowledge in a core area of engineering. They become familiar with the elements as well as the structure and behavior of dynamic systems. Students learn basic concepts of control engineering and gain an insight into the tasks involved in controller design and the corresponding solution methods in the frequency and time domain. This enables them to systematically apply mathematical methods to analyze and synthesize dynamic systems.

Module grade calculation
The module grade is the grade of the written examination.

Annotation
valid until 31.03.2025 - Replacement: M-ETIT-106339 - Measurement and Control Technology

Workload
The workload includes

1. attendance time in lecture/exercise (2+2 SWS: 60h, 2 LP)
2. preparation/follow-up of lecture/exercise/tutorial (optional) (105h, 3.5 CP)
3. preparation/attendance time for written examination (15h, 0.5 CP)

M 10.168 Module: Technical Design in Product Development [M-MACH-105318]

Responsible: Prof. Dr.-Ing. Albert Albers
Organisation: KIT Department of Mechanical Engineering
Part of: Master's Transfer Account

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

Mandatory			
T-MACH-105361	Technical Design in Product Development	4 CR	Albers, Matthiesen, Schmid

Competence Certificate
Written examination; duration approx. 1h

Prerequisites
None

Competence Goal
The students:

- acquire and possess sound design skills for use at the interface between engineer and designer.
- master all relevant human-product requirements, such as demographic/geographic and psychographic characteristics, relevant modes of perception, typical recognition contents as well as ergonomic basics.
- have a command of the procedure for designing a product, product range or product system from the structure, through form, colour and graphic design within the phases of the design process.
- have a command of the functional and structural design as well as the important human-machine interface of interface design, have knowledge of the essential parameters of a good corporate design.

Content
Value relevant parameters of the technical design

Basics Interface Design

Macroergonomics: Planning and concept phase

Microergonomics: Concept and design phase

Microergonomics: development phase

Best practice

Module grade calculation
The module grade is composed of:

1. Grade of the written examination (100%)

Annotation
After attending the module, students will have the knowledge of the essential fundamentals of technically oriented design, as an integral part of methodical product development.

Workload
1. Time of presence lecture: 21 h

2. Prepare/follow-up lecture exam preparation: 99 h

Total: 120 h = 4 LP

Learning type
Tutorial.

Media:

- Beamer
- Models

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

M 10.169 Module: Technical Thermodynamics and Heat Transfer I [M-MACH-102386]

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

Part of: Specialization in Mechatronics (Compulsary Elective Modules: Mechanical Engineering)
Specialization in Mechatronics (Compulsary Elective Modules: Electrical Engineering and Information Technology, Mechanical Engineering, Informatics, Economics and Management)
Specialization in Mechatronics (Supplementary Modules)

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

Mandatory			
T-MACH-104747	Technical Thermodynamics and Heat Transfer I	8 CR	Maas
T-MACH-105204	Excercises in Technical Thermodynamics and Heat Transfer I *This item will not influence the grade calculation of this parent.*	0 CR	Maas

Competence Certificate
See individual courses

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

An integral part of the module is that students can define the fundamental laws of thermodynamics and their applications. The students are competent in describing and comparing the main processes in energy conversion that are important in mechanical engineering. Using tools also applied in industry, they are capable of analyzing and rating the efficiency of processes. The students are capable of discussing the thermodynamic correlation of ideal gas mixtures, real gases, and humid air, as well as explaining the properties on a molecular basis and analyzing them with the help of the laws of thermodynamics.

Content

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

Module grade calculation
Grade of the written exam

Annotation
This module, including all brick details, exams and courses, is offered in German language.

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

Workload
Lectures and exercises: 75 h

Homework and preparation of examination: 165 h

Learning type
Lecture
Exercise course
Tutorial

Literature
Script

Additional literature will be provided in the lecture.

10.170 Module: Technical Thermodynamics and Heat Transfer II (7) [M-MACH-102830]

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

Part of: Specialization in Mechatronics (Supplementary Modules)

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

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

Competence Certificate
See individual courses

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

An integral part of the module is that students can define the fundamental laws of thermodynamics and their applications. The students are competent in describing and comparing the main processes in energy conversion that are important in mechanical engineering. Using tools also applied in industry, they are capable of analyzing and rating the efficiency of processes. The students are capable of discussing the thermodynamic correlation of ideal gas mixtures, real gases, and humid air, as well as explaining the properties on a molecular basis and analyzing them with the help of the laws of thermodynamics. Furthermore, the students are capable of explaining chemical reactions in the context of thermodynamics as well as defining and applying the heat transfer mechanisms.

Content

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

Module grade calculation
Weighting according to credit points.

Annotation
This module, including all brick details, exams and courses, is offered in German language.

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

Workload
Lectures and exercises: 75 h

Homework and preparation of examination: 135 h

Recommendation
Technical Thermodynamics and Heat Transfer I

Learning type
Lecture
Exercise course
Tutorial

Literature
Script

Additional literature will be provided in the lecture.

10.171 Module: Theory of Probability [M-ETIT-102104]

Responsible: Dr.-Ing. Holger Jäkel
Organisation: KIT Department of Electrical Engineering and Information Technology
Part of: Specialization in Mechatronics (Compulsary Elective Modules: Electrical Engineering and Information Technology, Mechanical Engineering, Informatics, Economics and Management)
Specialization in Mechatronics (Supplementary Modules)

Credits	Grading scale	Recurrence	Duration	Language	Level	Version
5	Grade to a tenth	Each winter term	1 term	German	3	2

Mandatory			
T-ETIT-101952	Theory of Probability	5 CR	Jäkel

Competence Certificate
Type of examination: written exam. Duration of examination: approx. 120 minutes.

Prerequisites
Contents of higher mathematics are necessary (e.g. M-MATH-101731 and M-MATH-101732).

Recommendation
Contents of digital technologies are recommanded (e.g. M-ETIT-102102).

M 10.172 Module: Theory of Probability/Communication Engineering I [M-ETIT-105646]

Responsible: Dr.-Ing. Holger Jäkel
Prof. Dr.-Ing. Laurent Schmalen

Organisation: KIT Department of Electrical Engineering and Information Technology

Part of: Specialization in Mechatronics (Compulsary Elective Modules: Electrical Engineering and Information Technology)

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

Mandatory			
T-ETIT-101952	Theory of Probability	5 CR	Jäkel
T-ETIT-101936	Communications Engineering I	6 CR	Schmalen

Competence Certificate

1. Theory of Probability:
   Type of examination: written exam. Duration of examination: approx. 120 minutes
2. Communication Engineering I:
   Type of examination: written exam. Duration of examination: approx. 180 minutes

Prerequisites

1. Theory of Probability:
   Contents of higher mathematics are necessary (e.g. M-MATH-101731 und M-MATH-101732).

M 10.173 Module: Thermal Solar Energy [M-MACH-102388]

Responsible: Prof. Dr. Robert Stieglitz
Organisation: KIT Department of Mechanical Engineering

Part of: Master's Transfer Account

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

Mandatory			
T-MACH-105225	Thermal Solar Energy	4 CR	N.N.

Competence Certificate
A performance assessment is obligatory; oral exam about 30 minutes

Prerequisites
none

Competence Goal
Based on the elaboration of the basic physics knowledge of the solar irradiation, heat radiation, optics and thermal-hydraulics, the student will be able to

- select solar thermal components such as mirrors, glasses, selective absorbers and insulation materials and their manufacturing processes and to calculate and assess their performance,
- identify different collector types and to indicate their potential field of application,
- characterize the entire solar thermal collector system with respect to its performance and derive from the collector characteristics its suitability for different types of use,
- embed collectors into a technical overall system for heat (household, process heat, heat storage networks) or electricity generation (power plant), to calculate the system efficiency and independently develop the basics of its optimization.
- identify adequate thermal storage types for the temporal separation of generation and consumption, to dimension them appropriately and to integrate them into a system concept,
- evaluate solar thermal systems in their entirety (capacity, estimation of system dynamics, response behavior, efficiency) and know options for integration into networks (heat, cold, electricity).

Content
Fundamentals of thermal solar energy from solar irradiation (influence of time and place, modifications in the atmosphere) and their implementation in a collector to integration into a technical overall system. In detail:

1. introduction to the energy demand and evaluation of the application potential of solar thermal energy.

2. primary energy source SUN: Sun, solar constant, solar radiation (scattering, absorption in the atmosphere, direct-diffuse radiation, angular influences, radiation balance).

3. solar collectors: basic design of a collector, basics of determining the efficiency, significance of concentration and its limitations, solar thermal collector types (designs, efficiency, system technology).

4. passive mechanisms of solar thermal energy: heat conduction in solids and gases, radiation heat transport in transparent and opaque bodies Design requirements and physical principles of solar thermal glasses, mirrors and selective absorbers. Goal oriented selection of materials and manufacturing processes.

5. momentum and heat transport: basic equations of single- and multi-phase transport, basic ideas of local and system engineering calculation methods, stability limits.

Optional

6. solar thermal low-temperature systems: collector variants, methods for system simulation, planning and dimensioning of systems, system-related system design and stagnation scenarios and their handling.

7. solar thermal high-temperature systems: solar thermal power plants (classification of system components, loss mechanisms, upwind power plants), coupling of collector with energy generation process.

At the end:

8. Thermal energy storage: Explanation of terms (energy contents, storage forms and materials, potentials ...), storage concepts (system structure, design ratio), system integration.

9. Solar air conditioning: Determination of cooling capacity, indoor climate, solar cooling methods and evaluation of air conditioning.

Workload
regular lecture attendance: 30 h
self-study: 60 h (incl. supplementary searches)

exam preparation 30 h

Recommendation
desirable are reliable knowledge in physics in optics and thermodynamics

Basics in heat and mass transfer, material science, energy technology and fluid mechanics

Learning type
Präsentation complemented by printouts

Literature
supply of lecture material in printed and electronic form

Stieglitz & Heinzel; Thermische Solarenergie -Grundlagen-Technologie- Anwendungen. Springer Vieweg Verlag. 711 Seiten. ISBN 978-3-642-29474-7

10.174 Module: Vehicle Lightweight Design - Strategies, Concepts, Materials [M-MACH-102703]

Responsible: Prof. Dr.-Ing. Frank Henning
Organisation: KIT Department of Mechanical Engineering

Lightweight Design

Part of: Master's Transfer Account

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

Mandatory			
T-MACH-105237	Vehicle Lightweight Design - Strategies, Concepts, Materials	4 CR	Henning

Competence Certificate
Written exam; Duration approx. 90 min

Prerequisites
none

Competence Goal
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.

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

Workload
1. Attendance of lectures: 21 h

2. Preparation and attendance of examination: 99 h

Total: 120 h = 4 LP

Learning type
Lecture

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.

10.175 Module: Vehicle Systems for Urban Mobility [M-MACH-106515]

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

Part of: Master's Transfer Account (Usage from 10/1/2023)

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

Mandatory			
T-MACH-113069	Vehicle Systems for Urban Mobility	4 CR	Cichon

Competence Certificate
Oral exam
Duration approx. 20 minutes
Auxiliary means: none

Prerequisites
none

Competence Goal
Students will gain a basic understanding of the essential traffic, transport policy and technological contexts of urban mobility. On the basis of this basic understanding, different vehicle concepts of public transport in urban and regional environments will be analyzed, compared
and the optimal range of applications will be discussed. In addition to the established public transport systems, special attention will be paid to innovative mobility solutions. In particular, an understanding of how sustainable, systemic mobility solutions should be designed depending on the individual use case is to be created
.

Content

- Definitions of urban mobility and public transport services
- Comparison and performance parameters of different vehicle concepts
- Rail-bound vehicle systems
- Bus systems and alternative propulsion systems
- Definition of an "innovative vehicle concept for public transport".
- Historical innovative urban vehicle concepts and analysis of why they did not succeed
- Future innovative urban vehicle concepts and discussion of their market opportunities
- Comparison of urban mobility solutions under the aspects of sustainability, resource conservation, resilience and economic efficiency
- Presentations by external experts

Annotation
A bibliography is available for students to download from the Ilias platform.

Workload
Attendance time: 21 hours
Preparation / wrap-up: 21 hours
Exam and exam preparation: 78 hours
Total time: 120 hours = 4 LP

Learning type
Lecture

M 10.176 Module: Virtual Engineering 1 [M-MACH-105293]

Responsible: Prof. Dr.-Ing. Jivka Ovtcharova
Organisation:
Part of: Master's Transfer Account

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

Mandatory			
T-MACH-102123	Virtual Engineering I	4 CR	Ovtcharova

Competence Certificate
Writen exam, graded, 90 min.

Competence Goal
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.

Content

- 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

Module grade calculation
Examination result "Virtual Engineering 1" 100%

Workload
120 h

Recommendation
None

Learning type
Lecture and exercises

Literature
Lecture slides

M 10.177 Module: Wearable Robotic Technologies [M-INFO-103294]

Responsible: Prof. Dr.-Ing. Tamim Asfour
Prof. Dr.-Ing. Michael Beigl

Organisation: KIT Department of Informatics

Part of: Master's Transfer Account

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

Mandatory			
T-INFO-106557	Wearable Robotic Technologies	4 CR	Asfour, Beigl

Competence Certificate
See partial achievements (Teilleistung)

Prerequisites
See partial achievements (Teilleistung)

Competence Goal
The student has received fundamental knowledge about wearable robotic technologies and understands the requirements for the design, the interface to the human body and the control of wearable robots. He/she is able to describe methods for modelling the human neuromusculoskeletal system, the mechatronic design, fabrication and composition of interfaces to the human body. The student understands the symbiotic human–machine interaction as a core topic of Anthropomatics and has knowledge of state-of-the-art examples of exoskeletons, orthoses and prostheses.

Content
The lecture provides an overview of wearable robot technologies (exoskeletons, prostheses and ortheses) and their potentials. It starts with the basics of wearable robotics and introduces different approaches to the design of wearable robots and their related actuator and sensor technology. The lecture focuses on modeling the neuromusculoskeletal system of the human body, the interfaces of wearable robots to the human body and the physical and cognitive human-robot interaction for tightly-coupled hybrid human-robot systems. Examples of current research and various applications of lower, upper and full body exoskeletons as well as prostheses are presented.

Workload
Lecture with 2 SWS, 4 LP
4 LP corresponds to 120 hours, including
15 * 2 = 30 hours attendance time
15 * 3 = 45 self-study
45 hours preparation for the exam

Recommendation
Attendance of the lecture Mechano-Informatics in Robotics is recommended.

11 Courses

T 11.1 Course: Accessibility - Assistive Technologies for Visually Impaired Persons [T-INFO-101301]

Responsible: Prof. Dr.-Ing. Rainer Stiefelhagen
Organisation: KIT Department of Informatics
Part of: M-INFO-100764 - Accessibility - Assistive Technologies for Visually Impaired Persons

Type	Credits	Grading scale	Recurrence	Version
Oral examination	3	Grade to a third	Each summer term	2

T 11.2 Course: Actuators and Sensors in Nanotechnology [T-MACH-105238]

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

Part of: M-MACH-102698 - Actuators and Sensors in Nanotechnology

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

Events					
WT 23/24	2141866	Actuators and sensors in nanotechnology	2 SWS	Lecture /	Kohl, Sommer
Exams					
WT 23/24	76-T-MACH-105238	Actuators and Sensors in Nanotechnology			Kohl, Sommer
ST 2024	76-T-MACH-105238	Actuators and Sensors in Nanotechnology			Kohl, Sommer

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

Competence Certificate
oral exam

Prerequisites
none

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

V Actuators and sensors in nanotechnology
2141866, WS 23/24, 2 SWS, Language: German, Open in study portal

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

T 11.3 Course: Advanced Artificial Intelligence [T-INFO-112768]

Responsible: Prof. Dr. Jan Niehues
Organisation: KIT Department of Informatics
Part of: M-INFO-106299 - Advanced Artificial Intelligence

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

Events					
ST 2024	2400141	Advanced Artificial Intelligence	4 SWS	Lecture / 🗣	Niehues, Asfour
Exams					
WT 23/24	7500071	Advanced Artificial Intelligence			Niehues
WT 23/24	7500092	Advanced Artificial Intelligence			Niehues, Waibel, Asfour
ST 2024	7500052	Advanced Artificial Intelligence			Niehues

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.

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

V Advanced Artificial Intelligence

2400141, SS 2024, 4 SWS, Language: English, Open in study portal

Lecture (V)
On-Site

Content

AI systems are increasingly integrated into our everyday lives. These are, for example, systems that can understand and generate language or analyze images and videos. In addition, AI systems are essential in robotics in order to be able to develop the next generation of intelligent robots.

Based on the knowledge of the lecture “Einführung in der KI”, the students learn to understand, develop and evaluate these systems. In order to bring this knowledge closer to the students, the lecture is divided into 4 parts. First, the methods of perception using different modalities are treated. The second part deals with advanced methods of learning that go beyond supervised learning. Then methods are discussed that are required for the representation of knowledge in AI systems . Finally, methods are presented that enable AI systems to generate content.

-

Requirements:

None

Recommendations:

- “Einführung in der KI”

- Good basic knowledge of mathematics

Workload :

approx. 180 hours, of which

approx. 45 hours lecture attendance

approx. 15 hours exercise visit

approx. 90 hours post-processing and processing of the exercise sheets

approx. 30 hours exam preparation

Learning goals:

- The students know the relevant elements of a technical cognitive system and their tasks.
- The students understand the algorithms and methods of AI to model technically cognitive systems.
- The students are able to understand the different sub -components to develop and analyze a system .
- The students can transfer this knowledge to new applications, as well as analyze and compare different methods.

success control:

See the module manual!

T 11.4 Course: Advanced Mathematics I [T-MATH-100275]

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

Organisation: KIT Department of Mathematics

Part of: M-MATH-102859 - Advanced Mathematics

Type	Credits	Grading scale	Recurrence	Version
Written examination	7	Grade to a third	Each term	3

Events					
WT 23/24	0131000	Höhere Mathematik I für die Fachrichtung Maschinenbau, Geodäsie, Materialwissenschaft und Werkstofftechnik	4 SWS	Lecture	Hettlich
WT 23/24	0131200	Höhere Mathematik I für die Fachrichtungen Chemieingenieurwesen, Verfahrenstechnik, Bioingenieurwesen und MIT	4 SWS	Lecture	Hettlich
Exams					
WT 23/24	6700007	Advanced Mathematics I			Arens, Griesmaier, Hettlich

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

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

Modeled Conditions
The following conditions have to be fulfilled:

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

T 11.5 Course: Advanced Mathematics II [T-MATH-100276]

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

Organisation: KIT Department of Mathematics

Part of: M-MATH-102859 - Advanced Mathematics

Type	Credits	Grading scale	Recurrence	Version
Written examination	7	Grade to a third	Each term	2

Events					
ST 2024	0180800	Höhere Mathematik II für die Fachrichtungen Maschinenbau, Geodäsie, Materialwissenschaft und Werkstofftechnik	4 SWS	Lecture	Arens
ST 2024	0181000	Höhere Mathematik II für die Fachrichtungen Chemieingenieurwesen, Verfahrenstechnik, Bioingenieurwesen und MIT	4 SWS	Lecture	Arens
Exams					
WT 23/24	6700008	Advanced Mathematics II			Arens, Griesmaier, Hettlich

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

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

Modeled Conditions
The following conditions have to be fulfilled:

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

T 11.6 Course: Advanced Mathematics III [T-MATH-100277]

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

Organisation: KIT Department of Mathematics

Part of: M-MATH-102859 - Advanced Mathematics

Type	Credits	Grading scale	Recurrence	Version
Written examination	7	Grade to a third	Each term	2

Events					
WT 23/24	0131400	Höhere Mathematik III für die Fachrichtungen Maschinenbau, Chemieingenieurwesen, Verfahrenstechnik, Bioingenieurwesen und das Lehramt Maschinenbau	4 SWS	Lecture	Arens
Exams					
WT 23/24	6700009	Advanced Mathematics III			Arens, Griesmaier, Hettlich

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

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

Modeled Conditions
The following conditions have to be fulfilled:

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

11.7 Course: Algorithms I [T-INFO-100001]

Responsible: TT-Prof. Dr. Thomas Bläsius
Organisation: KIT Department of Informatics
Part of: M-INFO-100030 - Algorithms I

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

Events					
ST 2024	24500	Algorithms I	4 SWS	Lecture / Practice (/ 🗣	Bläsius, Wilhelm, Yi, von der Heydt
Exams					
WT 23/24	7500117	Algorithms I			Bläsius
ST 2024	7500186	Algorithms I			Bläsius

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

T 11.8 Course: Antennas and Multiple Antenna Systems [T-ETIT-106491]

Responsible: Prof. Dr.-Ing. Thomas Zwick
Organisation: KIT Department of Electrical Engineering and Information Technology
Part of: M-ETIT-100565 - Antennas and Multiple Antenna Systems

Type	Credits	Grading scale	Recurrence	Version
Oral examination	5	Grade to a third	Each winter term	4

Events					
WT 23/24	2308416	Antennas and Multiple Antenna Systems	2 SWS	Lecture /	Zwick
WT 23/24	2308417	Workshop for 2308416 Antennas and Multiple Antenna Systems	2 SWS	Practice /	Zwick, Kretschmann, Bekker
Exams					
WT 23/24	7308416	Antennas and Multiple Antenna Systems			Zwick
ST 2024	7308416	Antennas and Multiple Antenna Systems			Zwick

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

Competence Certificate
The success control takes place within the framework of an oral overall examination (20 minutes).

Prerequisites
T-ETIT-100638 - Antennen und Mehrantennensysteme wurde weder begonnen, noch abgeschlossen.

Das Modul "Antennen und Antennensysteme" darf nichtbegonnen oder abgeschlossen sein.

T 11.9 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-102705 - Appliance and Power Tool Design

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	3 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, 3 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 11.10 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-102705 - Appliance and Power Tool Design

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	3 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, 3 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.

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

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

Part of: M-MACH-105108 - Automated Manufacturing Systems

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					
WT 23/24	76-T-MACH-108844	Automated Manufacturing Systems			Fleischer
WT 23/24	76-T-MACH-108844 - Wdh.	Automated Manufacturing Systems			Fleischer

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

Competence Certificate
oral exam (40 minutes)

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

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

V Automated Manufacturing Systems
2150904, SS 2024, 6 SWS, Language: German, Open in study portal

Lecture / Practice (VÜ)
On-Site

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 11.12 Course: Automated Visual Inspection and Image Processing [T-INFO-101363]

Responsible: Prof. Dr.-Ing. Jürgen Beyerer
Organisation: KIT Department of Informatics
Part of: M-INFO-100826 - Automated Visual Inspection and Image Processing

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

Events					
WT 23/24	24169	Automated Visual Inspection and Image Processing	4 SWS	Lecture / 🗣	Beyerer, Zander
Exams					
WT 23/24	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 23/24, 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 11.13 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-100501 - Automotive Engineering I

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

Events					
WT 23/24	2113805	Automotive Engineering I	4 SWS	Lecture / 🗣	Gauterin, Gießler
WT 23/24	2113809	Automotive Engineering I	4 SWS	Lecture / 🗣	Gauterin, Gießler
Exams					
WT 23/24	76-T-MACH-100092	Automotive Engineering			Unrau, Gauterin
ST 2024	76-T-MACH-100092	Automotive Engineering			Gauterin, 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 23/24, 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 23/24, 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 11.14 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-100502 - Automotive Engineering II

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					
WT 23/24	76-T-MACH-102117	Automotive Engineering II			Unrau, Gauterin
WT 23/24	76T-MACH-102117-2	Automotive Engineering II			Gauterin, Unrau
ST 2024	76-T-MACH-102117	Automotive Engineering II			Gauterin, 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 11.15 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-102693 - Automotive Vision

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

Events					
ST 2024	2138340	Automotive Vision	3 SWS	Lecture / 🗣	Lauer, Fehler
Exams					
WT 23/24	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 11.16 Course: Bachelor's Thesis [T-MACH-108800]

Responsible:	Prof. Dr.-Ing. Sven Matthiesen
Organisation:	KIT Department of Mechanical Engineering
Part of:	M-MACH-104262 - Bachelor's Thesis

Type	Credits	Grading scale	Recurrence	Version
Final Thesis	12	Grade to a third	Each term	1

Competence Certificate

The bachelor's 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 scope of the bachelor thesis corresponds to 12 ECTS. The maximal processing time of the bachelor thesis takes 6 months. The examination board defines the languages the thesis has to be written in. The date of issue of the subject has to be fixed by the supervisor and the student and to be put on record at the examination board. The subject of the bachelor thesis may be only returned once and only within the first month of processing time.

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

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

Prerequisites

The requirement for admission to the bachelor's thesis module are 120 ECTS. As to exceptions, the examination board decides on a request of the student.

Final Thesis

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

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

This thesis requires confirmation by the examination office.

T 11.17 Course: Basic Electronic Circuits Laboratory [T-ETIT-101943]

Responsible: Dr.-Ing. Armin Teltschik
Organisation: KIT Department of Electrical Engineering and Information Technology
Part of: M-ETIT-102113 - Basic Electronic Circuits Laboratory

Type	Credits	Grading scale	Recurrence	Version
Completed coursework (oral)	6	pass/fail	Each summer term	3

Events					
ST 2024	2303800	Basic Electronic Circuits Laboratory	4 SWS	Practical course / 🗣	Teltschik

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

Competence Certificate
The success control takes place in the form of an oral final colloquium of approximately 20 minutes duration and during the internship by checking the completed test tasks.

To participate in the final colloque, at least 8 of the 9 attempts must be successfully completed. The successfully carried out experiments together with the final colloquium form an examination unit. If you fail, the internship must be repeated completely.

The event is not graded.

Prerequisites
Knowledge of the contents of the following modules ist necessary: „M-ETIT-102102 – Digitaltechnik“ and „M-ETIT-104465 – Elektronische Schaltungen“.

Annotation
To participate in the final colloque, at least 8 of the 9 attempts must be successfully completed. The successfully carried out experiments together with the final colloquium form an examination unit. If you fail, the internship must be repeated completely.

T 11.18 Course: Basics Module - Self Assignment BAK [T-ZAK-112653]

Responsible: Dr. Christine Mielke
Christine Myglas

Organisation:

Part of: M-ZAK-106235 - Supplementary Studies on Culture and Society

Type	Credits	Grading scale	Version
Completed coursework	3	pass/fail	1

Competence Certificate
The monitoring in this module includes a course credit according to § 5 section 4 in the form of minutes of which two are to be handed in freely chosen topics of the lecture series " Introduction to Applied Studies on Culture and Society ". Length: approx. 6,000 characters each (incl. spaces).

Self service assignment of supplementary stdues
This course can be used for self service assignment of grade aquired from the following study providers:

- Zentrum für Angewandte Kulturwissenschaft und Studium Generale
- ZAK Begleitstudium

Recommendation
Fjordevik, Anneli und Jörg Roche: Angewandte Kulturwissenschaften. Vol. 10. Narr Francke Attempto Verlag, 2019.

Annotation
The Basic Module consists of the lecture “Introduction to Supplementary Studies on Culture and Society”, which is offered only in the winter semester. It is therefore recommended that students start their studies in the winter semester and complete them before module 2.

T 11.19 Course: Basics Module - Self Assignment BeNe [T-ZAK-112345]

Responsible: Christine Myglas
Organisation:
Part of: M-ZAK-106099 - Supplementary Studies on Sustainable Development

Type	Credits	Grading scale	Version
Completed coursework	3	pass/fail	1

Competence Certificate
The monitoring in this module includes a course credit according to § 5 section 4:

Introduction to Sustainable Development in the form of minutes of which two are to be handed in freely chosen topics of the lecture series "Introduction to Sustainable Development". Length: approx. 6,000 characters each (incl. spaces).

or

Sustainability Spring Days at KIT in the form of a reflection report on all components of the project days "Sustainability Spring Days at KIT". Length approx. 12,000 characters (incl. spaces).

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:

- Zentrum für Angewandte Kulturwissenschaft und Studium Generale
- ZAK Begleitstudium

Recommendation
Kropp, Ariane: Grundlagen der Nachhaltigen Entwicklung: Handlungsmöglichkeiten und Strategien zur Umsetzung. Springer-Verlag, 2018.

Pufé, Iris: Nachhaltigkeit. 3. überarb. Edition, UTB, 2017.

Roorda, Niko, et al.: Grundlagen der nachhaltigen Entwicklung. Springer-Verlag, 2021.

Annotation
Module Basics consists of the lecture " Introduction to Sustainable Development ", which is only offered in the summer semester or alternatively of the project days " Sustainability Spring Days at KIT ", which is only offered in the winter semester. It is recommended to complete the course before Elective Module an Specialisation Module.

In exceptional cases, Elective Module or Specialisation Module can also be completed simultaneously with Basics Module. However, the prior completion of the advanced modules Elective and Specialisation should be avoided.

T 11.20 Course: Basics of Manufacturing Technology [T-MACH-105219]

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

Part of: M-MACH-102549 - Manufacturing Processes

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

Events					
WT 23/24	2149658	Basics of Manufacturing Technology	2 SWS	Lecture / Practice (/)	Schulze
Exams					
WT 23/24	76-T-MACH-105219	Fundamentals of Manufacturing Technology			Schulze

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

Competence Certificate
written exam (duration: 60 min)

Prerequisites
none

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

V Basics of Manufacturing Technology

2149658, WS 23/24, 2 SWS, Language: German, Open in study portal

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

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

The following topics will be covered:

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

Learning Outcomes:

The students ...

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

Workload:

regular attendance: 30 hours
self-study: 60 hours

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

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

T 11.21 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-104919 - Advanced Topics and Methods in Mechanical Engineering (4 CP)

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

Events					
WT 23/24	2117095	Basics of Technical Logistics I	4 SWS	Lecture / Practice (/ 🗣	Mittwollen, Oellerich
Exams					
WT 23/24	76-T-MACH-109001	Basics of Technical Logistics I			Mittwollen
WT 23/24	76-T-MACH-109919	Basics of Technical Logistics I			Mittwollen

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

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

Prerequisites
none

Recommendation
Knowledge of the basics of technical mechanics preconditioned.

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

V Basics of Technical Logistics I

2117095, WS 23/24, 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 11.22 Course: Battery Modeling in MATLAB [T-ETIT-106507]

Responsible: Dr.-Ing. Andre Weber
Organisation: KIT Department of Electrical Engineering and Information Technology
Part of: M-ETIT-103271 - Battery Modeling in MATLAB

Type	Credits	Grading scale	Recurrence	Version
Oral examination	3	Grade to a third	Each winter term	1

Events					
WT 23/24	2304228	Battery Modeling in MATLAB	1 SWS	Lecture / 🗣	Weber
WT 23/24	2304229	Tutorial for 2304228 Battery Modeling in MATLAB	1 SWS	Practice / 🗣	Weber
Exams					
WT 23/24	7304228	Battery Modeling in MATLAB			Weber

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

Prerequisites
none

T 11.23 Course: Biologically Inspired Robots [T-INFO-101351]

Responsible: Dr.-Ing. Arne Rönnau
Organisation: KIT Department of Informatics
Part of: M-INFO-100814 - Biologically Inspired Robots

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					
WT 23/24	7500313	Biologically Inspired Robots			Rönnau

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

11.24 Course: Biomedical Measurement Techniques I [T-ETIT-106492]

Responsible: Prof. Dr. Werner Nahm
Organisation: KIT Department of Electrical Engineering and Information Technology
Part of: M-ETIT-100387 - Biomedical Measurement Techniques I

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

Events					
WT 23/24	2305269	Biomedical Measurement Techniques I	2 SWS	Lecture / Blended	Nahm, Schaufelberger
Exams					
WT 23/24	7305269	Biomedical Measurement Techniques I			Nahm

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

Prerequisites
The earlier version "T-ETIT-101928 - Biomedizinische Messtechnik I" may not have been started or completed.

T 11.25 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-100489 - BioMEMS - Microsystems Technologies for Life Sciences and Medicine I

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

Events					
WT 23/24	2141864	BioMEMS - Microsystems Technologies for Life-Sciences and Medicine I	2 SWS	Lecture / 🗣	Guber, Ahrens
Exams					
WT 23/24	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 23/24, 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

T 11.26 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-100490 - BioMEMS - Microsystems Technologies for Life Sciences and Medicine II

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					
WT 23/24	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:

V 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.

Prüfung:

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 11.27 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-100491 - BioMEMS - Microsystems Technologies for Life Sciences and Medicine III

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					
WT 23/24	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
2142879, SS 2024, 2 SWS, Language: German, Open in study portal

Lecture (V)
On-Site

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.

Prüfung:

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 11.28 Course: CAE-Workshop [T-MACH-105212]

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

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-104919 - Advanced Topics and Methods in Mechanical Engineering (4 CP)

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

Events					
WT 23/24	2147175	CAE-Workshop	3 SWS	Block / 🗣	Albers, Düser
ST 2024	2147175	CAE-Workshop	3 SWS	Block / 🗣	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, WS 23/24, 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 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.

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.

T 11.29 Course: Channel Coding: Algebraic Methods for Communications and Storage [T-ETIT-111244]

Responsible: Prof. Dr.-Ing. Laurent Schmalen
Organisation: KIT Department of Electrical Engineering and Information Technology
Part of: M-ETIT-105616 - Channel Coding: Algebraic Methods for Communications and Storage

Type	Credits	Grading scale	Recurrence	Expansion	Version
Oral examination	3	Grade to a third	Each summer term	1 terms	1

Events					
ST 2024	2310546	Channel Coding: Algebraic Methods for Communications and Storage	2 SWS	Lecture / 🗘	Schmalen
Exams					
WT 23/24	7310546-1	Channel Coding: Algebraic Methods for Communications and Storage			Schmalen
WT 23/24	7310546-2	Channel Coding: Algebraic Methods for Communications and Storage			Schmalen
ST 2024	7310546-1	Channel Coding: Algebraic Methods for Communications and Storage			Schmalen

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

Competence Certificate
The exam is held as an oral exam of 20 Min according to 4 Abs. 2 Nr. 1 SPO Bachelor/Master Elektrotechnik und Informationstechnik. Grade of the module corresponds to the grade of the oral exam.

Prerequisites
none

Recommendation
Previous attendance of the lectures "Communication Engineering I" and "Probability Theory" is recommended.

T 11.30 Course: Communications Engineering I [T-ETIT-101936]

Responsible: Prof. Dr.-Ing. Laurent Schmalen
Organisation: KIT Department of Electrical Engineering and Information Technology
Part of: M-ETIT-102103 - Communications Engineering I
M-ETIT-105646 - Theory of Probability/Communication Engineering I

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

Events					
WT 23/24	2310506	Communication Engineering I	3 SWS	Lecture /	Schmalen
WT 23/24	2310508	Übungen zu 2310506 Nachrichtentechnik I	1 SWS	Practice /	Schmalen, Edelmann
Exams					
WT 23/24	7310506	Communication Engineering I			Schmalen
ST 2024	7310506	Communication Engineering I			Schmalen

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

Prerequisites
none

T 11.31 Course: Communications Engineering II [T-ETIT-100745]

Responsible: Dr.-Ing. Holger Jäkel
Organisation: KIT Department of Electrical Engineering and Information Technology
Part of: M-ETIT-100440 - Communications Engineering II

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

Events					
ST 2024	2310513	Tutorial for 2310511 Communications Engineering II	1 SWS	Practice / Blended	Jäkel
Exams					
WT 23/24	7310511	Communications Engineering II			Jäkel
ST 2024	7310511	Communications Engineering II			Jäkel

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

11.32 Course: Complex Analysis and Integral Transformations [T-ETIT-109285]

Responsible: Dr.-Ing. Mathias Kluwe
Organisation: KIT Department of Electrical Engineering and Information Technology
Part of: M-ETIT-104534 - Complex Analysis and Integral Transformations

Type	Credits	Grading scale	Recurrence	Expansion	Version
Completed coursework (written)	4	pass/fail	Each summer term	1 terms	1

Events					
ST 2024	2303190	Complex analysis and integral transformations	1 SWS	Lecture / 🗣	Kluwe
ST 2024	2303191	Übungen zu 2303190 Komplexe Analysis und Integraltransformationen	1 SWS	Practice / 🗣	Kluwe
Exams					
WT 23/24	7303190	Complex Analysis and Integral Transformations			Kluwe

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

Prerequisites
none

T 11.33 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-ETIT-102734 - Materials

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					
WT 23/24	76-T-MACH-105535	Composite Manufacturing - Polymers, Fibers, Semi-Finished Products, Manufacturing Technologies			Henning
ST 2024	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

Modeled Conditions
The following conditions have to be fulfilled:

1. The course T-MACH-100531 - Systematic Materials Selection must not have been started.

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.

11.34 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-105296 - Computational Intelligence

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

Events					
WT 23/24	2105016	Computational Intelligence	2 SWS	Lecture /	Mikut, Reischl, Meisenbacher
Exams					
WT 23/24	76-T-MACH-105314	Computational Intelligence			Mikut
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:

Computational Intelligence
2105016, WS 23/24, 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 11.35 Course: Computer Organization [T-INFO-103531]

Responsible: Prof. Dr. Wolfgang Karl
Organisation: KIT Department of Informatics
Part of: M-INFO-103179 - Computer Organization

Type	Credits	Grading scale	Version
Written examination	6	Grade to a third	1

Events					
WT 23/24	24502	Computer Organization	3 SWS	Lecture	Henkel, Lehmann
WT 23/24	24505	Übungen zu Rechnerorganisation	2 SWS	Practice	Lehmann
Exams					
WT 23/24	7500228	Computer Organization			Henkel

T 11.36 Course: Control of Linear Multivariable Systems [T-ETIT-100666]

Responsible: Dr.-Ing. Mathias Kluwe
Organisation: KIT Department of Electrical Engineering and Information Technology
Part of: M-ETIT-100374 - Control of Linear Multivariable Systems

Type	Credits	Grading scale	Recurrence	Version
Written examination	6	Grade to a third	Each winter term	1

Events					
WT 23/24	2303177	Control of Linear Multivariable Systems	3 SWS	Lecture /	Kluwe
WT 23/24	2303179	Control of Linear Multivariable Systems (Tutorial to 2303177)	1 SWS	Practice /	Piscol
Exams					
WT 23/24	7303177	Control of Linear Multivariable Systems			Kluwe
ST 2024	7303177	Control of Linear Multivariable Systems			Kluwe

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

Competence Certificate
Success is checked as part of a written overall test (120 minutes) of the course.

Prerequisites
none

Recommendation
For a deeper understanding, basic knowledge of system dynamics and control technology is absolutely necessary, as taught in the ETIT Bachelor module "System Dynamics and Control Technology" M-ETIT-102181.

T 11.37 Course: Control Theory Laboratory [T-ETIT-111009]

Responsible: Prof. Dr.-Ing. Sören Hohmann
Organisation: KIT Department of Electrical Engineering and Information Technology
Part of: M-ETIT-105467 - Control Theory Laboratory

Type	Credits	Grading scale	Recurrence	Expansion	Version
Examination of another type	6	Grade to a third	Each term	1 terms	1

Events					
WT 23/24	2303169	Control Theory Laboratory	4 SWS	Block / 🗣	Hohmann
ST 2024	2303169	Control Theory Laboratory	4 SWS	Practical course / 🗣	Kluwe
Exams					
WT 23/24	7303156	Control Theory Laboratory			Kluwe

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

Prerequisites
none

T 11.38 Course: Cooperation in Interdisciplinary Teams [T-MACH-105699]

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

Part of: M-MACH-104355 - Soft Skills

Type	Credits	Grading scale	Recurrence	Version
Completed coursework	2	pass/fail	Each winter term	1

Events					
WT 23/24	2145166	Cooperation in interdisciplinary teams	2 SWS	Practical course /	Matthiesen
Exams					
WT 23/24	76-T-MACH-105699	Cooperation in interdisciplinary teams			Matthiesen

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

Competence Certificate
Accompanying the workshop, delivery services are required. In these the application of the knowledge of the students is examined.

Prerequisites
none

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

V Cooperation in interdisciplinary teams
2145166, WS 23/24, 2 SWS, Language: German, Open in study portal

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

Literature
Alt, Oliver (2012): Modell-basierte Systementwicklung mit SysML. In der Praxis. In: Modellbasierte Systementwicklung mit SysML.

Janschek, Klaus (2010): Systementwurf mechatronischer Systeme. Methoden - Modelle - Konzepte. Berlin, Heidelberg: Springer.

Weilkiens, Tim (2008): Systems engineering mit SysML/UML. Modellierung, Analyse, Design. 2., aktualisierte u. erw. Aufl. Heidelberg: Dpunkt-Verl

T 11.39 Course: Decentrally Controlled Intralogistic Systems [T-MACH-105230]

Responsible: Prof. Dr.-Ing. Kai Furmans
Dr.-Ing. Maximilian Hochstein

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102687 - Decentrally Controlled Intralogistic Systems

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

Events					
WT 23/24	2117084	Decentrally controlled intralogistic systems	2 SWS	Practical course / 🗣	Furmans, Sperling, Arndt
ST 2024	2117084	Decentrally controlled intralogistic systems	2 SWS	Practical course / 🗣	Furmans, Sperling, Arndt, Enke, Schumacher, Pang

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

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

V Decentrally controlled intralogistic systems

2117084, WS 23/24, 2 SWS, Language: German, Open in study portal

Practical course (P)
On-Site

Content
Proof:

- Certificate by colloquium with presentation

Note:

- Number of participants limited
- Participants will be selected
- Compulsory attendance

Media:

- Lego Mindstorms, PC

Teaching content:

- Introduction to material handling systems
- Construction of a model for decentralized logistic systems
- Object-oriented programming with LabView (or Python* with reservation)
- Implementation of the model with Mindstorms
- Presentation of the results

Learning objectives:

Students are able to:

- Model complex cinematic systems and use object-oriented programming for this purpose,
- Built experimental setups in a team for decentralized controlled intralogistic systems, choose appropriate system components and models and finally proof the function by using experiments.

Effort:

- Regular attendance: 90 hours (workplace is provided)
- Self-study: 30 hours

Dates and further information see homepage

Organizational issues
Termine im WS23/24:

Gruppe 1 05.02.- 23.02.2024, davon Präsenz: 05.02., 12.02. - 23.02.2024

Gruppe 2 19.02.- 08.03.2024, davon Präsenz: 19.02., 26.02. - 08.03.2024

Anmeldezeitraum:

01.11.2023 8:00 Uhr - 31.12.2023 18:00 Uhr (via Ilias-Kurs)

Literature
keine

V **Decentrally controlled intralogistic systems**
2117084, SS 2024, 2 SWS, Language: German, Open in study portal

Practical course (P)
On-Site

Content
Proof:

- Certificate by colloquium with presentation

Note:

- Number of participants limited
- Participants will be selected
- Compulsory attendance

Media:

- Lego Mindstorms, PC

Teaching content:

- Introduction to material handling systems
- Construction of a model for decentralized logistic systems
- Object-oriented programming with LabView (or Python* with reservation)
- Implementation of the model with Mindstorms
- Presentation of the results

Learning objectives:

Students are able to:

- Model complex cinematic systems and use object-oriented programming for this purpose,
- Built experimental setups in a team for decentralized controlled intralogistic systems, choose appropriate system components and models and finally proof the function by using experiments.

Effort:

- Regular attendance: 90 hours (workplace is provided)
- Self-study: 30 hours

Dates and further information see homepage

Organizational issues
Termin im SS24:

09.09.- 27.09.2024, davon Präsenz: 09.09., 16.09. - 27.09.2024

09.09.2024 14:00 Uhr Einführungsveranstaltung

Anmeldezeitraum:

01.04.2024 8:00 Uhr - 30.06.2024 18:00 Uhr (via Ilias-Kurs)

Literature
keine

T 11.40 Course: Deep Learning and Neural Networks [T-INFO-109124]

Responsible: Prof. Dr. Jan Niehues
Organisation: KIT Department of Informatics
Part of: M-INFO-104460 - Deep Learning and Neural Networks

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

Events					
ST 2024	2400024	Deep Learning and Neural Networks	4 SWS	Lecture / 🗣	Niehues, Waibel
Exams					
WT 23/24	7500259	Deep Learning and Neural Networks			Waibel
ST 2024	7500044	Deep Learning and Neural Networks			Niehues, Waibel

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

T 11.41 Course: Digital Technology [T-ETIT-101918]

Responsible: Prof. Dr.-Ing. Jürgen Becker
Organisation: KIT Department of Electrical Engineering and Information Technology
Part of: M-ETIT-102102 - Digital Technology

Type	Credits	Grading scale	Recurrence	Version
Written examination	6	Grade to a third	Each winter term	1

Events					
WT 23/24	2311613	Accompanying group tutorial for 2311615 Digital Technology / Fundamentals of Digital Technology		Tutorial (/ 🗣	Höfer
WT 23/24	2311615	Digital Technology / Fundamentals of Digital Technology	3 SWS	Lecture / 🧩	Becker
WT 23/24	2311617	Tutorial for 2311615 Digital Technology / Fundamentals of Digital Technology	1 SWS	Practice / 🧩	Höfer
Exams					
WT 23/24	7311615	Digital Technology			Becker
WT 23/24	73116151	Digital Technology			Becker

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

Prerequisites
none

T 11.42 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-106513 - Railway System Digitalisation

Type	Credits	Grading scale	Recurrence	Expansion	Version
Oral examination	4	Grade to a third	Each winter term	1 terms	2

Events					
WT 23/24	2115920	Railway System Digitalisation	2 SWS	Lecture / 🗣	Cichon
Exams					
WT 23/24	76-T-MACH-106426	Railway System Digitalisation			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 11.43 Course: Distributed Discrete Event Systems [T-ETIT-100960]

Responsible: Prof. Dr.-Ing. Michael Heizmann
Organisation: KIT Department of Electrical Engineering and Information Technology
Part of: M-ETIT-100361 - Distributed Discrete Event Systems

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

Events					
ST 2024	2302106	Verteilte ereignisdiskrete Systeme	2 SWS	Lecture / Blended	Heizmann
ST 2024	2302108	Übungen zu 2302106 Verteilte ereignisdiskrete Systeme	1 SWS	Practice / On-Site	Hoffmann
Exams					
WT 23/24	7302106	Distributed Discrete Event Systems			Heizmann

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

Prerequisites
none

T 11.44 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-102700 - Dynamics of the Automotive Drive Train

Type	Credits	Grading scale	Recurrence	Version
Oral examination	5	Grade to a third	Each winter term	2

Events					
WT 23/24	2163111	Dynamics of the Automotive Drive Train	2 SWS	Lecture / 🗣	Fidlin
WT 23/24	2163112	Übungen zu Dynamik des Kfz-Antriebsstrangs	2 SWS	Practice	Fidlin, Gießler
Exams					
WT 23/24	76-T-MACH-105226	Dynamics of the Automotive Drive Train			Fidlin
ST 2024	76-T-MACH-105226	Dynamics of the Automotive Drive Train			Fidlin

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

Competence Certificate
Oral examination, 30 min.

Prerequisites
none

Recommendation
Powertrain Systems Technology A: Automotive SystemsMachine DynamicsVibration Theory

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

V Dynamics of the Automotive Drive Train

2163111, WS 23/24, 2 SWS, Language: German, Open in study portal

Lecture (V)
On-Site

Content

- Main components of the vehicle powertrain and their modelling
- Typical driving situations
- Problemoriented models for particular driving situations
- System analysis and optimization with respect to dynamic behavior

Literature

- Dresig H. Schwingungen mechanischer Antriebssysteme, 2. Auflage, Springer, 2006
- Pfeiffer F., Mechanical System Dynamics, Springer, 2008
- Laschet A., Simulation von Antriebssystemen:Modellbildung der Schwingungssysteme und Beispiele aus der Antriebstechnik, Springer, 1988

V Übungen zu Dynamik des Kfz-Antriebsstrangs

2163112, WS 23/24, 2 SWS, Language: German, Open in study portal

Practice (Ü)

Content
Exercises related to the lecture

T 11.45 Course: Elective Module - Subject, Body, Individual: the Other Side of Sustainability - Self Assignment BeNe [T-ZAK-112349]

Organisation:

Part of: M-ZAK-106099 - Supplementary Studies on Sustainable Development

Type	Credits	Grading scale	Version
Examination of another type	3	Grade to a third	1

Competence Certificate

Examination of another kind according to § 7 section 7 in the form of a presentation in the selected course.

Prerequisites

Prerequisite for the 'Oral Examination' is the successful completion of Modules 1 and 3 and the required elective sections in Module 2.

Self service assignment of supplementary stdues

This course can be used for self service assignment of grade aquired from the following study providers:

- Zentrum für Angewandte Kulturwissenschaft und Studium Generale
- ZAK Begleitstudium

Recommendation

The content of the Basics Module is helpful.

T 11.46 Course: Elective Module - Sustainability Assessment of Technology - Self Assignment BeNe [T-ZAK-112348]

Organisation:

Part of: M-ZAK-106099 - Supplementary Studies on Sustainable Development

Type	Credits	Grading scale	Version
Examination of another type	3	Grade to a third	1

Competence Certificate
Examination of another kind according to § 7 section 7 in the form of a presentation in the selected course.

Prerequisites
Prerequisite for the 'Oral Examination' is the successful completion of Modules 1 and 3 and the required elective sections in Module 2.

Self service assignment of supplementary stdues
This course can be used for self service assignment of grade aquired from the following study providers:

- Zentrum für Angewandte Kulturwissenschaft und Studium Generale
- ZAK Begleitstudium

Recommendation
The content of the Basics Module is helpful.

T 11.47 Course: Elective Module - Sustainability in Culture, Economy and Society - Self Assignment BeNe [T-ZAK-112350]

Organisation:
Part of: M-ZAK-106099 - Supplementary Studies on Sustainable Development

Type	Credits	Grading scale	Version
Examination of another type	3	Grade to a third	1

Competence Certificate
Examination of another kind according to § 7 section 7 in the form of a presentation in the selected course.

Prerequisites
Prerequisite for the 'Oral Examination' is the successful completion of Modules 1 and 3 and the required elective sections in Module 2.

Self service assignment of supplementary stdues
This course can be used for self service assignment of grade aquired from the following study providers:

- Zentrum für Angewandte Kulturwissenschaft und Studium Generale
- ZAK Begleitstudium

Recommendation
The content of the Basics Module is helpful.

T 11.48 Course: Elective Module - Sustainable Cities and Neighbourhoods - Self Assignment BeNe [T-ZAK-112347]

Organisation: University

Part of: M-ZAK-106099 - Supplementary Studies on Sustainable Development

Type	Credits	Grading scale	Version
Examination of another type	3	Grade to a third	1

Competence Certificate
Examination of another kind according to § 7 section 7 in the form of a presentation in the selected course.

Prerequisites
Prerequisite for the 'Oral Examination' is the successful completion of Modules 1 and 3 and the required elective sections in Module 2.

Self service assignment of supplementary stdues
This course can be used for self service assignment of grade aquired from the following study providers:

- Zentrum für Angewandte Kulturwissenschaft und Studium Generale
- ZAK Begleitstudium

Recommendation
The content of the Basics Module is helpful.

11.49 Course: Electric Energy Systems [T-ETIT-101923]

Responsible: Prof. Dr.-Ing. Thomas Leibfried
Organisation: KIT Department of Electrical Engineering and Information Technology
Part of: M-ETIT-102156 - Electric Energy Systems
M-ETIT-105643 - Electric Energy Systems/Hybrid and Electric Vehicles

Type	Credits	Grading scale	Recurrence	Version
Written examination	5	Grade to a third	Each summer term	2

Events					
ST 2024	2307391	Electric Energy Systems	2 SWS	Lecture / 🗣	Leibfried
ST 2024	2307393	Übungen zu 2307391 Elektroenergiesysteme	1 SWS	Practice / 🗣	Eser
Exams					
WT 23/24	7307391	Electric Energy Systems			Leibfried

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

Prerequisites
none

T 11.50 Course: Electrical Engineering Components [T-ETIT-109292]

Responsible: Prof. Dr. Sebastian Kempf
Organisation: KIT Department of Electrical Engineering and Information Technology
Part of: M-ETIT-102734 - Materials

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

Events					
WT 23/24	2312700	Electrical Engineering Components	3 SWS	Lecture / 🗣	Kempf, Lemmer
WT 23/24	2312701	Tutorial for 2312700 Electrical Engineering Components	1 SWS	Practice / 🗣	Wünsch
Exams					
WT 23/24	7312700	Electrical Engineering Components			Kempf, Lemmer
ST 2024	7312700	Electrical Engineering Components			Kempf, Lemmer

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

Competence Certificate
The success control is carried out in the form of a written test of 120 minutes.

Prerequisites
none

T 11.51 Course: Electrical Machines and Power Electronics [T-ETIT-101954]

Responsible: Prof. Dr.-Ing. Marc Hiller
Organisation: KIT Department of Electrical Engineering and Information Technology
Part of: M-ETIT-102124 - Electrical Machines and Power Electronics

Type	Credits	Grading scale	Recurrence	Version
Written examination	6	Grade to a third	Each winter term	1

Events					
WT 23/24	2306387	Electrical Machines and Power Electronics	2 SWS	Lecture /	Hiller
WT 23/24	2306389	Tutorial for 2306387 Electrical Machines and Power Electronics	2 SWS	Practice /	Hiller
Exams					
WT 23/24	7306307	Electrical Machines and Power Electronics			Hiller
ST 2024	7306307	Electrical Machines and Power Electronics			Hiller

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

Prerequisites
none

T 11.52 Course: Electromagnetic Fields [T-ETIT-109078]

Responsible: Prof. Dr. Martin Doppelbauer
Organisation: KIT Department of Electrical Engineering and Information Technology
Part of: M-ETIT-104428 - Electromagnetic Fields

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

Events					
ST 2024	2306004	Electromagnetical Fields	2 SWS	Lecture /	Doppelbauer
ST 2024	2306005	Practice to 2306004 Electromagnetic Fields	2 SWS	Practice /	Kesten, Bischoff
ST 2024	2306006	Tutorium zu 2306004 Elektromagnetische Felder		/	Doppelbauer
Exams					
WT 23/24	7300019	Electromagnetical Fields			Doppelbauer
ST 2024	7300019	Electromagnetical Fields			Doppelbauer

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

Prerequisites
none

T 11.53 Course: Electromagnetic Waves [T-ETIT-109245]

Responsible: Prof. Dr.-Ing. Sebastian Randel
Organisation: KIT Department of Electrical Engineering and Information Technology
Part of: M-ETIT-104515 - Electromagnetic Waves
M-ETIT-105647 - Electromagnetic Waves/Fundamentals on High Frequency Techniques

Type	Credits	Grading scale	Recurrence	Version
Written examination	6	Grade to a third	Each winter term	1

Events					
WT 23/24	2309475	Electromagnetical Waves	2 SWS	Lecture / 🗣	Randel, Koos, N.N., Krimmer, Dittmer
WT 23/24	2309477	Tutorial for 2309475 Electromagnetical Waves	2 SWS	Practice / 🗣	Randel, Koos, N.N.
WT 23/24	232309477	Tutorial for 2309475 Electromagnetical Waves	2 SWS	Practice / 🗣	Randel, Koos, Krimmer, Dittmer
Exams					
WT 23/24	7300006	Electromagnetic Waves			Randel
WT 23/24	7309475	Electromagnetical Waves (repetition exam SoSe 2023)			Randel
ST 2024	7309475	Electromagnetical Waves			Randel

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

T 11.54 Course: Electronic Devices and Circuits [T-ETIT-109318]

Responsible: Prof. Dr.-Ing. Ahmet Cagri Ulusoy
Organisation: KIT Department of Electrical Engineering and Information Technology
Part of: M-ETIT-104465 - Electronic Devices and Circuits

Type	Credits	Grading scale	Recurrence	Expansion	Version
Written examination	6	Grade to a third	Each summer term	1 terms	2

Events					
ST 2024	2308655	Electronic Devices and Circuits	3 SWS	Lecture / 🗣	Ulusoy
ST 2024	2308657	Übungen zu 2312655 Elektronische Schaltungen	1 SWS	Practice / 🗣	Ulusoy
ST 2024	2308658	Tutorien zu 2312655 Elektronische Schaltungen	1 SWS	/ 🗣	Ulusoy
Exams					
WT 23/24	7308655	Electronic Devices and Circuits			Ulusoy

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

T 11.55 Course: Electronic Devices and Circuits - Workshop [T-ETIT-109138]

Responsible: Prof. Dr.-Ing. Thomas Zwick
Organisation: KIT Department of Electrical Engineering and Information Technology
Part of: M-ETIT-104465 - Electronic Devices and Circuits

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

Events					
ST 2024	2308450	Elektronische Schaltungen - Workshop	1 SWS	Practical course / 🗣	Zwick

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

T 11.56 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-102688 - Elements of Technical Logistics
M-MACH-105015 - Elements of Technical Logistics incl. Project

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 11.57 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-105015 - Elements of Technical Logistics incl. Project

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 11.58 Course: Engineering Mechanics I [T-MACH-100282]

Responsible: Prof. Dr.-Ing. Thomas Böhlke
Dr.-Ing. Tom-Alexander Langhoff

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102402 - Engineering Mechanics
M-MACH-104333 - Orientation Exam

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

Events					
WT 23/24	2161245	Engineering Mechanics I	3 SWS	Lecture / 🗣	Böhlke
WT 23/24	3161010	Engineering Mechanics I (Lecture)	3 SWS	Lecture / 🗣	Langhoff, Böhlke
Exams					
WT 23/24	76-T-MACH-100282	Engineering Mechanics I			Böhlke, Langhoff
WT 23/24	76-T-MACH-100282-englisch	Engineering Mechanics I			Böhlke, Langhoff

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

Competence Certificate
written exam, 90 min, graded

Prerequisites
successful participation in "Engineering Mechanics I (Tutorial)" (see T-MACH-100528)

Modeled Conditions
The following conditions have to be fulfilled:

1. The course T-MACH-100528 - Tutorial Engineering Mechanics I must have been passed.

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

V Engineering Mechanics I
2161245, WS 23/24, 3 SWS, Language: German, Open in study portal

Lecture (V)
On-Site

Content

- Basics of vector calculus
- Force systems
- Statics of rigid bodies
- Internal forces and moments in bars and beams
- Friction
- Centre of gravity, centre of mass
- Work, energy, principle of virtual work
- Statics of inextensible ropes
- Elastostatics of tension-compression- bars

Literature

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

T 11.59 Course: Engineering Mechanics II [T-MACH-100283]

Responsible: Prof. Dr.-Ing. Thomas Böhlke
Dr.-Ing. Tom-Alexander Langhoff

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102402 - Engineering Mechanics

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

Events					
ST 2024	2162250	Engineering Mechanics II	3 SWS	Lecture / 🗣	Böhlke, Langhoff
ST 2024	3162010	Engineering Mechanics II (Lecture)	3 SWS	Lecture / 🗣	Langhoff, Böhlke
Exams					
WT 23/24	76-T-MACH-100283	Engineering Mechanics II			Böhlke, Langhoff
WT 23/24	76-T-MACH-100283-englisch	Engineering Mechanics II			Böhlke, Langhoff

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

Competence Certificate
written exam, 90 min, graded

Prerequisites
successful participation in "Engineering Mechanics II (Tutorial)" (see T-MACH-100284)

Modeled Conditions
The following conditions have to be fulfilled:

1. The course T-MACH-100284 - Tutorial Engineering Mechanics II must have been passed.

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

V Engineering Mechanics II

2162250, SS 2024, 3 SWS, Language: German, Open in study portal

Lecture (V)
On-Site

Content

- bending
- shear
- torsion
- stress and strain state in 3D
- Hooke's law in 3D
- elasticity theors in 3D
- energy methods in elastostatics
- approximation methods
- stability of elastic bars

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

V Engineering Mechanics II (Lecture)

3162010, SS 2024, 3 SWS, Language: English, Open in study portal

Lecture (V)
On-Site

Content

- bending
- shear
- torsion
- stress and strain state in 3D
- Hooke's law in 3D
- elasticity theors in 3D
- energy methods in elastostatics
- approximation methods
- stability of elastic bars

T 11.60 Course: Engineering Mechanics III [T-MACH-100299]

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

Part of: M-MACH-102402 - Engineering Mechanics

Type	Credits	Grading scale	Recurrence	Version
Written examination	5	Grade to a third	Each winter term	2

Events					
WT 23/24	2161203	Engineering Mechanics III	2 SWS	Lecture / 🗣	Proppe
Exams					
WT 23/24	76-T-MACH-100299	Engineering Mechanics III			Proppe, Fidlin
ST 2024	76-T-MACH-100299	Engineering Mechanics III			Fidlin

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

Competence Certificate
written exam (90 min)

Prerequisites
successful participation in "Engineering Mechanics III (Tutorial)" (see T-MACH-105202)

Modeled Conditions
The following conditions have to be fulfilled:

1. The course T-MACH-105202 - Tutorial Engineering Mechanics III must have been passed.

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

V Engineering Mechanics III
2161203, WS 23/24, 2 SWS, Language: German, Open in study portal

Lecture (V)
On-Site

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

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

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

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

Organizational issues
Die Lehrveranstaltung TM III (MACH SPO: 2015, MIT SPO: 2016) wird letztmalig im Wintersemester 2023/24 angeboten. Die Lehrinhalte werden zu einem großen Teil ab Wintersemester 2024/25 im Rahmen der TM III (MACH und MIT: SPO 2023) behandelt. Die Vorleistung für Studierende in den alten SPOs (MACH SPO: 2015, MIT SPO: 2016) werden weiterhin in einer angepassten Form angeboten, die zu gegebener Zeit über ILIAS kommuniziert wird.

Literature

Hibbeler: Technische Mechanik 3, Dynamik, München, 2006

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

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

Göldner, Holzweissig: Leitfaden der Technischen Mechanik.

Hagedorn: Technische Mechanik III.

T 11.61 Course: Engineering Mechanics IV [T-MACH-105274]

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

Part of: M-MACH-102831 - Engineering Mechanics IV
M-MACH-103205 - Engineering Mechanics

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

Events					
ST 2024	2162231	Engineering Mechanics IV	2 SWS	Lecture / 🗣	Proppe
ST 2024	2162232	Engineering Mechanics IV (Tutorial)	2 SWS	Practice / 🗣	Proppe, Gießler, Kaupp
Exams					
WT 23/24	76-T-MACH-105274	Engineering Mechanics IV			Fidlin, Proppe
ST 2024	76-T-MACH-105274	Engineering Mechanics IV			Fidlin

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

Competence Certificate
Written examination

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

V Engineering Mechanics IV
2162231, SS 2024, 2 SWS, Language: German, Open in study portal

Lecture (V)
On-Site

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

Organizational issues
Hinweis: Die Lehrveranstaltung TM4 (MACH SPO: 2015, MIT SPO: 2016) wird letztmalig im Sommersemester 2024 angeboten. Die Lehrinhalte werden zu einem großen Teil ab Wintersemester 24/25 im Rahmen der TM3 (MACH und MIT: SPO 2023) behandelt. Die Vorleistung für Studierende in den alten SPOs (MACH SPO: 2015, MIT SPO: 2016) werden weiterhin in einer angepassten Form angeboten, die zu gegebener Zeit über ILIAS kommuniziert wird.

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

V Engineering Mechanics IV (Tutorial)
2162232, SS 2024, 2 SWS, Language: German, Open in study portal

Practice (Ü)
On-Site

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

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

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

T 11.62 Course: Engineering of Automation Systems [T-ETIT-112221]

Organisation: KIT Department of Electrical Engineering and Information Technology
Part of: M-ETIT-106037 - Engineering of Automation Systems

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

Events					
WT 23/24	2301485	Engineering von Automatisierungssystemen	2 SWS	Lecture / 🗣	Barth, Jilg
Exams					
WT 23/24	7300029	Engineering of Automation Systems			Barth

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

Prerequisites
none

T 11.63 Course: Examination Material Science I & II [T-MACH-105148]

Responsible: Dr.-Ing. Johannes Schneider
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102567 - Material Science and Engineering

Type	Credits	Grading scale	Recurrence	Version
Oral examination	9	Grade to a third	Each winter term	1

Events					
WT 23/24	2181555	Materials Science and Engineering I for ciw, vt, MIT	4 SWS	Lecture / Practice (/ 🗣	Schneider
ST 2024	2182562	Materials Science and Engineering II for ciw, vt, mit	4 SWS	Lecture / Practice (/ 🗣	Schneider
Exams					
WT 23/24	76-T-MACH-105148	Examination Material Science I, II			Schneider

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

Competence Certificate
oral; 30 to 40 minutes

No tools and reference tools are allowed!

Prerequisites
none

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

V Materials Science and Engineering I for ciw, vt, MIT

2181555, WS 23/24, 4 SWS, Language: German, Open in study portal

Lecture / Practice (VÜ)
On-Site

Content
Atomic structure and atomic bonds

Structures of crystalline and amorphous solids

Defects in crystalline solids

Alloys

Transport and transformation phenomena in the solid state
Corrosion

Wear

Mechanical properties
Testing of materials

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

The students can describe the typical property profiles and can name applications for the most important engineering materials.

The students are able to describe standard materials characterization methods and can explain the evaluation of these methods. They can judge materials on base of the data obtained by these methods.

regular attendance: 45 hours
self-study: 75 hours

Oral exam in combination with Materials Science and Engineering II; oral; 30 to 40 minutes

No tools and reference tools are allowed!

Literature
Vorlesungsskript

Aufgabenblätter

W. Bergmann: Werkstofftechnik I + II, Hanser Verlag, München, 2008/9

M. Merkel: Taschenbuch der Werkstoffe, Hanser Verlag, München, 2008

R. Schwab: Werkstoffkunde und Werkstoffprüfung für Dummies, Wiley VCH, Weinheim, 2019

J.F. Shackelford; Werkstofftechnologie für Ingenieure, Pearson Studium, München, 2007

J.F. Shackelford: Introduction to Materials Science for Engineers. Pearson, 2014

W. D. Callister: Materials Science and Engineering. John Wiley & Sons, 2020

M. Ashby: Materials. Elsevier, 2018

M. Ashby: Materials Selection in Mechanical Design. Elsevier, 2016

V	**Materials Science and Engineering II for ciw, vt, mit** 2182562, SS 2024, 4 SWS, Language: German, Open in study portal	**Lecture / Practice (VÜ)** **On-Site**

Content
Ferrous materials

Non-ferrous metals and alloys

Polymers

Engineering ceramics

Composites

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

The students can name representative materials for different material classes and can describe the differences.

The students are able to describe the basic mechanisms of hardening for ferrous and non-ferrous materials and reflect these mechanisms using phase and TTT diagrams.

The students can interpret given phase, TTT or other diagrams relevant for materials science, gather information from them and can correlate them regarding the microstructure evolution.

The students can describe the phenomena correlated with materials science in polymers, metals and ceramics and depict differences.

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

regular attendance: 45 hours
self-study: 105 hours

Combined oral exam with Materials Science and Engineering I; 30 to 40 minutes

No tools and reference tools are allowed!

Literature
Vorlesungsskript

Übungsaufgabenblätter

W. Bergmann: Werkstofftechnik I + II, Hanser Verlag, München, 2008/9

M. Merkel: Taschenbuch der Werkstoffe, Hanser Verlag, München, 2008

R. Schwab: Werkstoffkunde und Werkstoffprüfung für Dummies, Wiley VCH, Weinheim, 2011

J.F. Shackelford; Werkstofftechnologie für Ingenieure, Pearson Studium, München, 2008 (E-Book)

T 11.64 Course: Excercises in Technical Thermodynamics and Heat Transfer I [T-MACH-105204]

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

Part of: M-MACH-102386 - Technical Thermodynamics and Heat Transfer I

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

Events					
WT 23/24	2165502	Exercise course Technical Thermodynamics and Heat Transfer I	2 SWS	Practice / 🗣	Maas
WT 23/24	3165015	Technical Thermodynamics and Heat Transfer I (Tutorial)	2 SWS	Tutorial (/ 🗣	Schießl, Maas
Exams					
WT 23/24	76-T-MACH-105204	Excercises in Technical Thermodynamics and Heat Transfer I			Maas, Schießl
ST 2024	76-T-MACH-105204	Excercises in Technical Thermodynamics and Heat Transfer I			Maas, Schießl

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

Competence Certificate
Successful completion of written preliminary tests.

Prerequisites
none

T 11.65 Course: Excercises in Technical Thermodynamics and Heat Transfer II [T-MACH-105288]

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

Part of: M-MACH-102830 - Technical Thermodynamics and Heat Transfer II

Type	Credits	Grading scale	Recurrence	Version
Completed coursework	0	pass/fail	Each summer term	1

Events					
WT 23/24	2100020	Technical Thermodynamics and Heat Transfer II (Repeater Tutorial)	2 SWS	Tutorial (/ 🗣	Schießl
ST 2024	2166556	Technical Thermodynamics and Heat Transfer II (Tutorial)	2 SWS	Practice / 🗣	Maas
ST 2024	3166033	Technical Thermodynamics and Heat Transfer II (Tutorial)	2 SWS	Practice / 🗣	Schießl, Maas
Exams					
WT 23/24	76-T-MACH-105288	Excercises in Technical Thermodynamics and Heat Transfer II			Maas, Schießl
ST 2024	76-T-MACH-105288	Excercises in Technical Thermodynamics and Heat Transfer II			Maas

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

Competence Certificate
Successful completion of written preliminary tests.

Prerequisites
none

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

V Technical Thermodynamics and Heat Transfer II (Tutorial)
2166556, SS 2024, 2 SWS, Language: German, Open in study portal

Practice (Ü)
On-Site

Content
Calculation of thermodynamical problems

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

T 11.66 Course: Fluid Mechanics 1&2 [T-MACH-105207]

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

Part of: M-MACH-102565 - Fluid Mechanics

Type	Credits	Grading scale	Recurrence	Version
Written examination	8	Grade to a third	Each summer term	2

Events					
WT 23/24	2153512	Fluid Mechanics II	3 SWS	Lecture / Practice (/ 🗣	Frohnapfel
WT 23/24	3153511	Fluid Mechanics II	3 SWS	Lecture / Practice (/ 🗣	Frohnapfel
ST 2024	2154512	Fluid Mechanics I	3 SWS	Lecture / Practice (/ 🗣	Frohnapfel
ST 2024	3154510	Fluid Mechanics I	3 SWS	Lecture / Practice (/ 🗣	Frohnapfel
Exams					
WT 23/24	76-T-MACH-105207	Fluid Mechanics (1+2)			Frohnapfel
WT 23/24	76-T-MACH-105207 engl.	Fluid Mechanics 1&2			Frohnapfel
ST 2024	76-T-MACH-105207	Fluid Mechanics (1+2)			Frohnapfel, Kriegseis
ST 2024	76-T-MACH-105207 engl.	Fluid Mechanics 1&2			Frohnapfel

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

Competence Certificate
written exam 3 hours

Prerequisites
none

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

V Fluid Mechanics II

2153512, WS 23/24, 3 SWS, Language: German, Open in study portal

Lecture / Practice (VÜ)
On-Site

Content
The students know how to derive the fundamental equations for mass and momentum conservation and can introduce material laws for fluids into those. They can discuss the physical meaning of the different terms in the Navier-Stokes-Equations. They are capable of simplifying the mathematical equations that describe the motion of fluids and can compute flow quantities for generic problems based on these simplified equations. This includes the calculation of static and dynamic forces acting from the fluid onto the solid as well as the detailed analysis of two-dimensional viscous flows.

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

Literature
Kundu, P.K., Cohen, K.M.: Fluid Mechanics, Elsevier, 4th Edition, 2008

Durst, F.: Grundlagen der Strömungsmechanik, Springer, 2006

Oertel, H.: Strömungsmechanik, Vieweg-Verlag, 4. Auflage 2006
Oertel, H., Böhle, M.: Übungsbuch Strömungsmechanik, Vieweg-Verlag, 5. Auflage 2006

Zierep, J., Bühler, K.: Strömungsmechanik, Springer Lehrbuch bzw. entsprechende Kapitel in Hütte.Das Ingenieurwissen, Springer

V	**Fluid Mechanics II** 3153511, WS 23/24, 3 SWS, Language: English, Open in study portal	**Lecture / Practice (VÜ)** **On-Site**

Content
The students know how to derive the fundamental equations for mass and momentum conservation and can introduce material laws for fluids into those. They can discuss the physical meaning of the different terms in the Navier-Stokes-Equations. They are capable of simplifying the mathematical equations that describe the motion of fluids and can compute flow quantities for generic problems based on these simplified equations. This includes the calculation of static and dynamic forces acting from the fluid onto the solid as well as the detailed analysis of two-dimensional viscous flows.

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

Literature
Kundu, P.K., Cohen, K.M.: Fluid Mechanics, Elsevier, 4th Edition, 2008

Durst, F.: Grundlagen der Strömungsmechanik, Springer, 2006

Oertel, H.: Strömungsmechanik, Vieweg-Verlag, 4. Auflage 2006
Oertel, H., Böhle, M.: Übungsbuch Strömungsmechanik, Vieweg-Verlag, 5. Auflage 2006

Zierep, J., Bühler, K.: Strömungsmechanik, Springer Lehrbuch bzw. entsprechende Kapitel in Hütte.Das Ingenieurwissen, Springer

V	**Fluid Mechanics I** 2154512, SS 2024, 3 SWS, Language: German, Open in study portal	**Lecture / Practice (VÜ)** **On-Site**

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

Literature
Zierep, J., Bühler, K.: Strömungsmechanik, Springer Lehrbuch bzw. entsprechende Kapitel in Hütte.Das Ingenieurwissen, Springer

V	**Fluid Mechanics I** 3154510, SS 2024, 3 SWS, Language: English, Open in study portal	**Lecture / Practice (VÜ)** **On-Site**

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

Literature
Zierep, J., Bühler, K.: Principles of Fluid Mechanics, Springer, 2022

T 11.67 Course: Fluid Power Systems [T-MACH-102093]

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

Part of: M-MACH-104919 - Advanced Topics and Methods in Mechanical Engineering (4 CP)

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

Events					
WT 23/24	2114093	Fluid Technology	2 SWS	Lecture / 🗣	Geimer
Exams					
WT 23/24	76-T-MACH-102093	Fluid Power Systems			Geimer

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

Competence Certificate
The assessment consists of a writen exam (90 minutes) taking place in the recess period. The exam takes place in every semester. Re-examinations are offered at every ordinary examination date.

Prerequisites
none

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

V Fluid Technology
2114093, WS 23/24, 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 11.68 Course: Fundamentals in the Development of Commercial Vehicles [T-MACH-111389]

Responsible: Christof Weber
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-105824 - Fundamentals in the Development of Commercial Vehicles

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

Events					
WT 23/24	2113812	Fundamentals in the Development of Commercial Vehicles I	1 SWS	Lecture / 🗣	Weber
ST 2024	2114844	Fundamentals in the Development of Commercial Vehicles II	1 SWS	Lecture / 🗣	Weber
Exams					
WT 23/24	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 I

2113812, WS 23/24, 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.

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

T 11.69 Course: Fundamentals of Automobile Development I [T-MACH-105162]

Responsible: Prof.Dipl.-Ing. Rolf Frech
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-105289 - Principles of Whole Vehicle Engineering I

Type	Credits	Grading scale	Recurrence	Version
Written examination	2	Grade to a third	Each winter term	1

Events					
WT 23/24	2113810	Fundamentals of Automobile Development I	1 SWS	Lecture / 🗣	Frech
WT 23/24	2113851	Principles of Whole Vehicle Engineering I	1 SWS	Lecture / 🗣	Frech
Exams					
WT 23/24	76-T-MACH-105162	Fundamentals of Automobile Development I			Frech, Unrau
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 23/24, 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 23/24, 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 11.70 Course: Fundamentals of Automobile Development II [T-MACH-105163]

Responsible: Prof.Dipl.-Ing. Rolf Frech
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-105290 - Principles of Whole Vehicle Engineering II

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					
WT 23/24	76-T-MACH-105163	Fundamentals of Automobile Development II			Frech, Unrau
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.

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.

Kann nicht mit der Veranstaltung [2114842] kombiniert werden.

Cannot be combined with lecture [2114842].

Literature

Das Skript zur Vorlesung ist über ILIAS verfügbar.

T 11.71 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-105091 - Advanced Topics and Methods in Mechanical Engineering (5 CP)

Type	Credits	Grading scale	Recurrence	Version
Written examination	5	Grade to a third	Each winter term	2

Events					
WT 23/24	2133123	Fundamentals of Combustion Engine Technology	2 SWS	Lecture / 🗣	Kubach, Wagner, Toedter, Pfeil, Bernhardt, Velji
Exams					
WT 23/24	76-T-MACH-105652	Fundamentals of Combustion Engine Technology			Kubach
WT 23/24	76-T-MACH-105652(SP)	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 23/24, 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 11.72 Course: Fundamentals of Combustion I [T-MACH-105213]

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

Part of: M-MACH-102707 - Fundamentals of Combustion I
M-MACH-104919 - Advanced Topics and Methods in Mechanical Engineering (4 CP)

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

Events					
WT 23/24	2165515	Fundamentals of Combustion I	2 SWS	Lecture / 🗣	Maas, Shrotriya, Zenk
WT 23/24	2165517	Fundamentals of Combustion I (Tutorial)	1 SWS	Practice / 🗣	Bykov
WT 23/24	3165016	Fundamentals of Combustion I	2 SWS	Lecture / 🗣	Maas
WT 23/24	3165017	Fundamentals of Combustion I (Tutorial)	1 SWS	Practice / 🗣	Bykov
Exams					
WT 23/24	76-T-MACH-105213	Fundamentals of Combustion I - german exam			Maas
WT 23/24	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 23/24, 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 23/24, 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 23/24, 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 11.73 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-102690 - 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					
WT 23/24	76-T-MACH-105220	Fundamentals of Energy Technology			Badea, Cheng
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

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 11.74 Course: Fundamentals on High Frequency Techniques [T-ETIT-101955]

Responsible: Prof. Dr.-Ing. Thomas Zwick
Organisation: KIT Department of Electrical Engineering and Information Technology
Part of: M-ETIT-102129 - Fundamentals on High Frequency Techniques
M-ETIT-105647 - Electromagnetic Waves/Fundamentals on High Frequency Techniques

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

Events					
ST 2024	2308080	Accompanying group tutorial for 2308406 Fundamentals on High Frequency Techniques		Tutorial (/ 🗣	Nuß
ST 2024	2308406	Fundamentals on High Frequency Techniques	2 SWS	Lecture / 🗣	Nuß
ST 2024	2308408	Tutorial for 2308406 Fundamentals on High Frequency Techniques	2 SWS	Practice / 🗣	Nuß
Exams					
WT 23/24	7308406	Fundamentals on High Frequency Techniques			Zwick, Nuß

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

Competence Certificate
Success control is carried out as part of a written overall examination (120 minutes) of the selected courses, with which the minimum requirement for CP is met and the assessment of homework. Students can work on the homework exercises during the semester and submit them for correction. The handover is in handwritten form.

Prerequisites
none

Recommendation
Knowledge of the basics of high frequency technology is helpful.

Annotation
The module grade is the grade of the written exam. If at least 50% of the total points of the homework are achieved, the student receives a grade bonus of 0.3 or 0.4 grade points on passing the written exam. If the grade of the written exam is between 4.0 and 1.3, the bonus improves the grade of the written exam by one grade (0.3 or 0.4). The exact criteria for awarding a bonus will be announced at the beginning of the course.

The grade bonus once acquired will remain for a possible written examination in a later semester. The homework is a voluntary additional service, i.e. Even without the grade bonus, the full score or top grade can be achieved in the exam.

T 11.75 Course: Fuzzy Sets [T-INFO-101376]

Responsible: Prof. Dr.-Ing. Uwe Hanebeck
Organisation: KIT Department of Informatics
Part of: M-INFO-100839 - Fuzzy Sets

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

Exams			
WT 23/24	7500011	Fuzzy Sets	Pfaff

T 11.76 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-105288 - Handling Characteristics of Motor Vehicles I

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

Events					
WT 23/24	2113807	Handling Characteristics of Motor Vehicles I	2 SWS	Lecture / 🖥	Unrau
Exams					
WT 23/24	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 23/24, 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 11.77 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-102717 - Heat and Mass Transfer
M-MACH-104919 - Advanced Topics and Methods in Mechanical Engineering (4 CP)

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

Events					
WT 23/24	2165512	Heat and mass transfer	2 SWS	Lecture / 🗣	Yu, Maas
ST 2024	3122512	Heat and Mass Transfer	2 SWS	Lecture / 🗣	Maas
Exams					
WT 23/24	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
2165512, WS 23/24, 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
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

T 11.78 Course: Human-Machine-Interaction [T-INFO-101266]

Responsible: Prof. Dr.-Ing. Michael Beigl
Organisation: KIT Department of Informatics
Part of: M-INFO-100729 - Human Computer Interaction

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

Events					
ST 2024	24659	Human-Computer-Interaction	2 SWS	Lecture /	Beigl, Lee
Exams					
WT 23/24	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 11.79 Course: Human-Machine-Interaction in Anthropomatics: Basics [T-INFO-101361]

Responsible: Prof. Dr.-Ing. Jürgen Beyerer
Dr.-Ing. Florian van de Camp

Organisation: KIT Department of Informatics

Part of: M-INFO-100824 - Human-Machine-Interaction in Anthropomatics: Basics

Type	Credits	Grading scale	Recurrence	Version
Written examination	3	Grade to a third	Each winter term	2

Events					
WT 23/24	24100	Human-Machine-Interaction in Anthropomatics: Basics	2 SWS	Lecture / 🧩	van de Camp
Exams					
WT 23/24	7500017	Human-Machine-Interaction in Anthropomatics: Basics			Beyerer, van de Camp

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

T 11.80 Course: Human-Machine-Interaction Pass [T-INFO-106257]

Responsible: Prof. Dr.-Ing. Michael Beigl
Organisation: KIT Department of Informatics
Part of: M-INFO-100729 - Human Computer Interaction

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

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

T 11.81 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-ETIT-100514 - Hybrid and Electric Vehicles
M-ETIT-105643 - Electric Energy Systems/Hybrid and Electric Vehicles

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

Events					
WT 23/24	2306321	Hybrid and Electric Vehicles	2 SWS	Lecture /	Doppelbauer
WT 23/24	2306323	Tutorial for 2306323 Hybrid and Electric Vehicles	1 SWS	Practice /	Doppelbauer
Exams					
WT 23/24	7306321	Hybrid and Electric Vehicles			Doppelbauer
ST 2024	7306321	Hybrid and Electric Vehicles			Doppelbauer

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

Prerequisites
none

T 11.82 Course: Image Processing [T-ETIT-105566]

Responsible: Prof. Dr.-Ing. Michael Heizmann
Organisation: KIT Department of Electrical Engineering and Information Technology
Part of: M-ETIT-102651 - Image Processing

Type	Credits	Grading scale	Recurrence	Version
Written examination	3	Grade to a third	Each summer term	1

Events					
ST 2024	2302114	Bildverarbeitung	2 SWS	Lecture /	Heizmann
Exams					
WT 23/24	7302114	Image Processing			Heizmann

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

Prerequisites
none

T 11.83 Course: In-depth Module - Doing Culture - Self Assignment BAK [T-ZAK-112655]

Responsible: Dr. Christine Mielke
Christine Myglas

Organisation:

Part of: M-ZAK-106235 - Supplementary Studies on Culture and Society

Type	Credits	Grading scale	Version
Examination of another type	3	Grade to a third	1

Competence Certificate

At least two presentations must be given: An examination of another kind according to § 5 section 3 (3) in the form of a presentation in one of the chosen courses (3 ECT).
In a third seminar, either (a) a presentation is held (preliminary study achievement) which remains not graded and a topic-related term paper is submitted or (b) a written exam is taken.
The three courses can be selected individually from the 5 thematic blocks or – in exceptional cases and according to the agreement with the responsible lecturer – all three courses can be selected from one block in the sense of a specialization.
In addition, an oral examination is taken, which relates to the content of two of the chosen three courses.

Prerequisites

Prerequisite for the 'Oral Examination' is the successful completion of Modules 1 and 3 and the required elective sections in Module 2.

Self service assignment of supplementary stdues

This course can be used for self service assignment of grade aquired from the following study providers:

- Zentrum für Angewandte Kulturwissenschaft und Studium Generale
- ZAK Begleitstudium

Annotation

The content of the Basic Modul is helpful.

T 11.84 Course: In-depth Module - Global Cultures - Self Assignment BAK [T-ZAK-112658]

Responsible: Dr. Christine Mielke
Christine Myglas

Organisation:

Part of: M-ZAK-106235 - Supplementary Studies on Culture and Society

Type	Credits	Grading scale	Version
Examination of another type	3	Grade to a third	1

Competence Certificate
At least two presentations must be given: An examination of another kind according to § 5 section 3 (3) in the form of a presentation in one of the chosen courses (3 ECT).
In a third seminar, either (a) a presentation is held (preliminary study achievement) which remains not graded and a topic-related term paper is submitted or (b) a written exam is taken.
The three courses can be selected individually from the 5 thematic blocks or – in exceptional cases and according to the agreement with the responsible lecturer – all three courses can be selected from one block in the sense of a specialization.
In addition, an oral examination is taken, which relates to the content of two of the chosen three courses.

Prerequisites
Prerequisite for the 'Oral Examination' is the successful completion of Modules 1 and 3 and the required elective sections in Module 2.

Self service assignment of supplementary stdues
This course can be used for self service assignment of grade aquired from the following study providers:

- Zentrum für Angewandte Kulturwissenschaft und Studium Generale
- ZAK Begleitstudium

Annotation
The content of the Basic Modul is helpful.

T 11.85 Course: In-depth Module - Media & Aesthetics - Self Assignment BAK [T-ZAK-112656]

Responsible: Dr. Christine Mielke
Christine Myglas

Organisation:

Part of: M-ZAK-106235 - Supplementary Studies on Culture and Society

Type	Credits	Grading scale	Version
Examination of another type	3	Grade to a third	1

Competence Certificate
At least two presentations must be given: An examination of another kind according to § 5 section 3 (3) in the form of a presentation in one of the chosen courses (3 ECT).
In a third seminar, either (a) a presentation is held (preliminary study achievement) which remains not graded and a topic-related term paper is submitted or (b) a written exam is taken.
The three courses can be selected individually from the 5 thematic blocks or – in exceptional cases and according to the agreement with the responsible lecturer – all three courses can be selected from one block in the sense of a specialization.
In addition, an oral examination is taken, which relates to the content of two of the chosen three courses.

Prerequisites
Prerequisite for the 'Oral Examination' is the successful completion of Modules 1 and 3 and the required elective sections in Module 2.

Self service assignment of supplementary stdues
This course can be used for self service assignment of grade aquired from the following study providers:

- Zentrum für Angewandte Kulturwissenschaft und Studium Generale
- ZAK Begleitstudium

Annotation
The content of the Basic Modul is helpful.

T 11.86 Course: In-depth Module - Spheres of Life - Self Assignment BAK [T-ZAK-112657]

Responsible: Dr. Christine Mielke
Christine Myglas

Organisation:

Part of: M-ZAK-106235 - Supplementary Studies on Culture and Society

Type	Credits	Grading scale	Version
Examination of another type	3	Grade to a third	1

Competence Certificate
At least two presentations must be given: An examination of another kind according to § 5 section 3 (3) in the form of a presentation in one of the chosen courses (3 ECT).
In a third seminar, either (a) a presentation is held (preliminary study achievement) which remains not graded and a topic-related term paper is submitted or (b) a written exam is taken.
The three courses can be selected individually from the 5 thematic blocks or – in exceptional cases and according to the agreement with the responsible lecturer – all three courses can be selected from one block in the sense of a specialization.
In addition, an oral examination is taken, which relates to the content of two of the chosen three courses.

Prerequisites
Prerequisite for the 'Oral Examination' is the successful completion of Modules 1 and 3 and the required elective sections in Module 2.

Self service assignment of supplementary stdues
This course can be used for self service assignment of grade aquired from the following study providers:

- Zentrum für Angewandte Kulturwissenschaft und Studium Generale
- ZAK Begleitstudium

Annotation
The content of the Basic Modul is helpful.

T 11.87 Course: In-depth Module - Technology & Responsibility - Self Assignment BAK [T-ZAK-112654]

Responsible: Dr. Christine Mielke
Christine Myglas

Organisation:

Part of: M-ZAK-106235 - Supplementary Studies on Culture and Society

Type	Credits	Grading scale	Version
Examination of another type	3	Grade to a third	1

Competence Certificate

At least two presentations must be given: An examination of another kind according to § 5 section 3 (3) in the form of a presentation in one of the chosen courses (3 ECT).
In a third seminar, either (a) a presentation is held (preliminary study achievement) which remains not graded and a topic-related term paper is submitted or (b) a written exam is taken.
The three courses can be selected individually from the 5 thematic blocks or – in exceptional cases and according to the agreement with the responsible lecturer – all three courses can be selected from one block in the sense of a specialization.
In addition, an oral examination is taken, which relates to the content of two of the chosen three courses.

Prerequisites

Prerequisite for the 'Oral Examination' is the successful completion of Modules 1 and 3 and the required elective sections in Module 2.

Self service assignment of supplementary stdues

This course can be used for self service assignment of grade aquired from the following study providers:

- Zentrum für Angewandte Kulturwissenschaft und Studium Generale
- ZAK Begleitstudium

Annotation

The content of the Basic Modul is helpful.

T 11.88 Course: Information Processing in Sensor Networks [T-INFO-101466]

Responsible: Prof. Dr.-Ing. Uwe Hanebeck
Organisation: KIT Department of Informatics
Part of: M-INFO-100895 - Information Processing in Sensor Networks

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

Exams			
WT 23/24	7500030	Information Processing in Sensor Networks	Pfaff

T 11.89 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-105281 - Information Systems and Supply Chain Management

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 11.90 Course: Information Technology I [T-ETIT-109300]

Responsible: Prof. Dr.-Ing. Eric Sax
Organisation: KIT Department of Electrical Engineering and Information Technology
Part of: M-ETIT-104539 - Information Technology I

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

Events					
ST 2024	2303185	Informationstechnik und Automatisierungstechnik	3 SWS	Lecture / 🗣	Barth
ST 2024	2303186	Übung zu Informationstechnik und Automatisierungstechnik	1 SWS	Practice / 🗣	Madsen
Exams					
WT 23/24	7311651	Information Technology I			Sax
ST 2024	7300024	Information and Automation Technology			Barth

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

Competence Certificate
Einer schriftlichen Prüfung nach im Umfang von 120 Minuten zu den Lehrveranstaltungen Vorlesung, Übung.

11.91 Course: Information Technology I - Practical Course [T-ETIT-109301]

Responsible: Prof. Dr.-Ing. Eric Sax
Organisation: KIT Department of Electrical Engineering and Information Technology
Part of: M-ETIT-104539 - Information Technology I

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

Events					
ST 2024	2311653	Laboratory on Information Technology I	1 SWS	Practical course /	Sax

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

Competence Certificate
Einer Erfolgskontrolle in Form von Projektdokumentationen und Kontrolle des Quellcodes im Rahmen der Lehrveranstaltung Praktikum.

T 11.92 Course: Information Technology II and Automation Technology [T-ETIT-109319]

Responsible: Prof. Dr.-Ing. Eric Sax
Organisation: KIT Department of Electrical Engineering and Information Technology
Part of: M-ETIT-104547 - Information Technology II and Automation Technology
M-ETIT-105644 - Information and Automation Technology II/Laboratory for Machine Learning Algorithms
M-ETIT-105645 - Information and Automation Technology II/Seminar Embedded Systems

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

Events					
ST 2024	2311654	Information Technology II and Automation Technology	2 SWS	Lecture / 🗣	Sax
ST 2024	2311655	Tutorial for 2311654 Information Technology II and Automation Technology	1 SWS	Practice / 🗣	Zink
Exams					
WT 23/24	7311654	Information Technology II and Automation Technology			Sax

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

Competence Certificate
Einer schriftlichen Prüfung nach im Umfang von 120 Minuten zu den Lehrveranstaltungen Vorlesung, Übung.

T 11.93 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-106514 - Innovation and Project Management in Rail Vehicle Engineering

Type	Credits	Grading scale	Version
Examination of another type	4	Grade to a third	3

Events					
WT 23/24	2115921	Innovation and Project Management with Case Study "Innovative Rail Vehicle"	2 SWS	Lecture / 🗣	Cichon
ST 2024	2115921	Innovation and Project Management with Case Study "Innovative Rail Vehicle"	2 SWS	Lecture / 🗣	Cichon, Berthold
Exams					
WT 23/24	76-T-MACH-106427	Innovation and Project Management in Rail Vehicle Engineering			Cichon
ST 2024	76-T-MACH-106427	Innovation and Project Management in Rail Vehicle Engineering			Cichon, Berthold

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

Competence Certificate
Presentation (duration approx. 20 minutes) and colloquium

T 11.94 Course: Innovative Concepts for Programming Industrial Robots [T-INFO-101328]

Responsible: Prof. Dr.-Ing. Björn Hein
Organisation: KIT Department of Informatics
Part of: M-INFO-100791 - Innovative Concepts for Programming Industrial Robots

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

Events					
ST 2024	24179	Innovative Concepts for Programming Industrial Robots	2 SWS	Lecture / 🗣	Hein
Exams					
WT 23/24	750001	Innovative Concepts for programming Industrial Robots			Hein

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

T 11.95 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-104919 - Advanced Topics and Methods in Mechanical Engineering (4 CP)

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

Events					
WT 23/24	2121001	Integrated Information Systems for engineers	3 SWS	Lecture / Practice (/ 🗣	Ovtcharova, Elstermann
ST 2024	2121001	Integrated Information Systems for engineers	3 SWS	Lecture / Practice (/ 🗣	Elstermann, Meyer
Exams					
WT 23/24	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, WS 23/24, 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, 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

T 11.96 Course: Internship [T-MACH-108803]

Responsible: Prof. Dr. Martin Doppelbauer
Prof. Dr.-Ing. Marcus Geimer
Organisation: KIT Department of Mechanical Engineering
Part of: M-MACH-104265 - Internship

Type	Credits	Grading scale	Recurrence	Version
Completed coursework	15	pass/fail	Each term	1

Exams			
WT 23/24	76-T-MACH-108803	Internship	Doppelbauer, Geimer

Competence Certificate
An internship of at least thirteen weeks has to be fulfilled, which is suitable to provide the student an insight into the professionell work in the area of mechatronics and information technology. 15 ECTS are allocated to the intership.

Original certificates and reports about the internship has to be provided to the appropriate internship office.

The reports have to contain a compilation of activities during the internship with the following content:
company, area of production, workshop or department, instruction period in each workshop or department with start and end date and one detailed report per week or project. The report hast to consist of at least one DIN A4 page per week and should have the format of a scientific report. The reports should give evidence, that the author has done all reported activities by himself, for example by describing the work flow or reflecting the gained experience. Sketches, drawings, schematics etc. can save a long report.

The reports have to be checked by the supervisor in the company and have to be approved by stamp and signature. Periods which are not verified by a report cannot be accredited.

Prerequisites
None

Annotation
Further information are provided by the internship guidlines for the BSc-course in Mechatronics and Information Technology.

T 11.97 Course: Introduction to Energy Economics [T-WIWI-102746]

Responsible: Prof. Dr. Wolf Fichtner
Organisation: KIT Department of Economics and Management
Part of: M-WIWI-100498 - Introduction into Energy Economics

Type	Credits	Grading scale	Recurrence	Version
Written examination	5	Grade to a third	Each summer term	6

Events					
ST 2024	2581010	Introduction to Energy Economics	2 SWS	Lecture / 🗣	Fichtner
ST 2024	2581011	Übungen zu Einführung in die Energiewirtschaft	2 SWS	Practice / 🗣	Sandmeier, Fichtner, Scharnhorst
Exams					
WT 23/24	7981010	Introduction to Energy Economics			Fichtner

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

Competence Certificate
The assessment consists of a written exam (90 minutes) (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 Introduction to Energy Economics

2581010, SS 2024, 2 SWS, Language: German, Open in study portal

Lecture (V)
On-Site

Content

1. Introduction: terms, units, conversions
2. The energy carrier gas (reserves, resources, technologies)
3. The energy carrier oil (reserves, resources, technologies)
4. The energy carrier hard coal (reserves, resources, technologies)
5. The energy carrier lignite (reserves, resources, technologies)
6. The energy carrier uranium (reserves, resources, technologies)
7. The final carrier source electricity
8. The final carrier source heat
9. Other final energy carriers (cooling energy, hydrogen, compressed air)

The student is able to

- characterize and judge the different energy carriers and their peculiarities,
- understand contexts related to energy economics.

Literature
Weiterführende Literatur:

Pfaffenberger, Wolfgang. Energiewirtschaft. ISBN 3-486-24315-2

Feess, Eberhard. Umweltökonomie und Umweltpolitik. ISBN 3-8006-2187-8

Müller, Leonhard. Handbuch der Elektrizitätswirtschaft. ISBN 3-540-67637-6

Stoft, Steven. Power System Economics. ISBN 0-471-15040-1

Erdmann, Georg. Energieökonomik. ISBN 3-7281-2135-5

T 11.98 Course: Introduction to High Voltage Engineering [T-ETIT-110702]

Responsible: Dr.-Ing. Michael Suriyah
Organisation: KIT Department of Electrical Engineering and Information Technology
Part of: M-ETIT-105276 - Introduction to High Voltage Engineering

Type	Credits	Grading scale	Recurrence	Expansion	Version
Oral examination	3	Grade to a third	Each summer term	1 terms	1

Events					
ST 2024	2307395	Introduction to High Voltage Engineering	2 SWS	Lecture / 🗣	Suriyah
Exams					
WT 23/24	7307396	Introduction to High Voltage Engineering			Suriyah
ST 2024	7307395	Introduction to High Voltage Engineering			Suriyah

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

Competence Certificate
Oral exam approx. 20 min.

Prerequisites
none

Recommendation
Basic knowledge in network theory, field theory and electrical metrology

T 11.99 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-102691 - Introduction to Microsystem Technology I

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

Events					
WT 23/24	2141861	Introduction to Microsystem Technology I	2 SWS	Lecture / 🗣	Korvink, Badilita
Exams					
WT 23/24	76-T-MACH-105182	Introduction to Microsystem Technology I			Korvink, Badilita
ST 2024	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 23/24, 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 11.100 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-102706 - Introduction to Microsystem Technology II

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					
WT 23/24	76-T-MACH-105183	Introduction to Microsystem Technology II			Korvink, Badilita
ST 2024	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

2142874, SS 2024, 2 SWS, Language: English, Open in study portal

Lecture (V)
On-Site

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 11.101 Course: Introduction to Multi-Body Dynamics [T-MACH-105209]

Responsible: Dr.-Ing. Ulrich Römer
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-103205 - Engineering Mechanics
M-MACH-105091 - Advanced Topics and Methods in Mechanical Engineering (5 CP)

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					
WT 23/24	76-T-MACH-105209	Introduction into the Multi-Body Dynamics			Proppe, Römer
WT 23/24	76-T-MACH-105209-mPr	Introduction to Multi-Body Dynamics			Römer
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 11.102 Course: Introduction to Operations Research I and II [T-WIWI-102758]

Responsible: Prof. Dr. Stefan Nickel
Prof. Dr. Steffen Rebennack
Prof. Dr. Oliver Stein
Organisation: KIT Department of Economics and Management
Part of: M-WIWI-101418 - Introduction to Operations Research

Type	Credits	Grading scale	Recurrence	Version
Written examination	9	Grade to a third	see Annotations	2

Events					
WT 23/24	2500030	Computer Exercises on Introduction to Operations Research II	1 SWS	Tutorial (/ 🖥	Dunke
WT 23/24	2530043	Introduction to Operations Reseasrch II	2 SWS	Lecture / 🧩	Rebennack
WT 23/24	2530044			Tutorial (/ 🗣	Dunke
ST 2024	2500008	Computer Exercises on Introduction to Operations Research I	1 SWS	Tutorial (/ 🖥	Dunke
ST 2024	2550040	Introduction to Operations Research I	2 SWS	Lecture / 🗣	Nickel
ST 2024	2550043	Tutorials on Introduction to Operations Research I	2 SWS	Tutorial (/ 🗣	Dunke
Exams					
WT 23/24	7900209	Introduction to Operations Research I and II			Rebennack

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

Competence Certificate
The assessment of the module is carried out by a written examination (120 minutes) according to Section 4(2), 1 of the examination regulation.
In each term (usually in March and August), one examination is held for both courses.
The overall grade of the module is the grade of the written examination.

Prerequisites
None

Recommendation
Knowledge of Mathematics I and II is recommended, as well as programming knowledge for the software laboratory.
It is strongly recommended to attend the course Introduction to Operations Research I [2550040] before attending the courseIntroduction to Operations Research II [2530043].

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

V Introduction to Operations Reseasrch II

2530043, WS 23/24, 2 SWS, Open in study portal

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

Content
Integer and combinatorial optimization: basic concepts, cutting plane methods, branch-and-bound methods, branch-and-cut methods, heuristic methods.

Nonlinear optimization: basic concepts, optimality conditions, solution methods for convex and nonconvex optimization problems.

Dynamic and stochastic models and methods: Dynamic optimization, Bellman methods, lot-sizing models and dynamic and stochastic models of inventory, queues.

Learning Objectives:

The student

- knows and describes the basic concepts of integer and combinatorial optimization, nonlinear optimization and dynamic optimization,
- knows the methods and models indispensable for a quantitative analysis,
- models and classifies optimization problems and selects appropriate solution procedures to solve simple optimization problems independently,
- validates, illustrates and interprets obtained solutions.

Literature

- Nickel, Stein, Waldmann: Operations Research, 2. Auflage, Springer, 2014
- Hillier, Lieberman: Introduction to Operations Research, 8th edition. McGraw-Hill, 2005
- Murty: Operations Research. Prentice-Hall, 1995
- Neumann, Morlock: Operations Research, 2. Auflage. Hanser, 2006
- Winston: Operations Research - Applications and Algorithms, 4th edition. PWS-Kent, 2004

V **Introduction to Operations Research I**
2550040, SS 2024, 2 SWS, Language: German, Open in study portal

Lecture (V)
On-Site

Content
Examples for typical OR problems.

Linear Programming: Basic notions, simplex method, duality, special versions of the simplex method (dual simplex method, three phase method), sensitivity analysis, parametric optimization, game theory.

Graphs and Networks: Basic notions of graph theory, shortest paths in networks, project scheduling, maximal and minimal cost flows in networks.

Learning objectives:

The student

- names and describes basic notions of linear programming as well as graphs and networks,
- knows the indispensable methods and models for quantitative analysis,
- models and classifies optimization problems and chooses the appropriate solution methods to solve optimization problems independently,
- validates, illustrates and interprets the obtained solutions.

Literature

- Nickel, Rebennack, Stein, Waldmann: Operations Research, 3. Auflage, Springer, 2022
- Hillier, Lieberman: Introduction to Operations Research, 8th edition. McGraw-Hill, 2005
- Murty: Operations Research. Prentice-Hall, 1995
- Neumann, Morlock: Operations Research, 2. Auflage. Hanser, 2006
- Winston: Operations Research - Applications and Algorithms, 4th edition. PWS-Kent, 2004

T 11.103 Course: Introduction to Video Analysis [T-INFO-101273]

Responsible: Prof. Dr.-Ing. Jürgen Beyerer
Organisation: KIT Department of Informatics
Part of: M-INFO-100736 - Introduction to Video Analysis

Type	Credits	Grading scale	Recurrence	Version
Oral examination	3	Grade to a third	Each summer term	1

Events					
ST 2024	24684	Introduction to Video Analysis	2 SWS	Lecture / 🗣	Arens
Exams					
WT 23/24	7500099	Introduction to Video Analysis			Beyerer, Arens

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

T 11.104 Course: IT-Fundamentals of Logistics [T-MACH-105187]

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

Part of: M-MACH-105282 - IT-Fundamentals of Logistics: Opportunities for Digital Transformation

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 11.105 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-105291 - Lab Computer-Aided Methods for Measurement and Control

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

Events					
WT 23/24	2137306	Lab Computer-aided methods for measurement and control	3 SWS	Practical course / 🗣	Stiller, Immel
Exams					
WT 23/24	76-T-MACH-105341	Lab Computer-Aided Methods for Measurement and Control			Stiller

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

Competence Certificate
Colloquia

Prerequisites
none

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

V Lab Computer-aided methods for measurement and control

2137306, WS 23/24, 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 11.106 Course: Lab Course Electrical Drives and Power Electronics [T-ETIT-100718]

Responsible: Prof. Dr. Martin Doppelbauer
Organisation: KIT Department of Electrical Engineering and Information Technology
Part of: M-ETIT-100401 - Lab Course Electrical Drives and Power Electronics

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

Events					
ST 2024	2306331	Lab Course Electrical Drives and Power Electronics	4 SWS	Practical course / 🗣	Brodatzki, Hiller

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

Prerequisites
none

T 11.107 Course: Lab Course Electrical Power Engineering [T-ETIT-100728]

Responsible: Dr.-Ing. Rainer Badent
Prof. Dr. Martin Doppelbauer
Prof. Dr.-Ing. Thomas Leibfried

Organisation: KIT Department of Electrical Engineering and Information Technology

Part of: M-ETIT-100419 - Lab Course Electrical Power Engineering

Type	Credits	Grading scale	Recurrence	Version
Examination of another type	6	Grade to a third	Each winter term	2

Events					
WT 23/24	2307398	Lab Course Electrical Power Engineering	4 SWS	Practical course / 🗣	Badent, Brodatzki, N.N.
Exams					
WT 23/24	7307398	Lab Course Electrical Power Engineering			Badent

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

Prerequisites
none

T 11.108 Course: Laboratory Biomedical Engineering [T-ETIT-101934]

Responsible: Prof. Dr. Werner Nahm
Organisation: KIT Department of Electrical Engineering and Information Technology
Part of: M-ETIT-100389 - Laboratory Biomedical Engineering

Type	Credits	Grading scale	Recurrence	Version
Examination of another type	6	Grade to a third	Each summer term	3

Events					
ST 2024	2305276	Laboratory Biomedical Engineering	4 SWS	Practical course / 🗣	Nahm
Exams					
ST 2024	7305276	Laboratory Biomedical Engineering			Nahm

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

Prerequisites
Passed exam of the module "Biomedizinische Messtechnik I".

Modeled Conditions
You have to fulfill one of 2 conditions:

1. The course T-ETIT-106492 - Biomedical Measurement Techniques I must have been passed.
2. The course T-ETIT-101928 - Biomedical Measurement Techniques I must have been passed.

T 11.109 Course: Laboratory Circuit Design [T-ETIT-100788]

Responsible: Prof. Dr.-Ing. Jürgen Becker
Dr.-Ing. Oliver Sander

Organisation: KIT Department of Electrical Engineering and Information Technology

Part of: M-ETIT-100518 - Laboratory Circuit Design

Type	Credits	Grading scale	Recurrence	Version
Examination of another type	6	Grade to a third	Each winter term	1

Events					
WT 23/24	2311638	Laboratory Circuit Design	4 SWS	Practical course / 🗣	Becker
Exams					
WT 23/24	7311638	Laboratory Circuit Design			Becker

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

Prerequisites
none

T 11.110 Course: Laboratory for Applied Machine Learning Algorithms [T-ETIT-109839]

Responsible: Prof. Dr.-Ing. Jürgen Becker
Prof. Dr.-Ing. Eric Sax
Prof. Dr. Wilhelm Stork

Organisation: KIT Department of Electrical Engineering and Information Technology

Part of: M-ETIT-104823 - Laboratory for Applied Machine Learning Algorithms
M-ETIT-105644 - Information and Automation Technology II/Laboratory for Machine Learning Algorithms

Type	Credits	Grading scale	Recurrence	Expansion	Version
Examination of another type	6	Grade to a third	Each winter term	1 terms	1

Events					
WT 23/24	2311650	Laboratory for Applied Machine Learning Algorithms	4 SWS	Practical course / 🗣	Sax, Stork, Becker
Exams					
WT 23/24	7311650	Laboratory for Applied Machine Learning Algorithms			Sax, Stork, Becker

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

Prerequisites
none

11.111 Course: Laboratory Hardware and Software in Power Electronic Systems [T-ETIT-106498]

Responsible: Prof. Dr.-Ing. Marc Hiller
Organisation: KIT Department of Electrical Engineering and Information Technology
Part of: M-ETIT-103263 - Laboratory Hardware and Software in Power Electronic Systems

Type	Credits	Grading scale	Recurrence	Version
Examination of another type	6	Grade to a third	Each term	1

Events					
WT 23/24	2306346	Laboratory Hardware and Software in Power Electronic Systems	4 SWS	Practical course / 🗣	Hiller, Swoboda, Cujic
ST 2024	2306346	Laboratory Hardware and Software in Power Electronic Systems	4 SWS	Practical course / 🗣	Hiller, Swoboda, Cujic
Exams					
WT 23/24	7306346	Laboratory Hardware and Software in Power Electronic Systems			Hiller, Stoß

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

Prerequisites
The moduls "M-ETIT-100402 - Workshop Schaltungstechnik in der Leistungselektronik" and "M-ETIT-100404 - Workshop Mikrocontroller in der Leistungselektronik" may neither be started nor completed.

T 11.112 Course: Laboratory Mechatronic Measurement Systems [T-ETIT-106854]

Responsible: Prof. Dr.-Ing. Michael Heizmann
Organisation: KIT Department of Electrical Engineering and Information Technology
Part of: M-ETIT-103448 - Laboratory Mechatronic Measurement Systems

Type	Credits	Grading scale	Recurrence	Version
Written examination	6	Grade to a third	Each winter term	1

Events					
WT 23/24	2302123	Laboratory Mechatronic Measurement Systems	4 SWS	Practical course / 🗣	Heizmann, Steffens
Exams					
WT 23/24	7302123	Laboratory Mechatronic Measurement Systems			Heizmann

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

Competence Certificate
The success control is carried out in the form of a written test of 120 minutes. If there are fewer than 20 candidates, an oral exam of around 20 minutes can alternatively take place. The module grade is the grade of the written or oral exam.

Prerequisites
none

Recommendation
Knowledge from the lectures "Metrology" or "Metrology in Mechatronics" and "Manufacturing Metrology" as well as basic knowledge of programming (e.g. in Matlab, C / C ++) are helpful.

Annotation
Annotations

The submission of the protocols of all experiments is required for admission to the examination. The quality of the protocols is assessed; for the admission to the exam, the quality must be acceptable.

Attendance of all laboratory dates including the introductory event is required. Already in the event of a single unexcused absence, admission to the examination will not be granted.

T 11.113 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-102699 - Laboratory Mechatronics

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

Events					
WT 23/24	2105014	Laboratory mechatronics	3 SWS	Practical course / 🗣	Fidlin, Hagenmeyer, Böhland, Stiller, Chen, Orth, Immel
Exams					
WT 23/24	76-T-MACH-105370	Laboratory Mechatronics			Stiller, Hagenmeyer

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 23/24, 3 SWS, Language: German, Open in study portal

Practical course (P)
On-Site

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

Part II
Solution of a complex problem in team work

Learning objectives:

The student is able to ...

- use his knowledge about mechatronics and microsystems technology to solve a practical problem. The laboratory course comprises simulation, bus communication, measurement instrumentation, control engineering and programming.
- integrate the different subsystems from a manipulator to a working compound system in teamwork.

Nachweis (EN): certificate of successful attendance

Voraussetzung (EN): none

Arbeitsaufwand (EN):

regular attendance: 33.5 h

self-study: 88.5 h

Organizational issues
Das Praktikum ist anmeldepflichtig.

Die Anmeldungsmodalitäten-/fristen werden auf https://www.iai.kit.edu/Pruefungen.php bekannt gegeben.
Siehe Internet / Aushang Raum 033 EG, im Gebäude 40.32.

Literature
Materialien zum Mechatronik-Praktikum

Manuals for the laboratory course on Mechatronics

T 11.114 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-102696 - Lightweight Engineering Design

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					
WT 23/24	76-T-MACH-105221	Lightweight Engineering Design			Albers, Burkardt
ST 2024	76-T-MACH-105221	Lightweight Engineering Design			Düser, Ott, 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

Lecture (V)
On-Site

2146190, SS 2024, 2 SWS, Language: German, Open in study portal

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 11.115 Course: Linear Electronic Networks [T-ETIT-109316]

Responsible: Prof. Dr.-Ing. John Jelonnek
Prof. Dr. Sebastian Kempf

Organisation: KIT Department of Electrical Engineering and Information Technology

Part of: M-ETIT-104519 - Linear Electric Circuits
M-MACH-104333 - Orientation Exam

Type	Credits	Grading scale	Recurrence	Version
Written examination	7	Grade to a third	Each winter term	1

Events					
WT 23/24	2305256	Linear Electric Circuits	4 SWS	Lecture / 🗣	Kempf, Jelonnek
WT 23/24	2305258	Linear Electric Circuits (Tutorial to 2305256)	1 SWS	Practice / 🗣	Wünsch
Exams					
WT 23/24	7305256	Linear Electronic Networks			Kempf, Jelonnek
ST 2024	7312701	Linear Electronic Networks			Kempf, Jelonnek

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

Prerequisites
none

T 11.116 Course: Linear Electronic Networks - Workshop A [T-ETIT-109317]

Responsible: Prof. Dr.-Ing. Thomas Leibfried
Prof. Dr. Ulrich Lemmer

Organisation: KIT Department of Electrical Engineering and Information Technology

Part of: M-ETIT-104519 - Linear Electric Circuits
M-MACH-104333 - Orientation Exam

Type	Credits	Grading scale	Recurrence	Version
Completed coursework	1	pass/fail	Each winter term	2

Events					
WT 23/24	2313732	Linear Electric Circuits - Workshop A	1 SWS	Practical course / 🗣	Lemmer
Exams					
WT 23/24	7313732	Linear Electronic Networks - Workshop A			Lemmer

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

Prerequisites
none

T 11.117 Course: Linear Electronic Networks - Workshop B [T-ETIT-109811]

Responsible: Prof. Dr. Werner Nahm
Organisation: KIT Department of Electrical Engineering and Information Technology
Part of: M-ETIT-104519 - Linear Electric Circuits
M-MACH-104333 - Orientation Exam

Type	Credits	Grading scale	Recurrence	Expansion	Version
Completed coursework	1	pass/fail	Each winter term	1 terms	1

Events					
WT 23/24	2307306	Linear Electronic Networks Workshop B	1 SWS	Practical course / 🗣	Leibfried
WT 23/24	2307400	Linear Electronic Networks - Workshop B	1 SWS	Practical course / 🗣	Leibfried
Exams					
WT 23/24	7307400	Linear Electronic Networks - Workshop B			Leibfried

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

11.118 Course: Localization of Mobile Agents [T-INFO-101377]

Responsible: Prof. Dr.-Ing. Uwe Hanebeck
Organisation: KIT Department of Informatics
Part of: M-INFO-100840 - Localization of Mobile Agents

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
Exams					
WT 23/24	7500020	Localization of Mobile Agents			Zea Cobo

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 11.119 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-105298 - Logistics and Supply Chain Management

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

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

Modeled Conditions
The following conditions have to be fulfilled:

1. The course T-MACH-102089 - Logistics - Organisation, Design and Control of Logistic Systems must not have been started.

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 (also in times during and after Corona) requires working in an international environment and therefore many terms are derived from English, the lecture will be held in English.

T 11.120 Course: Machine Dynamics [T-MACH-105210]

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

Part of: M-MACH-102694 - Machine Dynamics
M-MACH-105091 - Advanced Topics and Methods in Mechanical Engineering (5 CP)

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

Events					
WT 23/24	2161224	Machine Dynamics	2 SWS	Lecture / 🖥	Proppe
ST 2024	2161224	Machine Dynamics	2 SWS	Lecture / 🗣	Proppe
ST 2024	2161225	Machine Dynamics (Tutorial)	1 SWS	Practice / 🗣	Proppe, Fischer
Exams					
WT 23/24	76-T-MACH-105210	Machine Dynamics			Proppe
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, WS 23/24, 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

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

T 11.121 Course: Machine Learning 1 - Basic Methods [T-WIWI-106340]

Responsible: Prof. Dr.-Ing. Johann Marius Zöllner
Organisation: KIT Department of Economics and Management
Part of: M-WIWI-105003 - Machine Learning 1

Type	Credits	Grading scale	Recurrence	Version
Written examination	5	Grade to a third	Each winter term	4

Events					
WT 23/24	2511500	Machine Learning 1 - Fundamental Methods	2 SWS	Lecture / 🗣	Zöllner
WT 23/24	2511501	Exercises to Machine Learning 1 - Fundamental Methods	1 SWS	Practice / 🗣	Zöllner, Polley, Fechner, Daaboul
Exams					
WT 23/24	79AIFB_ML1_C5	Machine Learning 1 - Basic Methods			Zöllner

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

Competence Certificate
Depending on further pandemic developments, the exam will be offered either as an open-book exam, or as a written exam (60 min):

The exam takes place every semester and can be repeated at every regular examination date.

A grade bonus can be earned by successfully completing practice exercises. If the grade of the written exam is between 4.0 and 1.3, the bonus improves the grade by up to one grade level (0.3 or 0.4). Details will be announced in the lecture.

Prerequisites
None.

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

V Machine Learning 1 - Fundamental Methods

2511500, WS 23/24, 2 SWS, Language: German, Open in study portal

Lecture (V)
On-Site

Content
The course prepares students for the rapidly evolving field of machine learning by providing a solid foundation, covering core concepts and techniques to get started in the field. Students delve into different methods in supervised, unsupervised, and reinforcement learning, as well as various model types, ranging from basic linear classifiers to more complex methods, such as deep neural networks. Topics include general learning theory, support vector machines, decision trees, neural network fundamentals, convolutional neural networks, recurrent neural networks, unsupervised learning, reinforcement learning, and Bayesian learning.

The course is accompanied by a corresponding exercise, where students gain hands-on experience by implementing and experimenting with different machine learning algorithms, helping them to apply machine learning algorithms on real world problems.

By the end of the course, students will have acquired a solid foundation in machine learning, enabling them to apply state-of-the-art algorithms to solve complex problems, contribute to research efforts, and explore advanced topics in the field.

Learning obectives:

- Students acquire knowledge of the fundamental methods in the field of machine learning.
- Students can classify, formally describe and evaluate methods of machine learning.
- Students can use their knowledge to select suitable models and methods for selected problems in the field of of machine learning.

Literature
Die Foliensätze sind als PDF verfügbar

Weiterführende Literatur

- Machine Learning - Tom Mitchell
- Deep Learning - Ian Goodfellow, Yoshua Bengio, Aaron Courville
- Pattern Recognition and Machine Learning - Christopher M. Bishop
- Artificial Intelligence: A Modern Approach - Peter Norvig and Stuart J. Russell
- Reinforcement Learning: An Introduction - Richard S. Sutton and Andrew G. Barto

Weitere (spezifische) Literatur zu einzelnen Themen wird in der Vorlesung angegeben.

T 11.122 Course: Machine Learning 2 – Advanced Methods [T-WIWI-106341]

Responsible: Prof. Dr.-Ing. Johann Marius Zöllner
Organisation: KIT Department of Economics and Management
Part of: M-WIWI-105006 - Machine Learning 2

Type	Credits	Grading scale	Recurrence	Version
Written examination	5	Grade to a third	Each summer term	4

Events					
ST 2024	2511502	Machine Learning 2 - Advanced methods	2 SWS	Lecture / 🗣	Zöllner, Fechner, Polley
ST 2024	2511503	Exercises for Machine Learning 2 - Advanced Methods	1 SWS	Practice / 🗣	Zöllner, Fechner, Polley
Exams					
WT 23/24	79AIFB_ML2_B8	Machine Learning 2 – Advanced Methods			Zöllner

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

Competence Certificate
Depending on further pandemic developments, the exam will be offered either as an open-book exam, or as a written exam (60 min).

The exam takes place every semester and can be repeated at every regular examination date.

Prerequisites
None.

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

V Machine Learning 2 - Advanced methods
2511502, SS 2024, 2 SWS, Language: German, Open in study portal

Lecture (V)
On-Site

Content
The subject area of machine intelligence and, in particular, machine learning, taking into account real challenges of complex application domains, is a rapidly expanding field of knowledge and the subject of numerous research and development projects.

The lecture "Machine Learning 2" deals with modern advanced methods of machine learning such as semi-supervised, self-supervised and active learning, deep neural networks (deep learning, CNNs, GANs, diffusion models, transformer, adversarial attacks) and hierarchical approaches, e.g. reinforcement learning. Another focus is the embedding and application of machine learning methods in real systems.

The lecture introduces the latest basic principles as well as extended basic structures and elucidates previously developed algorithms. The structure and the mode of operation of the methods and methods are presented and explained by means of some application scenarios, especially in the field of technical (sub) autonomous systems (vehicles, robotics, neurorobotics, image processing, etc.).

Learning objectives:

- Students understand extended concepts of machine learning and their possible applications.
- Students can classify, formally describe and evaluate methods of machine learning.
- In detail, methods of machine learning can be embedded and applied in complex decision and inference systems.
- Students can use their knowledge to select suitable models and methods of machine learning for existing problems in the field of machine intelligence.

Recommendations:

Attending the lecture ***Machine Learning 1*** or a comparable lecture is very helpful in understanding this lecture.

Literature

Die Foliensätze sind als PDF verfügbar

Weiterführende Literatur

- Deep Learning - Ian Goodfellow
- Artificial Intelligence: A Modern Approach - Peter Norvig and Stuart J. Russell
- Machine Learning - Tom Mitchell
- Pattern Recognition and Machine Learning - Christopher M. Bishop
- Reinforcement Learning: An Introduction - Richard S. Sutton and Andrew G. Barto
- Deep Learning - Ian Goodfellow, Yoshua Bengio, Aaron Courville

Weitere (spezifische) Literatur zu einzelnen Themen wird in der Vorlesung angegeben.

T 11.123 Course: Machine Learning for Robotic Systems 1 [T-MACH-113064]

Responsible: Jun.-Prof. Dr. Rania Rayyes

Organisation: KIT Department of Electrical Engineering and Information Technology

KIT Department of Mechanical Engineering

Part of: M-MACH-106457 - Machine Learning for Robotic Systems 1

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

Events					
WT 23/24	2117055	Machine Learning for Robotic Systems 1	4 SWS	Lecture / Practice (/ 🗣	Rayyes
Exams					
WT 23/24	76-T-MACH-113064	Machine Learning for Robotic Systems 1			Rayyes

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

Competence Certificate
The assessment of this course is a written examination (90 min) according to §4(2), 1 of the examination regulation or an oral exam (20 min) following §4, Abs. 2, 2 of the examination regulation.

Prerequisites
None

Recommendation

- The course assumes basic knowledge in mathematics. e.g., particular (conditional) probabilities, the exponential function, basic linear algebra etc.
- programming skills in one programming language is recommended.
- Attendance of the lectures Robotics 1.
- Some knowledge in statistics is useful.

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

V Machine Learning for Robotic Systems 1

2117055, WS 23/24, 4 SWS, Language: English, Open in study portal

Lecture / Practice (VÜ)
On-Site

Content
This lecture provides an overview of essential and current methods and concepts of Machine Learning for different robotic applications. It covers also their underlying mathematical and statistical methods. Important fundamental terminology, concepts and methods are presented for various topics including:

- Model selection, machine learning bias vs. parameter optimization
- Training, test, validation, generalization, overfitting, regularization
- Supervised vs unsupervised learning
- Regression
- Classifications
- Neural Networks
- Gaussian mixtures, Gaussian mixture regression

And other interesting topics

T 11.124 Course: Machine Learning for Robotic Systems 2 [T-MACH-113403]

Responsible: Jun.-Prof. Dr. Rania Rayyes

Organisation: KIT Department of Electrical Engineering and Information Technology

KIT Department of Mechanical Engineering

Part of: M-MACH-106652 - Machine Learning for Robotic Systems 2

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

Events					
ST 2024	2100015	Machine Learning for Robotic Systems 2	4 SWS	Lecture / Practice (/ 🗣	Rayyes

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

Competence Certificate
The assessment of this course is a written examination (90 min) according to §4(2), 1 of the examination regulation or an oral exam (approx. 20 min) following §4, Abs. 2, 2 of the examination regulation.

Prerequisites
None

Recommendation

- The course assumes basic knowledge in mathematics. e.g., particular (conditional) probabilities, the exponential function, basic linear algebra etc.
- programming skills in one programming language is recommended.
- Attendance of the lecture Machine Learning for Robotic Systems 1
- Attendance of the lectures Robotics 1.
- Some knowledge in statistics is useful.

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

V Machine Learning for Robotic Systems 2

2100015, SS 2024, 4 SWS, Language: English, Open in study portal

Lecture / Practice (VÜ)
On-Site

Content
This lecture provides an overview of current advanced machine learning for different robotic applications. Important fundamental terminology, concepts, and methods are presented for various topics including:

- Active Learning
- Transformers
- Adversarial learning, GANs
- Deep Reinforcement Learning
- Goal-Directed Exploration
- Recurrent Neural Network

And other interesting topics

The course also includes hands-on sessions for programming and implementing the methods.

T 11.125 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-105107 - Machine Tools and Industrial Handling

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

Events					
WT 23/24	2149910	Machine Tools and High-Precision Manufacturing Systems	6 SWS	Lecture / Practice (/ 🗣	Fleischer
Exams					
WT 23/24	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.

Modeled Conditions
The following conditions have to be fulfilled:

1. The course T-MACH-110963 - Machine Tools and High-Precision Manufacturing Systems must not have been started.

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

V Machine Tools and High-Precision Manufacturing Systems

Lecture / Practice (VÜ)
On-Site

2149910, WS 23/24, 6 SWS, Language: German, Open in study portal

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 11.126 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-101923 - Machine Vision

Type	Credits	Grading scale	Recurrence	Version
Written examination	8	Grade to a third	Each winter term	2

Events					
WT 23/24	2137308	Machine Vision	4 SWS	Lecture / Practice (/ 🗣	Lauer, Klemp
Exams					
WT 23/24	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 23/24, 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 11.127 Course: Manufacturing Measurement Technology [T-ETIT-106057]

Responsible: Prof. Dr.-Ing. Michael Heizmann
Organisation: KIT Department of Electrical Engineering and Information Technology
Part of: M-ETIT-103043 - Manufacturing Measurement Technology

Type	Credits	Grading scale	Recurrence	Version
Written examination	3	Grade to a third	Each summer term	1

Events					
ST 2024	2302116	Fertigungsmesstechnik	2 SWS	Lecture /	Heizmann
Exams					
WT 23/24	7302116	Manufacturing Measurement Technology			Heizmann

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

T 11.128 Course: Material Flow in Logistic Systems [T-MACH-102151]

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

Part of: M-MACH-104984 - Material Flow in Logistic Systems

Type	Credits	Grading scale	Recurrence	Version
Examination of another type	9	Grade to a third	Each winter term	3

Exams			
WT 23/24	76-T-MACH-102151	Material Flow in Logistic Systems	Furmans

Competence Certificate
The assessment (Prüfungsleistung anderer Art) consists of the following assignments:

- 40% assessment of the final case study as individual performance,
- 60% semester evaluation which includes working on 5 case studies and defending those (For both assessment types, the best 4 of 5 tries count for the final grade.):
    - 40% assessment of the result of the case studies as group work,
    - 20% assessment of the oral examination during the case study colloquiums as individual performance.

A detailed description of the learning control can be found under Annotations.

Prerequisites
none

Recommendation
Recommended elective subject: Probability Theory and Statistics

Annotation
Students are divided into groups for this course. Five case studies are carried out in these groups. The results of the group work during the lecture period are presented and evaluated in writing. In the oral examination during the case study colloquiums, the understanding of the result of the group work and the models dealt with in the course is tested. The participation in the oral defenses is compulsory and will be controlled. For the written submission the group receives a common grade, in the oral defense each group member is evaluated individually.

After the lecture period, there is the final case study. This case study contains the curriculum of the whole semester. The students work individually on this case study which takes place at a predefined place and time (duration: 4h).

T 11.129 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-103205 - Engineering Mechanics

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

Events					
WT 23/24	2161254	Mathematical Methods in Continuum Mechanics	2 SWS	Lecture / 🗣	Böhlke
Exams					
WT 23/24	76-T-MACH-110375	Mathematical Methods in Continuum Mechanics			Böhlke

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

Competence Certificate
written exam (90 min). Additives as announced.

Prerequisites
Passing the Tutorial to Mathematical Methods of Continuum Mechanics (T-MACH-110376)

Modeled Conditions
The following conditions have to be fulfilled:

1. The course T-MACH-110376 - Tutorial Mathematical Methods in Continuum Mechanics must have been passed.

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

V Mathematical Methods in Continuum Mechanics

2161254, WS 23/24, 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 11.130 Course: Mathematical Methods in Dynamics [T-MACH-105293]

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

Part of: M-MACH-106309 - Advanced Topics and Methods in Mechanical Engineering (6 CP)

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

Events					
WT 23/24	2161206	Mathematical Methods in Dynamics	2 SWS	Lecture /	Proppe
WT 23/24	2161207	Übungen zu Mathematische Methoden der Dynamik	1 SWS	Practice /	Proppe, Bitner
ST 2024	2161206	Mathematical Methods in Dynamics	2 SWS	Lecture /	Proppe
Exams					
WT 23/24	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, WS 23/24, 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 23/24, 1 SWS, Language: German, Open in study portal	**Practice (Ü)** **On-Site**

Content
Excercises related to the lecture

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

T 11.131 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-106309 - Advanced Topics and Methods in Mechanical Engineering (6 CP)

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					
WT 23/24	76-T-MACH-105295	Mathematical Methods in Fluid Mechanics			Frohnapfel
WT 23/24	76-T-MACH-105295 (engl.)	Mathematical Methods in Fluid Mechanics			Frohnapfel, Gatti
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 11.132 Course: Mathematical Methods of Vibration Theory [T-MACH-105294]

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

Part of: M-MACH-106309 - Advanced Topics and Methods in Mechanical Engineering (6 CP)

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					
WT 23/24	76-T-MACH-105294	Mathematical Methods of Vibration Theory			Fidlin
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 11.133 Course: Measurement Technology [T-ETIT-112147]

Responsible: Prof. Dr.-Ing. Michael Heizmann
Organisation: KIT Department of Electrical Engineering and Information Technology
Part of: M-ETIT-105982 - Measurement Technology

Type	Credits	Grading scale	Version
Written examination	5	Grade to a third	1

Events					
WT 23/24	2302117	Measurement Technology	2 SWS	Lecture / Blended	Heizmann
WT 23/24	2302118	Exercise for 2302117 Measurement Technology	1 SWS	Practice / On-Site	Heizmann, Panther
Exams					
WT 23/24	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.

Modeled Conditions
The following conditions have to be fulfilled:

1. The course T-ETIT-101937 - Measurement Technology must not have been started.

T 11.134 Course: Mechanical Design I and II [T-MACH-112225]

Responsible: Prof. Dr.-Ing. Sven Matthiesen
Organisation: KIT Department of Mechanical Engineering
Part of: M-MACH-101299 - Mechanical Design

Type	Credits	Grading scale	Version
Written examination	6	Grade to a third	3

Exams			
WT 23/24	76-T-MACH-110363	Mechanical Design I and II	Matthiesen, Düser
ST 2024	76-T-MACH-110363	Mechanical Design I and II	Matthiesen

Competence Certificate
Written Exam (90min) on the topics of MKL I and MKL II.

Prerequisites
The bricks "T-MACH-112226- Mechanical Design I, Tutorial" and "T-MACH-112227 - Mechanical Design II, Tutorial" must be passed successfully.

T 11.135 Course: Mechanical Design I, Tutorial [T-MACH-112226]

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

Part of: M-MACH-101299 - Mechanical Design

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

Exams			
WT 23/24	76-T-MACH-110364	Mechanical Design I, Tutorial	Matthiesen

Competence Certificate
Concomitant to the lecture, a workshop with 3 workshop sessions takes place over the semester. During the workshop the students are divided into groups and their mechanical design knowledge will be tested during a colloquium at the beginning of every single workshop session. The attendance is mandatory and will be controlled. The pass of the colloquia and the process of the workshop task are required for the successful participation.

Furthermore an online test is carried out.

T 11.136 Course: Mechanical Design II, Tutorial [T-MACH-112227]

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

Part of: M-MACH-101299 - Mechanical Design

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

Competence Certificate
CIW/ VT/ IP-M/ WiING / MATH/ MWT: To pass the prerequisite it is required that a design task is successfully completed.

MIT: To pass the prerequisite it is required that a design task is successfully completed.

NWT: For students of the subject area NwT, the creation of a teaching video for the teaching of a technical system must be completed as a prerequisite for the exam instead.

Prerequisites
None

T 11.137 Course: Mechanical Design III and IV [T-MACH-104810]

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

Part of: M-MACH-102829 - Mechanical Design III and IV

Type	Credits	Grading scale	Recurrence	Version
Written examination	11	Grade to a third	Each term	3

Events					
WT 23/24	2145151	Mechanical Design III	2 SWS	Lecture / 🗣	Matthiesen, Düser
WT 23/24	3145016	Mechanical Design III (Lecture)	2 SWS	Lecture / 🗣	Burkardt, Düser
ST 2024	2146177	Mechanical Design IV	2 SWS	Lecture / 🗣	Matthiesen, Düser
ST 2024	3146020	Mechanical Design IV Lecture	2 SWS	Lecture / 🗣	Düser, Burkardt
Exams					
WT 23/24	76-T-MACH-104810	Mechanical Design III & IV			Albers, Matthiesen, Düser, Burkardt
WT 23/24	76T-MACH-104810_EN	Mechanical Design III & IV (english)			Albers, Burkardt
ST 2024	76-T-MACH-104810	Mechanical Design III & IV			Albers, Matthiesen, Düser
ST 2024	76-T-MACH-104810_EN	Mechanical Design III & IV (english)			Albers, Matthiesen, Düser

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

Competence Certificate
written exam consisting of:

- written part duration 60 min and
- design part duration 180 min

Sum: 240 min

Prerequisites
Admission to the exam only with successful completion of the Mechanical Design III, Tutorial and Mechanical Design IV, Tutorial.

Modeled Conditions
You have to fulfill one of 2 conditions:

1. The course T-MACH-110955 - Mechanical Design III, Tutorial must have been passed.
2. The course T-MACH-110956 - Mechanical Design IV, Tutorial must have been passed.

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

V Mechanical Design III

2145151, WS 23/24, 2 SWS, Language: German, Open in study portal

Lecture (V)
On-Site

Literature
Vorlesungsumdruck:

Der Umdruck zur Vorlesung kann über die eLearning-Plattform Ilias bezogen werden.

Literatur:

Konstruktionselemente des Maschinenbaus - 1 und 2
Grundlagen der Berechnung und Gestaltung von Maschinenelementen;
Steinhilper, Sauer, Springer Verlag, ISBN 3-540-22033-X

oder Volltextzugriff über Uni-Katalog der Universitätsbibliothek

Grundlagen von Maschinenelementen für Antriebsaufgaben;
Steinhilper, Sauer, Springer Verlag, ISBN 3-540-29629-8

CAD:

3D-Konstruktion mit Pro/Engineer - Wildfire, Paul Wyndorps, Europa Lehrmittel, ISBN: 978-3-8085-8948-9

Pro/Engineer Tipps und Techniken, Wolfgang Berg, Hanser Verlag, ISBN: 3-446-22711-3(für Fortgeschrittene)

V **Mechanical Design III (Lecture)**
3145016, WS 23/24, 2 SWS, Language: English, Open in study portal

Lecture (V)
On-Site

Literature
Vorlesungsumdruck:

Der Umdruck zur Vorlesung kann über die eLearning-Plattform Ilias bezogen werden.

Literatur:

Konstruktionselemente des Maschinenbaus - 1 und 2
Grundlagen der Berechnung und Gestaltung von Maschinenelementen;
Steinhilper, Sauer, Springer Verlag, ISBN 3-540-22033-X

oder Volltextzugriff über Uni-Katalog der Universitätsbibliothek

Grundlagen von Maschinenelementen für Antriebsaufgaben;
Steinhilper, Sauer, Springer Verlag, ISBN 3-540-29629-8

CAD:

3D-Konstruktion mit Pro/Engineer - Wildfire, Paul Wyndorps, Europa Lehrmittel, ISBN: 978-3-8085-8948-9

Pro/Engineer Tipps und Techniken, Wolfgang Berg, Hanser Verlag, ISBN: 3-446-22711-3(für Fortgeschrittene)

T 11.138 Course: Mechanical Design III, Tutorial [T-MACH-110955]

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

Part of: M-MACH-102829 - Mechanical Design III and IV

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

Events					
WT 23/24	2145153	Tutorials Mechanical Design III	2 SWS	Practice / 🗣	Matthiesen, Düser
WT 23/24	2145154	Mechanical Design III Workshop	1 SWS	Practical course / 🗣	Matthiesen, Düser
WT 23/24	3145017	Mechanical Design III (Tutorial)	2 SWS	Practice / 🗣	Burkardt, Düser
WT 23/24	3145018	Mechanical Design III (Workshop)	1 SWS	/ 🗣	Burkardt, Düser
Exams					
WT 23/24	76-T-MACH-110955	Mechanical Design III, Constructing with Team			Albers, Matthiesen, Düser

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

Competence Certificate
Concomitant to the lecture, a workshop with 3 workshop sessions takes place over the semester. During the workshop the students are divided into groups and their mechanical design knowledge will be tested during a colloquium at the beginning of every single CAD-workshop session. The attendance is mandatory and will be controlled. The pass of the colloquia and the process of the workshop task are required for the successful participation.

Prerequisites
None

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

V Tutorials Mechanical Design III
2145153, WS 23/24, 2 SWS, Language: German, Open in study portal

Practice (Ü)
On-Site

Literature
Konstruktionselemente des Maschinenbaus - 1 und 2
Grundlagen der Berechnung und Gestaltung von Maschinenelementen;
Steinhilper, Sauer, Springer Verlag, ISBN 3-540-22033-X

Grundlagen von Maschinenelementen für Antriebsaufgaben;
Steinhilper, Sauer, Springer Verlag, ISBN 3-540-29629-8

CAD:

3D-Konstruktion mit Pro/Engineer - Wildfire, Paul Wyndorps, Europa Lehrmittel, ISBN: 978-3-8085-8948-9

Pro/Engineer Tipps und Techniken, Wolfgang Berg, Hanser Verlag, ISBN: 3-446-22711-3 (für Fortgeschrittene)

V Mechanical Design III Workshop
2145154, WS 23/24, 1 SWS, Language: German, Open in study portal

Practical course (P)
On-Site

Literature
Konstruktionselemente des Maschinenbaus - 1 und 2
Grundlagen der Berechnung und Gestaltung von
Maschinenelementen;
Steinhilper, Sauer, Springer Verlag, ISBN 3-540-22033-X

Grundlagen von Maschinenelementen für Antriebsaufgaben;
Steinhilper, Sauer, Springer Verlag, ISBN 3-540-29629-8

CAD:

3D-Konstruktion mit Pro/Engineer - Wildfire, Paul Wyndorps, Europa Lehrmittel, ISBN: 978-3-8085-8948-9

Pro/Engineer Tipps und Techniken, Wolfgang Berg, Hanser Verlag, ISBN: 3-446-22711-3 (für Fortgeschrittene)

V **Mechanical Design III (Tutorial)**
3145017, WS 23/24, 2 SWS, Language: English, Open in study portal

Practice (Ü)
On-Site

Literature
Konstruktionselemente des Maschinenbaus - 1 und 2
Grundlagen der Berechnung und Gestaltung von
Maschinenelementen;
Steinhilper, Sauer, Springer Verlag, ISBN 3-540-22033-X

Grundlagen von Maschinenelementen für Antriebsaufgaben;
Steinhilper, Sauer, Springer Verlag, ISBN 3-540-29629-8

CAD:

3D-Konstruktion mit Pro/Engineer - Wildfire, Paul Wyndorps, Europa Lehrmittel, ISBN: 978-3-8085-8948-9

Pro/Engineer Tipps und Techniken, Wolfgang Berg, Hanser Verlag, ISBN: 3-446-22711-3 (für Fortgeschrittene)

V **Mechanical Design III (Workshop)**
3145018, WS 23/24, 1 SWS, Language: English, Open in study portal

On-Site

Organizational issues
Termine siehe Lehrveranstaltung 2145154

Literature
Konstruktionselemente des Maschinenbaus - 1 und 2
Grundlagen der Berechnung und Gestaltung von
Maschinenelementen;
Steinhilper, Sauer, Springer Verlag, ISBN 3-540-22033-X

Grundlagen von Maschinenelementen für Antriebsaufgaben;
Steinhilper, Sauer, Springer Verlag, ISBN 3-540-29629-8

CAD:

3D-Konstruktion mit Pro/Engineer - Wildfire, Paul Wyndorps, Europa Lehrmittel, ISBN: 978-3-8085-8948-9

Pro/Engineer Tipps und Techniken, Wolfgang Berg, Hanser Verlag, ISBN: 3-446-22711-3 (für Fortgeschrittene)

11.139 Course: Mechanical Design IV, Tutorial [T-MACH-110956]

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

Part of: M-MACH-102829 - Mechanical Design III and IV

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

Events					
ST 2024	2146184	Tutorials Mechanical Design IV	1 SWS	Practice / 🗣	Matthiesen, Düser
ST 2024	2146187	Workshop 'Mechanical Design IV'	1 SWS	/ 🗣	Matthiesen, Düser
ST 2024	3146021	Mechanical Design IV Tutorials	1 SWS	Practice / 🖥	Düser, Burkardt
ST 2024	3146022	Mechanical Design IV Workshop	1 SWS	/ 🗣	Düser, Burkardt
Exams					
ST 2024	76-T-MACH-105285	Mechanical Design IV, tutorial			Albers, Matthiesen, Düser

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

Competence Certificate
Concomitant to the lecture, a workshop with 3 workshop sessions takes place over the semester. During the workshop the students are divided into groups and their mechanical design knowledge will be tested during a colloquium at the beginning of every single workshop session. The attendance is mandatory and will be controlled. The pass of the colloquia and the process of the workshop task are required for the successful participation.

Prerequisites
None

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

V Mechanical Design IV Workshop
3146022, SS 2024, 1 SWS, Language: English, Open in study portal **On-Site**

Organizational issues
Registration required, information on the IPEK website.

Literature
Konstruktionselemente des Maschinenbaus - 1 und 2
Grundlagen der Berechnung und Gestaltung von Maschinenelementen;
Steinhilper, Sauer, Springer Verlag, ISBN 3-540-22033-X

Grundlagen von Maschinenelementen für Antriebsaufgaben;
Steinhilper, Sauer, Springer Verlag, ISBN 3-540-29629-8

CAD:

3D-Konstruktion mit Pro/Engineer - Wildfire, Paul Wyndorps, Europa Lehrmittel, ISBN: 978-3-8085-8948-9

Pro/Engineer Tipps und Techniken, Wolfgang Berg, Hanser Verlag, ISBN: 3-446-22711-3 (für Fortgeschrittene)

T 11.140 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-102713 - Mechanics in Microtechnology

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

Events					
WT 23/24	2181710	Mechanics in Microtechnology	2 SWS	Lecture / 🗣	Gruber, Greiner
Exams					
WT 23/24	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 23/24, 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 11.141 Course: Mechano-Informatics and Robotics [T-INFO-101294]

Responsible: Prof. Dr.-Ing. Tamim Asfour
Organisation: KIT Department of Informatics
Part of: M-INFO-100757 - Mechano-Informatics and Robotics

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

Events					
WT 23/24	2400077	Mechano-Informatics and Robotics	2 SWS	Lecture / 🗣	Asfour
Exams					
WT 23/24	7500176	Mechano-Informatics and Robotics			Asfour
ST 2024	7500217	Nachprüfung: Mechano-Informatics and 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.

Recommendation
Basispraktikum Mobile Roboter

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

V Mechano-Informatics and Robotics

2400077, WS 23/24, 2 SWS, Language: German/English, Open in study portal

Lecture (V)
On-Site

Content
The lecture addresses various engineering and algorithmic aspects and topics in robotics which are illustrated and explained based on examples originating from current research conducted in the field of humanoid robotics. First, this lecture gives an introduction into the mathematical fundamentals which are needed to describe a robotic system as well as the basic algorithms commonly applied in motion planning.
Subsequently, models and methods are introduced with which dynamical systems can be formalized and which can be used to encode and represent robot actions. To do so, we will discuss linear time-invariant systems in state.

Learning Objectives:

Based on the example of robotics students understand the synergistic effects and interdisciplinarity of mechatronics and informatics, the embedded systems, the control, and the methods and the algorithms. They are acquainted with the basic terminology and the methods which are common in robotics, signal processing, action representation, machine learning and cognitive systems. They are capable of applying fundamental state-of-the-art methods and tools for the development and programming of robots. Based on
examples originating from current research conducted in the fields of humanoid robotics, the students interactively learn how to identify and formalize problems and tasks and how to develop solutions in an analytical and goal-directed way.

Organizational issues
Zugehörige Veranstaltungen: Empfehlung - Basispraktikum Mobile Roboter

Die Erfolgskontrolle erfolgt in Form einer schriftlichen Prüfung in englischer Sprache im Umfang von i.d.R. 60 Minuten nach § 4 Abs. 2 Nr. 1 SPO.

Arbeitsaufwand:

2h Präsenz

+ 2*2h = 4h Vor/Nachbereitung

+ 30h Prüfungsvorbereitung

120h

T 11.142 Course: Mechatronical Systems and Products [T-MACH-105574]

Responsible: Prof. Dr.-Ing. Sören Hohmann
Prof. Dr.-Ing. Sven Matthiesen

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102749 - Mechatronical Systems and Products

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

Events					
WT 23/24	2303003	Exercises for 2303161 Mechatronical Systems and Products	1 SWS	Practice / 🗣	Matthiesen, Hohmann
WT 23/24	2303161	Mechatronical Systems and Products	2 SWS	Lecture / 🔀	Matthiesen, Hohmann
Exams					
WT 23/24	76-T-MACH-105574	Mechatronical Systems and Products			Matthiesen

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

Competence Certificate
written examination (duration: 60min)

Annotation
All relevant content (scripts, exercise sheets, etc.) for the course can be obtained via the eLearning platform ILIAS. To participate in the course, please complete the survey " Anmeldung und Gruppeneinteilung " in ILIAS before the start of the semester.

T 11.143 Course: Medical Imaging Technology I [T-ETIT-113048]

Responsible: Prof. Dr. Maria Francesca Spadea
Organisation: KIT Department of Electrical Engineering and Information Technology
Part of: M-ETIT-106449 - Medical Imaging Technology I

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

Events					
WT 23/24	2305261	Medical Imaging Technology I	2 SWS	Lecture	Spadea
Exams					
WT 23/24	7305012	Medical Imaging Technology I			Spadea
ST 2024	7305261	Medical Imaging Technology I			Spadea

Competence Certificate
The examination takes place in form of a written examination lasting 60 minutes. The course grade is the grade of the written exam.

Prerequisites
none

T 11.144 Course: Medical Imaging Technology II [T-ETIT-113421]

Responsible: Prof. Dr. Maria Francesca Spadea
Organisation: KIT Department of Electrical Engineering and Information Technology
Part of: M-ETIT-106670 - Medical Imaging Technology II

Type	Credits	Grading scale	Recurrence	Version
Written examination	3	Grade to a third	Each summer term	1

Events					
ST 2024	2305262	Medical Imaging Technology II	2 SWS	Lecture / 🗣	Spadea
Exams					
ST 2024	7305262	Medical Imaging Technology II			Spadea

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

Competence Certificate
The examination takes place in form of a written examination lasting 60 minutes. The course grade is the grade of the written exam.

Prerequisites
none

T 11.145 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					
WT 23/24	76-T-MACH-105382	Methods and Processes of PGE - Product Generation Engineering			Albers, Burkardt
WT 23/24	76-T-MACH-105382-en	Methods and Processes of PGE - Product Generation Engineering			Albers
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

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
2146176, SS 2024, 4 SWS, Language: German, Open in study portal

Lecture (V)
On-Site

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 11.146 Course: Microactuators [T-MACH-101910]

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

Part of: M-MACH-100487 - Microactuators

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					
WT 23/24	7600002	Microactuators			Kohl
WT 23/24	76-T-MACH-101910	Microactuators			Kohl
ST 2024	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 11.147 Course: Microenergy Technologies [T-MACH-105557]

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

Part of: M-MACH-102714 - Microenergy Technologies

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
Exams					
WT 23/24	76-T-MACH-105557	Microenergy Technologies			Kohl
ST 2024	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 11.148 Course: Mobile Computing and Internet of Things [T-INFO-102061]

Responsible: Prof. Dr.-Ing. Michael Beigl
Organisation: KIT Department of Informatics
Part of: M-INFO-101249 - Mobile Computing and Internet of Things

Type	Credits	Grading scale	Recurrence	Version
Written examination	2,5	Grade to a third	Each winter term	5

Events					
WT 23/24	2400051	Mobile Computing and Internet of Things	2+1 SWS	Lecture / Practice (	Beigl, Röddiger
Exams					
WT 23/24	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.

11.149 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-INFO-101249 - Mobile Computing and Internet of Things

Type	Credits	Grading scale	Recurrence	Version
Examination of another type	2,5	Grade to a third	Each winter term	2

Events					
WT 23/24	2400051	Mobile Computing and Internet of Things	2+1 SWS	Lecture / Practice (	Beigl, Röddiger
Exams					
WT 23/24	7500358	Mobile Computing and Internet of Things			Beigl

T 11.150 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-105091 - Advanced Topics and Methods in Mechanical Engineering (5 CP)

Type	Credits	Grading scale	Recurrence	Version
Written examination	5	Grade to a third	Each term	3

Events					
WT 23/24	2183703	Numerical methods and simulation techniques	3 SWS	Lecture / Practice (/ 🗣	Nestler, August, Prahs
ST 2024	2183703	Modelling and Simulation	2+1 SWS	Lecture / Practice (/ 🗣	Nestler, August, Prahs
Exams					
WT 23/24	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 Numerical methods and simulation techniques

2183703, WS 23/24, 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)

V **Modelling and Simulation**
2183703, SS 2024, 2+1 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. Achtung: Der erste Termin für das Praktikum ist der 04.05.2023. und nicht der 20.04.2023.

Literature

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

T 11.151 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-105091 - Advanced Topics and Methods in Mechanical Engineering (5 CP)

Type	Credits	Grading scale	Recurrence	Version
Oral examination	5	Grade to a third	Each winter term	3

Events					
WT 23/24	2183702	Modelling of Microstructures	3 SWS	Lecture / Practice (/ 🗣	August, Prahs, Nestler
Exams					
WT 23/24	76-T-MACH-105303	Modelling of Microstructures			August, Weygand, Nestler
ST 2024	76-T-MACH-105303	Modelling of Microstructures			August, Nestler, Weygand

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 23/24, 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

Der erste Termin (am 27.10.2023) findet ausnahmsweise ohne die Dozentin statt. Bitte schauen Sie sich an diesem Termin die erste Aufzeichnung der Vorlesung an (s. das entsprechende Verzeichnis bei ILIAS).

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

T 11.152 Course: Motor Vehicle Labor [T-MACH-105222]

Responsible: Dr.-Ing. Michael Frey
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102695 - Motor Vehicle Laboratory

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

Events					
WT 23/24	2115808	Motor Vehicle Laboratory	2 SWS	Practical course / 🗣	Frey
ST 2024	2115808	Motor Vehicle Laboratory	2 SWS	Practical course / 🗣	Frey
Exams					
WT 23/24	76-T-MACH-105222	Motor Vehicle Laboratory			Frey, Unrau
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, WS 23/24, 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

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

T 11.153 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-105292 - Novel Actuators and Sensors

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

Events					
WT 23/24	2141865	Novel actuators and sensors	2 SWS	Lecture / 🗣	Kohl, Sommer
Exams					
WT 23/24	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 23/24, 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 11.154 Course: Numerical Methods - Exam [T-MATH-111700]

Responsible: apl. Prof. Dr. Peer Kunstmann
Prof. Dr. Michael Plum
Prof. Dr. Wolfgang Reichel

Organisation: KIT Department of Mathematics

Part of: M-MATH-105831 - Numerical Methods

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

Events					
ST 2024	0180300	Numerical Methods (Electrical Engineering, Meteorology, Remote Sensing, Geoinformatics)	2 SWS	Lecture	Liao
ST 2024	0180400	Tutorial for 0180300	1 SWS	Practice	Liao
Exams					
WT 23/24	7700069	Numerical Methods - Exam			Anapolitanos, Plum, Kunstmann

Competence Certificate
Success control takes the form of a written examination (120 minutes).

Prerequisites
none

T 11.155 Course: Optics and Solid State Electronics [T-ETIT-110275]

Responsible: Prof. Dr. Ulrich Lemmer
Organisation: KIT Department of Electrical Engineering and Information Technology
Part of: M-ETIT-105005 - Optics and Solid State Electronics

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

Events					
ST 2024	2304205	Optics and Solid State Electronics	3 SWS	Lecture / 🗣	Lemmer, Krewer
ST 2024	2304206	Optics and Solid State Electronics (Tutorial to 2304205)	2 SWS	Practice / 🗣	Lemmer, Krewer
ST 2024	2304207	Tutorien zu 2304205 Optik- und Festkörperelektronik	1 SWS	Tutorial (/ 🗣	Lemmer, Krewer
Exams					
WT 23/24	7313719	Optics and Solid State Electronics			Lemmer, Krewer

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

Prerequisites
none

T 11.156 Course: Optoelectronic Components [T-ETIT-101907]

Responsible: Prof. Dr. Wolfgang Freude
Organisation: KIT Department of Electrical Engineering and Information Technology
Part of: M-ETIT-100509 - Optoelectronic Components

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

Events					
ST 2024	2309486	Optoelectronic Components	2 SWS	Lecture /	Randel
ST 2024	2309487	Optoelectronic Components (Tutorial)	1 SWS	Practice /	Randel
Exams					
WT 23/24	7309486	Optoelectronic Components			Freude
ST 2024	7309486	Optoelectronic Components			Randel

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

Prerequisites
none

T 11.157 Course: Optoelectronics [T-ETIT-100767]

Responsible: Prof. Dr. Ulrich Lemmer
Organisation: KIT Department of Electrical Engineering and Information Technology
Part of: M-ETIT-100480 - Optoelectronics

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

Events					
WT 23/24	2313726	Optoelectronics	2 SWS	Lecture /	Lemmer
WT 23/24	2313728	Übungen zu 2313726 Optoelektronik	1 SWS	Practice	Lemmer
Exams					
WT 23/24	7313726	Optoelectronics			Lemmer

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

Competence Certificate
The success check is carried out in the context of a written exam (90 minutes).

Prerequisites
none

Recommendation
Knowledge of solid state electronics

T 11.158 Course: Oral Exam - Supplementary Studies on Culture and Society [T-ZAK-112659]

Responsible: Dr. Christine Mielke
Christine Myglas

Organisation:

Part of: M-ZAK-106235 - Supplementary Studies on Culture and Society

Type	Credits	Grading scale	Version
Oral examination	4	Grade to a third	1

Competence Certificate
An oral examination according to § 7 section 6 of approx. 45 minutes on the contents of two courses from In-depth Module.

Prerequisites
Prerequisite for the 'Oral Examination' is the successful completion of Modules 1 and 3 and the required elective sections in Module 2.

T 11.159 Course: Oral Exam - Supplementary Studies on Sustainable Development [T-ZAK-112351]

Organisation:
Part of: M-ZAK-106099 - Supplementary Studies on Sustainable Development

Type	Credits	Grading scale	Version
Oral examination	4	Grade to a third	1

Competence Certificate
An oral examination according to § 7 section 6 of approx. 45 minutes on the contents of two courses from Elective Module.

Prerequisites
A requirement for the Supplementary Course: Oral examination is the successful completion of the modules Basics Module and Specialisation Module and the required electives of Elective Module.

T 11.160 Course: Organ Support Systems [T-MACH-105228]

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

Part of: M-MACH-102702 - Organ Support Systems

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					
WT 23/24	76-T-MACH-105228	Organ Support Systems			Pylatiuk
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 11.161 Course: Photovoltaic System Design [T-ETIT-100724]

Responsible: Dipl.-Ing. Robin Grab
Organisation: KIT Department of Electrical Engineering and Information Technology
Part of: M-ETIT-100411 - Photovoltaic System Design

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

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

Prerequisites
none

T 11.162 Course: Physical Basics of Laser Technology [T-MACH-102102]

Responsible: Dr.-Ing. Johannes Schneider
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-105091 - Advanced Topics and Methods in Mechanical Engineering (5 CP)

Type	Credits	Grading scale	Recurrence	Version
Oral examination	5	Grade to a third	Each winter term	4

Events					
WT 23/24	2181612	Physical basics of laser technology	3 SWS	Lecture / Practice (/ 🗣	Schneider
Exams					
WT 23/24	76-T-MACH-102102	Physical Basics of Laser Technology			Schneider
ST 2024	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]

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 23/24, 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 11.163 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-105091 - Advanced Topics and Methods in Mechanical Engineering (5 CP)

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					
WT 23/24	76-T-MACH-100530	Physics for Engineers			Gumbsch, Dienwiebel, Nesterov-Müller, Weygand
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 11.164 Course: Physiology and Anatomy for Engineers I [T-ETIT-101932]

Responsible: Prof. Dr. Werner Nahm
Organisation: KIT Department of Electrical Engineering and Information Technology
Part of: M-ETIT-100390 - Physiology and Anatomy for Engineers I

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

Events					
WT 23/24	2305281	Physiology and Anatomy for Engineers I	2 SWS	Lecture /	Nahm
Exams					
WT 23/24	7305281	Physiology and Anatomy for Engineers I			Nahm

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

Competence Certificate
Success control is carried out in the form of a written test of 60 minutes.

Prerequisites
none

T 11.165 Course: Power Electronic Systems in Energy Technology [T-ETIT-112286]

Responsible: Prof. Dr.-Ing. Marc Hiller
Organisation: KIT Department of Electrical Engineering and Information Technology
Part of: M-ETIT-106067 - Power Electronic Systems in Energy Technology

Type	Credits	Grading scale	Version
Oral examination	6	Grade to a third	1

Events					
WT 23/24	2306357	Power Electronic Systems in Energy applications	3 SWS	Lecture / 🔀	Hiller
WT 23/24	2306358	Power Electronic Systems in Energy applications	1 SWS	Practice / 🔀	Hiller
Exams					
WT 23/24	7300035	Power Electronic Systems in Energy Technology			Hiller
ST 2024	7300035	Power Electronic Systems in Energy Technology			Hiller

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

Prerequisites
none

T 11.166 Course: Power Electronics [T-ETIT-109360]

Responsible: Prof. Dr.-Ing. Marc Hiller
Organisation: KIT Department of Electrical Engineering and Information Technology
Part of: M-ETIT-104567 - Power Electronics

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

Events					
ST 2024	2300004	Ausweich- und Praktikumstermin für ETI-Vorlesungen	2 SWS	Practical course /	Hiller, Thönelt
ST 2024	2306323	Power Electronics	2 SWS	Lecture /	Hiller
ST 2024	2306324	Tutorial for 2306385 Power Electronics	2 SWS	Practice /	Hiller, Thönelt
Exams					
WT 23/24	7306385	Power Electronics			Hiller
ST 2024	7306385	Power Electronics			Hiller

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

Competence Certificate
The examination takes place in form of a written examination lasting 120 minutes.

Prerequisites
none

T 11.167 Course: Power Generation [T-ETIT-101924]

Responsible: Dr.-Ing. Bernd Hoferer
Organisation: KIT Department of Electrical Engineering and Information Technology
Part of: M-ETIT-100407 - Power Generation

Type	Credits	Grading scale	Recurrence	Version
Oral examination	3	Grade to a third	Each winter term	2

Events					
WT 23/24	2307356	Power Generation	2 SWS	Lecture / 🗣	Hoferer
Exams					
WT 23/24	7307356	Power Generation			Hoferer
ST 2024	7307356	Power Generation			Hoferer

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

Prerequisites
none

T 11.168 Course: Power Transmission and Power Network Control [T-ETIT-101941]

Responsible: Prof. Dr.-Ing. Thomas Leibfried
Organisation: KIT Department of Electrical Engineering and Information Technology
Part of: M-ETIT-100534 - Power Transmission and Power Network Control

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

Events					
ST 2024	2307372	Power Transmission and Power Network Control	2 SWS	Lecture / 🗣	Leibfried
ST 2024	2307374	Übungen zu 2307372 Energieübertragung und Netzregelung	1 SWS	Practice / 🗣	Bisseling
Exams					
WT 23/24	7307372	Power Transmission and Power Network Control			Leibfried

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

Prerequisites
none

T 11.169 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-ETIT-100394 - Practical Aspects of Electrical Drives

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
Exams					
WT 23/24	7306313	Practical Aspects of Electrical Drives			Doppelbauer

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

Prerequisites
none

11.170 Course: Practical Project Robotics and Automation I (Software) [T-INFO-104545]

Responsible: Prof. Dr.-Ing. Björn Hein
Prof. Dr.-Ing. Thomas Längle

Organisation: KIT Department of Informatics

Part of: M-INFO-102224 - Practical Project Robotics and Automation I (Software)

Type	Credits	Grading scale	Recurrence	Version
Examination of another type	6	Grade to a third	Each term	1

Events					
WT 23/24	24282	Project practical Robotics and Automation I (Software)	4 SWS	Practical course	Hein, Längle
Exams					
WT 23/24	750003	Project practical Robotics and Automation I (Software)			Hein, Längle

T 11.171 Course: Practical Project Robotics and Automation II (Hardware) [T-INFO-104552]

Responsible: Prof. Dr.-Ing. Björn Hein
Prof. Dr.-Ing. Thomas Längle

Organisation: KIT Department of Informatics

Part of: M-INFO-102230 - Practical Project Robotics and Automation II (Hardware)

Type	Credits	Grading scale	Recurrence	Version
Examination of another type	6	Grade to a third	Each term	1

Events					
WT 23/24	24290	Robotics and Automation II (Hardware)	4 SWS	Practical course	Hein, Längle
Exams					
WT 23/24	750004	Project practical Robotics and Automation II (Hardware)			Hein, Längle

T 11.172 Course: Practice Module [T-ZAK-112660]

Responsible: Dr. Christine Mielke
Christine Myglas

Organisation:

Part of: M-ZAK-106235 - Supplementary Studies on Culture and Society

Type	Credits	Grading scale	Version
Completed coursework	4	pass/fail	1

Competence Certificate
Internship (3 ECT)
Report within the framework of the practical training (Length approx. 18,000 characters (incl. spaces)
(1 ECT)

Prerequisites
none

Annotation
Knowledge from the Basic Module and the Elective Module is helpful.

T 11.173 Course: Presentation [T-MACH-107760]

Responsible: Prof. Dr.-Ing. Sven Matthiesen
Organisation: KIT Department of Mechanical Engineering
Part of: M-MACH-104262 - Bachelor's Thesis

Type	Credits	Grading scale	Recurrence	Version
Completed coursework	3	pass/fail	Each term	1

Competence Certificate
The colloquium presentation must be held within the maximum processing time of the modul Bachleor Thesis but latest 6 weeks after the submission of the bachelor thesis.

The presentation should last around 20 minutes followed by a scientific discussion with the present expert audience. The students should show that they are able to independently present and discuss the content of their bachelor thesis according to scientific criteria.

Prerequisites
Bachelor Thesis has been started.

Modeled Conditions
The following conditions have to be fulfilled:

1. The course T-MACH-108800 - Bachelor's Thesis must have been started.

Annotation
No exam registration is required for the presentation. Passing will be registered by MACH's Examination Office.

T 11.174 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-102720 - Principles of Medicine for Engineers

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

Events					
WT 23/24	2105992	Principles of Medicine for Engineers	2 SWS	Lecture / 🗣	Pylatiuk
Exams					
WT 23/24	76-T-MACH-105235	Principles of Medicine for Engineers			Pylatiuk
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 23/24, 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 11.175 Course: Product Lifecycle Management [T-MACH-105147]

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

Part of: M-MACH-104919 - Advanced Topics and Methods in Mechanical Engineering (4 CP)

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

Events					
WT 23/24	2121350	Product Lifecycle Management	2 SWS	Lecture / 🗣	Ovtcharova, Elstermann
Exams					
WT 23/24	76-T-MACH-105147	Product Lifecycle Management			Ovtcharova, Elstermann
ST 2024	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 23/24, 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 11.176 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-102711 - Production Techniques Laboratory

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 /	Deml, Fleischer, Furmans, Meyer

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 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

Das Skript und Literaturhinweise stehen auf ILIAS zum Download zur Verfügung.

T 11.177 Course: Programming [T-INFO-101531]

Responsible: Prof. Dr.-Ing. Anne Koziolek
Prof. Dr. Ralf Reussner

Organisation: KIT Department of Informatics

Part of: M-INFO-101174 - Programming

Type	Credits	Grading scale	Recurrence	Version
Examination of another type	6	Grade to a third	Each winter term	1

Events					
WT 23/24	24004	Programming	4 SWS	Lecture / Practice (	Heinrich
Exams					
WT 23/24	7500075	Programming			Koziolek, Heinrich

Modeled Conditions
The following conditions have to be fulfilled:

1. The course T-INFO-101967 - Programming Pass must have been passed.

T 11.178 Course: Programming Pass [T-INFO-101967]

Responsible: Prof. Dr.-Ing. Anne Koziolek
Prof. Dr. Ralf Reussner

Organisation: KIT Department of Informatics

Part of: M-INFO-101174 - Programming

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

Events					
WT 23/24	24004	Programming	4 SWS	Lecture / Practice (	Heinrich
Exams					
WT 23/24	7500074	Programming Pass			Koziolek, Heinrich

T 11.179 Course: Project Management in the Development of Products for Safety-Critical Applications [T-ETIT-109148]

Responsible: Dr.-Ing. Manfred Nolle
Organisation: KIT Department of Electrical Engineering and Information Technology
Part of: M-ETIT-104475 - Project Management in the Development of Products for Safety-Critical Applications

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

Events					
WT 23/24	2311641	Project Management in the Development of Products for Safety-Critical Applications	2 SWS	/ 🧩	Nolle
WT 23/24	2311643	Tutorial for 2311641 Project Management in the Development of Products for Safety-Critical Applications	1 SWS	Practice / 🧩	Nolle
Exams					
WT 23/24	7311641	Project Management in the development of products for safety-critical applications			Nolle

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

T 11.180 Course: Quality Management [T-MACH-102107]

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

Part of: M-MACH-105332 - Quality Management

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

Events					
WT 23/24	2149667	Quality Management	2 SWS	Lecture /	Lanza
Exams					
WT 23/24	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].

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

V Quality Management
2149667, WS 23/24, 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 11.181 Course: Radiation Protection [T-ETIT-100825]

Responsible: PD Dr. Bastian Breustedt
Prof. Dr. Werner Nahm
Organisation: KIT Department of Electrical Engineering and Information Technology
Part of: M-ETIT-100562 - Radiation Protection

Type	Credits	Grading scale	Recurrence	Version
Written examination	3	Grade to a third	Each summer term	2

Events					
ST 2024	2305272	Radiation Protection	2 SWS	Lecture / 🗣	Breustedt
Exams					
WT 23/24	7305272	Radiation Protection			Breustedt
ST 2024	7305272	Radiation Protection			Breustedt

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

Competence Certificate
Success control is carried out as part of an overall written examination (2 h).
The module grade is the grade of the written exam.

Prerequisites
none

T 11.182 Course: Radio-Frequency Electronics [T-ETIT-110359]

Responsible: Prof. Dr.-Ing. Ahmet Cagri Ulusoy
Organisation: KIT Department of Electrical Engineering and Information Technology
Part of: M-ETIT-105124 - Radio-Frequency Electronics

Type	Credits	Grading scale	Recurrence	Version
Written examination	5	Grade to a third	Each winter term	2

Events					
WT 23/24	2308503	Radio-Frequency Electronics	2 SWS	Lecture /	Ulusoy
Exams					
WT 23/24	7308503	Radio-Frequency Electronics			Ulusoy

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

Competence Certificate
The success criteria will be determined by a written examination of 120 min.

Recommendation
Contents of the modules "Linear electrical networks" and "Electronic circuits".

T 11.183 Course: Rail System Technology [T-MACH-106424]

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

Part of: M-MACH-103232 - Rail System Technology

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

Events					
WT 23/24	2115919	Rail System Technology	2 SWS	Lecture / 🗣	Cichon, Heckele
ST 2024	2115919	Rail System Technology	2 SWS	Lecture / 🗣	Cichon
Exams					
WT 23/24	76-T-MACH-106424	Rail System Technology			Cichon, Heckele, Reimann
ST 2024	76-T-MACH-106424	Rail System Technology			Cichon, Berthold

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

Competence Certificate
written examination in German language
Duration: 60 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, WS 23/24, 2 SWS, Language: German, Open in study portal

Lecture (V)
On-Site

Content

1. Railway System: railway as system, subsystems and interdependencies, definitions, laws, rules, railway and environment, economic impact
2. Operation: Transportation, public transport, regional transport, long-distance transport, freight service, scheduling
3. Infrastructure: rail facilities, track alignment, railway stations, clearance diagram
4. Wheel-rail-contact: carrying of vehicle mass, adhesion, wheel guidance, current return
5. Vehicle dynamics: tractive and brake effort, driving resistance, inertial force, load cycles
6. Signaling and Control: operating procedure, succession of trains, European Train Control System, blocking period, automatic train control
7. Traction power supply: power supply of rail vehicles, comparison electric traction and diesel traction, dc and ac networks, system pantograph and contact wire, filling stations

Literature
Eine Literaturliste steht den Studierenden auf der Ilias-Plattform zum Download zur Verfügung.

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

V Rail System Technology

2115919, 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).

T 11.184 Course: Rail Vehicle Technology [T-MACH-105353]

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

Part of: M-MACH-102683 - Rail Vehicle Technology

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

Events					
WT 23/24	2115996	Rail Vehicle Technology	2 SWS	Lecture / 🗣	Cichon, Reimann
ST 2024	2115996	Rail Vehicle Technology	2 SWS	Lecture / 🗣	Cichon
Exams					
WT 23/24	76-T-MACH-105353	Rail Vehicle Technology			Cichon, Reimann, Heckele
ST 2024	76-T-MACH-105353	Rail Vehicle Technology			Cichon, Berthold

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

Competence Certificate
written examination in German language
Duration: 60 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, WS 23/24, 2 SWS, Language: German, Open in study portal

Lecture (V)
On-Site

Content

1. Vehicle system technology: structure and main systems of rail vehicles
2. Car body: functions, requirements, design principles, crash elements, coupling, doors and windows
3. Bogies: forces, running gears, bogies, Jakobs-bogies, active components, connection to car body, wheel arrangement
4. Drives: priciples, electric drives (main components, asynchronous traction motor, inverter, with DC supply, with AC supply, without line supply, multisystem vehicles, dual mode vehicles, hybrid vehicles), non-electric drives
5. Brakes: basics, principles (wheel brakes, rail brakes, blending), brake control (requirements and operation modes, pneumatic brake, electropneumatic brake, emergency brake, parking brake)
6. Train control management system: definition of TCMS, bus systems, components, network architectures, examples, future trends
7. Vehicle concepts: trams, metros, regional trains, intercity trains, high speed trains, double deck vehicles, locomotives, freight wagons

Literature
Eine Literaturliste steht den Studierenden auf der Ilias-Plattform zum Download zur Verfügung.

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

V Rail Vehicle Technology
2115996, 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).

T 11.185 Course: Real-Time Systems [T-INFO-101340]

Responsible: Prof. Dr.-Ing. Thomas Längle
Organisation: KIT Department of Informatics
Part of: M-INFO-100803 - Real-Time Systems

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

Events					
ST 2024	24576	Real-Time Systems	4 SWS	Lecture / Practice (/ 🗣	Längle, Ledermann
Exams					
WT 23/24	750002	Real-Time Systems			Längle

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

T 11.186 Course: Robotics - Practical Course [T-INFO-105107]

Responsible: Prof. Dr.-Ing. Tamim Asfour
Organisation: KIT Department of Informatics
Part of: M-INFO-102522 - Robotics - Practical Course

Type	Credits	Grading scale	Recurrence	Version
Examination of another type	6	Grade to a third	Each summer term	2

Events					
ST 2024	24870	Robotics - Practical Course	4 SWS	Practical course / 🗣	Asfour
Exams					
ST 2024	7500261	Robotics - Practical Course			Asfour

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

Competence Certificate
The assessment is carried out as an examination of another type (§ 4 Abs. 2 No. 3 SPO). It is composed of several sub-tasks.

Prerequisites
Knowledge of the programming language C++ is required.

Recommendation
Attending the lectures Robotics I – Introduction to Robotics, Robotics II: Humanoid Robotics, Robotics III - Sensors and Perception in Robotics and Mechano-Informatics and Robotics is recommended.

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

V Robotics - Practical Course

24870, SS 2024, 4 SWS, Language: German, Open in study portal

Practical course (P)
On-Site

Content
The practical course is offered as an accompanying course to the lectures Robotics I-III. Every week, a small team of students will work on solving a given robotics problem. The list of topics includes robot modeling and simulation, inverse kinematics, robot programming via statecharts, collision-free motion planning, grasp planning, robot vision and robot learning.

Learning Objectives:

The student knows concrete solutions for different problems in robotics. He/she uses methods of inverse kinematics, grasp and motion planning, and visual perception. The student can implement solutions in the programming languages C++ and Python with the help of suitable software frameworks.

Organizational issues
Die Erfolgskontrolle erfolgt in Form einer Prüfungsleistung anderer Art nach § 4 Abs. 2 Nr. 3 SPO und besteht aus mehreren Teilaufgaben.

Arbeitsaufwand: 180 h

Voraussetzungen: Kenntnisse in der Programmiersprache C++ werden vorausgesetzt.

Empfehlungen: Der Besuch der Vorlesungen *Robotik I – Einführung in die Robotik*, *Robotik II: Humanoide Robotik*, *Robotik III - Sensoren und Perzeption in der Robotik* sowie *Mechano-Informatik in der Robotik* wird empfohlen.

Attending the lectures *Robotics I – Introduction to Robotics*, *Robotics II: Humanoid Robotics*, *Robotics III - Sensors and Perception in Robotics* and *Mechano-Informatics and Robotics* is recommended.

Zielgruppe: **Modul für Master Maschinenbau, Mechatronik und Informationstechnik, Elektrotechnik und Informationstechnik**

T 11.187 Course: Robotics I - Introduction to Robotics [T-INFO-108014]

Responsible: Prof. Dr.-Ing. Tamim Asfour
Organisation: KIT Department of Informatics
Part of: M-INFO-100893 - Robotics I - Introduction to Robotics

Type	Credits	Grading scale	Recurrence	Version
Written examination	6	Grade to a third	Each winter term	1

Events					
WT 23/24	2424152	Robotics I - Introduction to Robotics	3/1 SWS	Lecture / 🗣	Asfour
Exams					
WT 23/24	7500106	Robotics I - Introduction to Robotics			Asfour
ST 2024	7500218	Robotik I - Einführung in die Robotik			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.

T 11.188 Course: Robotics II - Humanoid Robotics [T-INFO-105723]

Responsible: Prof. Dr.-Ing. Tamim Asfour
Organisation: KIT Department of Informatics
Part of: M-INFO-102756 - Robotics II - Humanoid 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					
WT 23/24	7500211	Robotics II: Humanoid Robotics			Asfour
ST 2024	7500086	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 11.189 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-INFO-104897 - Robotics III - Sensors and Perception in 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					
WT 23/24	7500207	Robotics III - Sensors and Perception in Robotics			Asfour
ST 2024	7500242	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.

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 11.190 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-104919 - Advanced Topics and Methods in Mechanical Engineering (4 CP)

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

Events					
WT 23/24	2181738	Scientific computing for Engineers	2 SWS	Lecture / 🗣	Weygand, Gumbsch
WT 23/24	2181739	Exercises for Scientific Computing for Engineers	2 SWS	Practice / 🗣	Weygand
Exams					
WT 23/24	76-T-MACH-100532	Scientific Computing for Engineers			Weygand, Gumbsch
ST 2024	76-T-MACH-100532	Scientific Computing for Engineers			Weygand, Gumbsch

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

Competence Certificate
Written exam (90 minutes)

Prerequisites
The brick can not be combined with the brick "Application of advanced programming languages in mechanical engineering" (T-MACH-105390).

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

V Scientific computing for Engineers

Lecture (V)
On-Site

2181738, WS 23/24, 2 SWS, Language: German, Open in study portal

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

The student can

- apply the programming language C++ for scientific computing in the field of materials science
- adapt programs for use on parallel platforms
- choose suitable numerical methods for the solution of differential equations.

The lecture can not be combined with the lecture "Application of advanced programming languages in mechanical engineering" (2182735).

regular attendance: 22,5 hours
Lab: 22,5 hours (optional)
self-study: 75 hours

written exam 90 minutes

Literature

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

Numerik:

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

V **Exercises for Scientific Computing for Engineers**
2181739, WS 23/24, 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 11.191 Course: Seamless Engineering [T-MACH-111401]

Responsible: Prof. Dr.-Ing. Kai Furmans
Prof. Dr.-Ing. Eric Sax

Organisation: KIT Department of Electrical Engineering and Information Technology

KIT Department of Mechanical Engineering

Part of: M-MACH-105725 - Seamless Engineering

Type	Credits	Grading scale	Recurrence	Version
Examination of another type	9	Grade to a third	Each winter term	1

Events					
WT 23/24	2117072	Seamless Engineering - Logistics Robotics Workshop	2 SWS	Lecture / Practice (/ 🗣	Furmans, Sax
Exams					
WT 23/24	76-T-MACH-111401	Seamless Engineering			Sax, Furmans

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

Competence Certificate
Competence certificate in the form of an examination of another type.

The overall grade is composed as follows:

- 50% assessment of an examination as individual performance as the conclusion of the lecture block.
- 50% assessment of colloquia as individual performance on defined milestones during the project work

Failing the final examination or the colloquia does not result in failing the course.

Prerequisites
None

Recommendation
None

Annotation
The course consists of two components. Theoretical knowledge and basics about structured system design are taught in lecture and exercise. In parallel, a practical part takes place throughout the semester. In this, the students design and implement a mechatronic system in small groups using industry-related hardware and software to deal with a given task in the logistics environment.

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

V Seamless Engineering - Logistics Robotics Workshop
2117072, WS 23/24, 2 SWS, Language: English, Open in study portal

Lecture / Practice (VÜ)
On-Site

Content
The aim of this module is to teach students how to develop a heterogeneous integrated mechatronic system. In the lecture, students are introduced to a system-oriented, higher-level approach to the description, evaluation and development of a mechatronic system. Special emphasis is placed on the description of intralogistics systems and modular material flow technology.

At the same time, the practical part of the course applies and deepens the knowledge gained to hardware used in industry. The students learn the systematic development in a simulation environment as well as the transition from simulation to real hardware. In small groups, the students will implement an autonomous material flow.

For this purpose, important components of software development in the robotics environment are taught. This includes, among other things, the basics of programming (Python and "Robot Operating System (ROS)"). In addition, students will gain insights into sensor and actuator technology, image processing, autonomous navigation of automated guided vehicles as well as handling robotics.

Organizational issues

The course consists of two components: 1) lectures and 2) a intralogistics robotic workshop. In lectures, theoretical knowledge and fundamentals of structured system design and modular material handling are taught. There will be a written exam at the end of the lecture unit.

In parallel, a practical workshop takes place throughout the semester. For this, small group of students design and implement a mechatronic intralogistic system using industry-related robotic hardware and software to accomplish a given material flow task.

Registration takes place via the ILIAS course and the poll contained therein.
The course is exclusively for mechatronics students and number of participants is limited.

T 11.192 Course: Seminar Battery I [T-ETIT-110800]

Organisation: KIT Department of Electrical Engineering and Information Technology
Part of: M-ETIT-105319 - Seminar Battery I

Type	Credits	Grading scale	Recurrence	Expansion	Version
Examination of another type	3	Grade to a third	Each term	1 terms	1

Events					
WT 23/24	2304226	Seminar Battery	2 SWS	Seminar / 🗣	Weber
ST 2024	2304226	Seminar Batteries	2 SWS	Seminar / 🗣	Weber
Exams					
WT 23/24	7300001	Seminar Battery I			Weber

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

Prerequisites
none

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

V Seminar Battery

2304226, WS 23/24, 2 SWS, Language: German/English, Open in study portal

Seminar (S)
On-Site

Content
Seminar Batteries (I + II for Bachelor and Master students respectively)

The battery seminar is offered all year round (including the lecture-free period). In the seminar, topics related to current research work at the IAM-ET are discussed on a weekly basis. Participation in the seminar is possible for students from the Faculty of Electrical Engineering and Information Technology as well as for students from other faculties. The seminar paper is usually a theoretical work consisting of literature research and comparative evaluation of different approaches to solve a scientific or technical question. A seminar paper can be started at any time (just come along). The work includes a written thesis and a lecture to be given as part of the event. Regular attendance at the weekly appointments is not required. If possible, you should attend dates where other participants give their presentations. If you are interested in taking part in the seminar and writing a seminar paper, please contact the lecturer.

Organizational issues
Anmeldungen können unter: andre.weber@kit.edu erfolgen.

Literature
werden zu Beginn der Seminararbeit themenspezifisch gegeben

V Seminar Batteries

2304226, SS 2024, 2 SWS, Language: German/English, Open in study portal

Seminar (S)
On-Site

Content
Seminar Batteries (I + II for Bachelor and Master students respectively)

The battery seminar is offered all year round (including the lecture-free period). In the seminar, topics related to current research work at the IAM-ET are discussed on a weekly basis. Participation in the seminar is possible for students from the Faculty of Electrical Engineering and Information Technology as well as for students from other faculties. The seminar paper is usually a theoretical work consisting of literature research and comparative evaluation of different approaches to solve a scientific or technical question. A seminar paper can be started at any time (just come along). The work includes a written thesis and a lecture to be given as part of the event. Regular attendance at the weekly appointments is not required. If possible, you should attend dates where other participants give their presentations. If you are interested in taking part in the seminar and writing a seminar paper, please contact the lecturer.

Organizational issues
Anmeldungen können unter: andre.weber@kit.edu erfolgen.

Veranstaltung findet auch außerhalb der Vorlesungszeiten **ganzjährig** statt.

Literature
werden zu Beginn der Seminararbeit themenspezifisch gegeben

11.193 Course: Seminar Embedded Systems [T-ETIT-100753]

Responsible: Prof. Dr.-Ing. Jürgen Becker
Prof. Dr.-Ing. Eric Sax
Prof. Dr. Wilhelm Stork

Organisation: KIT Department of Electrical Engineering and Information Technology

Part of: M-ETIT-100455 - Seminar Embedded Systems

Type	Credits	Grading scale	Version
Examination of another type	4	Grade to a third	3

Events					
WT 23/24	2311627	Seminar Embedded Systems	2 SWS	Seminar / 🗣	Becker, Sax, Stork
ST 2024	2311627	Seminar Embedded Systems	2 SWS	Seminar / 🧩	Becker, Sax, Stork
Exams					
WT 23/24	7311627	Seminar Embedded Systems			Becker, Sax, Stork

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

Prerequisites
none

T 11.194 Course: Seminar Fuel Cell I [T-ETIT-110798]

Responsible: Dr.-Ing. Andre Weber
Organisation: KIT Department of Electrical Engineering and Information Technology
Part of: M-ETIT-105320 - Seminar Fuel Cell I

Type	Credits	Grading scale	Recurrence	Expansion	Version
Examination of another type	3	Grade to a third	Each term	1 terms	1

Events					
WT 23/24	2304227	Seminar Fuel Cell	2 SWS	Seminar / 🗣	Weber
ST 2024	2304227	Seminar Fuel Cell	2 SWS	Seminar / 🗣	Weber
Exams					
WT 23/24	7300003	Seminar Fuel Cell I			Weber

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

Competence Certificate
Success control takes the form of other types of examination.

The grade consists of:

1. written report (50%)

2. seminar lecture (50%)

Prerequisites
none

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

V Seminar Fuel Cell
2304227, WS 23/24, 2 SWS, Language: German/English, Open in study portal

Seminar (S)
On-Site

Content
Seminar Fuel Cells (I + II for Bachelor and Master students respectively)

The fuel cell seminar is offered all year round (including the lecture-free period). In the seminar, topics related to current research work at the IAM-ET are discussed on a weekly basis. Participation in the seminar is possible for students from the Faculty of Electrical Engineering and Information Technology as well as for students from other faculties. The seminar paper is usually a theoretical work consisting of literature research and comparative evaluation of different approaches to solve a scientific or technical question. A seminar paper can be started at any time (just come along). The work includes a written thesis and a lecture to be given as part of the event. Regular attendance at the weekly appointments is not required. If possible, you should attend dates where other participants give their presentations. If you are interested in taking part in the seminar and writing a seminar paper, please contact the lecturer.

Organizational issues
Anmeldungen können unter: andre.weber@kit.edu erfolgen.

Literature
werden zu Beginn der Seminararbeit themenspezifisch gegeben

V Seminar Fuel Cell
2304227, SS 2024, 2 SWS, Language: German/English, Open in study portal

Seminar (S)
On-Site

Content

Seminar Fuel Cells (I + II for Bachelor and Master students respectively)

The fuel cell seminar is offered all year round (including the lecture-free period). In the seminar, topics related to current research work at the IAM-ET are discussed on a weekly basis. Participation in the seminar is possible for students from the Faculty of Electrical Engineering and Information Technology as well as for students from other faculties. The seminar paper is usually a theoretical work consisting of literature research and comparative evaluation of different approaches to solve a scientific or technical question. A seminar paper can be started at any time (just come along). The work includes a written thesis and a lecture to be given as part of the event. Regular attendance at the weekly appointments is not required. If possible, you should attend dates where other participants give their presentations. If you are interested in taking part in the seminar and writing a seminar paper, please contact the lecturer.

Organizational issues

Anmeldungen können unter: **andre.weber@kit.edu** erfolgen.

Veranstaltung findet auch außerhalb der Vorlesungszeiten ganzjährig statt.

Literature

werden zu Beginn der Seminararbeit themenspezifisch gegeben

T 11.195 Course: Seminar on Selected Chapters of Biomedical Engineering [T-ETIT-100710]

Responsible: Dr.-Ing. Axel Loewe
Organisation: KIT Department of Electrical Engineering and Information Technology
Part of: M-ETIT-100383 - Seminar on Selected Chapters of Biomedical Engineering

Type	Credits	Grading scale	Recurrence	Version
Examination of another type	3	Grade to a third	Each winter term	1

Events					
WT 23/24	2305254	Seminar on Selected Chapters of Biomedical Engineering	2 SWS	Seminar / 🗣	Loewe
Exams					
WT 23/24	7305254	Seminar on Selected Chapters of Biomedical Engineering			Loewe

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

Competence Certificate
Success monitoring is carried out in the context of a lecture (approx. 25 minutes) followed by a discussion (approx. 10 minutes).

Prerequisites
none

T 11.196 Course: Seminar Power Electronics in Regenerative Energy Systems [T-ETIT-100714]

Responsible: Prof. Dr.-Ing. Marc Hiller
Organisation: KIT Department of Electrical Engineering and Information Technology
Part of: M-ETIT-100397 - Seminar Power Electronics in Regenerative Energy Systems

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

Events					
ST 2024	2306318	Seminar Power Electronics in Regenerative Energy Systems	3 SWS	Seminar / 🗣	Hiller
Exams					
ST 2024	7306318	Seminar Power Electronics in Regenerative Energy Systems			Hiller

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

Prerequisites
none

T 11.197 Course: Seminar: Fundamentals of Embedded Systems [T-ETIT-110832]

Responsible: Prof. Dr.-Ing. Jürgen Becker
Prof. Dr.-Ing. Eric Sax
Prof. Dr. Wilhelm Stork

Organisation: KIT Department of Electrical Engineering and Information Technology

Part of: M-ETIT-105645 - Information and Automation Technology II/Seminar Embedded Systems

Type	Credits	Grading scale	Recurrence	Expansion	Version
Examination of another type	4	Grade to a third	Each term	1 terms	3

Events					
WT 23/24	2311628	Seminar: Fundamentals of Embedded Systems	2 SWS	Seminar / On-Site	Becker, Sax, Stork
ST 2024	2311628	Seminar Fundamentals of Embedded Systems	2 SWS	Seminar / Blended	Becker, Sax, Stork
Exams					
WT 23/24	7311628	Seminar: Fundamentals of Embedded Systems			Becker, Sax, Stork

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

Prerequisites
none

T 11.198 Course: Sensors [T-ETIT-101911]

Responsible: Dr. Wolfgang Menesklou
Organisation: KIT Department of Electrical Engineering and Information Technology
Part of: M-ETIT-100378 - Sensors

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					
WT 23/24	7304231	Sensors			Menesklou
ST 2024	7304231	Sensors			Menesklou

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

T 11.199 Course: Signals and Systems [T-ETIT-109313]

Responsible: Prof. Dr.-Ing. Michael Heizmann
Organisation: KIT Department of Electrical Engineering and Information Technology
Part of: M-ETIT-104525 - Signals and Systems

Type	Credits	Grading scale	Recurrence	Expansion	Version
Written examination	6	Grade to a third	Each winter term	1 terms	1

Events					
WT 23/24	2302109	Signals and Systems	2 SWS	Lecture / 🔀	Wahls, Heizmann
WT 23/24	2302111	Signals and Systems (Tutorial to 2302109)	2 SWS	Practice / 🗣	Wahls, Heizmann, Leven
Exams					
WT 23/24	7302109	Signals and Systems			Wahls

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

Prerequisites
none

11.200 Course: Signals and Systems - Workshop [T-ETIT-109314]

Responsible: Prof. Dr.-Ing. Michael Heizmann
Organisation: KIT Department of Electrical Engineering and Information Technology
Part of: M-ETIT-104525 - Signals and Systems

Type	Credits	Grading scale	Recurrence	Expansion	Version
Completed coursework (written)	1	pass/fail	Each summer term	1 terms	3

Events					
ST 2024	2302905	Signals and Systems - Workshop	1 SWS	Practical course /	Wahls
Exams					
ST 2024	7302314	Signals and Systems - Workshop			Wahls

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

Prerequisites
none

T 11.201 Course: Software Engineering I [T-INFO-101968]

Responsible: Prof. Dr.-Ing. Ina Schaefer
Organisation: KIT Department of Informatics
Part of: M-INFO-101175 - Software Engineering I

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

Events					
ST 2024	24518	Softwaretechnik I	4 SWS	Lecture / Practice (/ 🗣	Schaefer, Eichhorn
Exams					
WT 23/24	7500123	Software Engineering I			Schaefer
ST 2024	7500152	Software Engineering I			Schaefer

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

T 11.202 Course: Software Engineering I Pass [T-INFO-101995]

Responsible: Prof. Dr.-Ing. Ina Schaefer
Organisation: KIT Department of Informatics
Part of: M-INFO-101175 - Software Engineering I

Type	Credits	Grading scale	Recurrence	Version
Completed coursework	0	pass/fail	Each summer term	1

Events					
ST 2024	24518	Softwaretechnik I	4 SWS	Lecture / Practice (/ 🗣	Schaefer, Eichhorn
Exams					
ST 2024	7500250	Software Engineering I Pass			Schaefer

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

11.203 Course: Software Engineering II [T-INFO-101370]

Responsible: Prof. Dr.-Ing. Anne Koziolek
Prof. Dr. Ralf Reussner
Organisation: KIT Department of Informatics
Part of: M-INFO-100833 - Software Engineering II

Type	Credits	Grading scale	Recurrence	Version
Written examination	6	Grade to a third	Each winter term	1

Events					
WT 23/24	24076	Software Engineering II	4 SWS	Lecture / 🗣	Reussner
Exams					
WT 23/24	7500054	Software Engineering II			Reussner

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

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

Software Engineering II
24076, WS 23/24, 4 SWS, Language: German, Open in study portal

Lecture (V)
On-Site

Literature
Craig Larman, Applying UML and Patterns, 3rd edition, Prentice Hall, 2004. Weitere Literaturhinweise werden in der Vorlesung gegeben.

11.204 Course: Specialisation Module - Self Assignment BeNe [T-ZAK-112346]

Responsible: Christine Myglas
Organisation:
Part of: M-ZAK-106099 - Supplementary Studies on Sustainable Development

Type	Credits	Grading scale	Version
Examination of another type	6	Grade to a third	1

Competence Certificate
The monitoring occurs in the form of several supplementary courses, which usually comprise a presentation of the (group) project, a written elaboration of the (group) project as well as an individual term paper, if necessary with appendices (examination performances of other kind according to statutes § 5 section 3 No. 3 or § 7 section 7).

The presentation is usually with the accompanying practice partners, as well as the written paper.

Prerequisites
Active participation in all three mandatory components.

Self service assignment of supplementary stdues
This course can be used for self service assignment of grade aquired from the following study providers:

- Zentrum für Angewandte Kulturwissenschaft und Studium Generale
- ZAK Begleitstudium

Recommendation
Knowledge from 'Basic Module ' and 'Elective Module ' is helpful.

T 11.205 Course: Stochastic Information Processing [T-INFO-101366]

Responsible: Prof. Dr.-Ing. Uwe Hanebeck
Organisation: KIT Department of Informatics
Part of: M-INFO-100829 - Stochastic Information Processing

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

Events					
WT 23/24	24113	Stochastic Information Processing	3 SWS	Lecture / 🗣	Hanebeck, Frisch
Exams					
WT 23/24	7500031	Stochastic Information Processing			Hanebeck

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

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

V Stochastic Information Processing

24113, WS 23/24, 3 SWS, Language: German, Open in study portal

Lecture (V)
On-Site

Content

In order to handle complex dynamic systems (e.g., in robotics), an in-step estimation of the system's internal state (e.g., position and orientation of the actuator) is required. Such an estimation is ideally based on the system model (e.g., a discretized differential equation describing the system dynamics) and the measurement model (e.g., a nonlinear function that maps the state space to a measurement subspace). Both system and measurement model are uncertain (e.g., include additive or multiplicative noise).

For continuous state spaces, an exact calculation of the probability densities is only possible in a few special cases. In practice, general nonlinear systems are often traced back to these special cases by simplifying assumptions. One extreme is linearization with subsequent application of linear estimation theory. However, this often leads to unsatisfactory results and requires additional heuristic measures. At the other extreme are numerical approximation methods, which only evaluate the desired distribution densities at discrete points in the state space. Although the working principle of these procedures is usually quite simple, a practical implementation often turns out to be difficult and especially for higher-dimensional systems it is computationally complex.

As a middle ground, analytical nonlinear estimation methods would therefore often be desirable. In this lecture the main difficulties in the development of such estimation methods are presented and corresponding solution modules are presented. Based on these building blocks, some analytical estimation methods are discussed in detail as examples, which are very suitable for practical implementation and offer a good compromise between computing effort and performance. Useful applications of these estimation methods are also discussed. Both known methods and the results of current research are presented.

Organizational issues

Der Prüfungstermin ist per E-Mail (gambichler@kit.edu) zu vereinbaren.

Literature
Weiterführende Literatur

Skript zur Vorlesung

T 11.206 Course: Superconducting Magnet Technology [T-ETIT-113440]

Responsible: Prof. Dr. Tabea Arndt
Organisation: KIT Department of Electrical Engineering and Information Technology
Part of: M-ETIT-106684 - Superconducting Magnet Technology

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

Events					
ST 2024	2312698	Superconducting Magnet Technology	3 SWS	Lecture / Practice (/	Arndt

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

Competence Certificate
The examination takes place in form of an oral exam (abt. 30 minutes).

Two timeslots (weeks) for examination dates will be announced (usually near end of lecture period & end of semester).

The module grade is the grade of the oral exam.

Prerequisites
none

T 11.207 Course: Superconducting Power Systems [T-ETIT-113439]

Responsible: Prof. Dr. Mathias Noe
Organisation: KIT Department of Electrical Engineering and Information Technology
Part of: M-ETIT-106683 - Superconducting Power Systems

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

Events					
WT 23/24	2314011	Superconducting Power Systems	3 SWS	Lecture / Practice (/	Noe

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

Competence Certificate
The examination takes place in form of an oral exam (abt. 45 minutes).

The module grade is the grade of the oral exam.

Prerequisites
none

T 11.208 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-ETIT-105299 - Superconductors for Energy Applications

Type	Credits	Grading scale	Recurrence	Expansion	Version
Oral examination	5	Grade to a third	Each winter term	1 terms	2

Events					
WT 23/24	2312704	Superconductors for Energy Applications	2 SWS	Lecture / 🗣	Grilli
WT 23/24	2312705	Übungen zu 2312704 Superconductors for Energy Applications	1 SWS	Practice / 🗣	Grilli
Exams					
WT 23/24	7300015	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 11.209 Course: System Dynamics and Control Engineering [T-ETIT-101921]

Responsible: Prof. Dr.-Ing. Sören Hohmann
Organisation: KIT Department of Electrical Engineering and Information Technology
Part of: M-ETIT-102181 - System Dynamics and Control Engineering

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

Events					
WT 23/24	2303155	Systemdynamik und Regelungstechnik	2 SWS	Lecture /	Hohmann
WT 23/24	2303156	Tutorien zu 2303155 Systemdynamik und Regelungstechnik		Tutorial (/	Piscol
WT 23/24	2303157	Übungen zu 2303155 Systemdynamik und Regelungstechnik	1 SWS	Practice /	Piscol
Exams					
WT 23/24	7303155	System Dynamics and Control Engineering			Hohmann

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

Prerequisites
none

T 11.210 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-ETIT-102734 - Materials
M-MACH-104919 - Advanced Topics and Methods in Mechanical Engineering (4 CP)

Type	Credits	Grading scale	Recurrence	Version
Written examination	5	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					
WT 23/24	76-T-MACH-100531	Systematic Materials Selection			Dietrich
ST 2024	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

2174576, SS 2024, 3 SWS, Language: German, Open in study portal

Lecture (V)
On-Site

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 11.211 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-105318 - Technical Design in Product Development

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 11.212 Course: Technical Thermodynamics and Heat Transfer I [T-MACH-104747]

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

Part of: M-MACH-102386 - Technical Thermodynamics and Heat Transfer I

Type	Credits	Grading scale	Recurrence	Version
Written examination	8	Grade to a third	Each winter term	3

Events					
WT 23/24	2165501	Technical Thermodynamics and Heat Transfer I	4 SWS	Lecture / 🗣	Maas
WT 23/24	3165014	Technical Thermodynamics and Heat Transfer I	4 SWS	Lecture / 🗣	Schießl, Maas
Exams					
WT 23/24	76-T-MACH-104747	Technical Thermodynamics and Heat Transfer I			Maas, Schießl
WT 23/24	76-T-MACH-104747-english	Technical Thermodynamics and Heat Transfer I			Maas, Schießl
ST 2024	76-T-MACH-104747	Technical Thermodynamics and Heat Transfer I			Maas, Schießl
ST 2024	76-T-MACH-104747-englisch	Technical Thermodynamics and Heat Transfer I			Maas, Schießl

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

Competence Certificate
Written exam, approx. 3 hours

Prerequisites
Successful participation in the tutorial (T-MACH-105204 - Excercises in Technical Thermodynamics and Heat Transfer I)

Modeled Conditions
The following conditions have to be fulfilled:

1. The course T-MACH-105204 - Excercises in Technical Thermodynamics and Heat Transfer I must have been passed.

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

V Technical Thermodynamics and Heat Transfer I

2165501, WS 23/24, 4 SWS, Language: German, Open in study portal

Lecture (V)
On-Site

Content

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

Literature
Vorlesungsskriptum

Elsner, N.; Dittmann, A.: Energielehre und Stoffverhalten (Grundlagen der technischen Thermodynamik Bd. 1 und 2), 8. Aufl., Akademie-Verlag, 680 S. 1993.

Baehr, H.D.: Thermodynamik: eine Einführung in die Grundlagen und ihre technischen Anwendungen, 9. Aufl., Springer-Verlag, 460 S., 1996.

V

Technical Thermodynamics and Heat Transfer I

3165014, WS 23/24, 4 SWS, Language: English, Open in study portal

Lecture (V)
On-Site

Content

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

Literature

Vorlesungsskriptum

Elsner, N.; Dittmann, A.: Energielehre und Stoffverhalten (Grundlagen der technischen Thermodynamik Bd. 1 und 2), 8. Aufl., Akademie-Verlag, 680 S. 1993.

Baehr, H.D.: Thermodynamik: eine Einführung in die Grundlagen und ihre technischen Anwendungen, 9. Aufl., Springer-Verlag, 460 S., 1996.

T 11.213 Course: Technical Thermodynamics and Heat Transfer II [T-MACH-105287]

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

Part of: M-MACH-102830 - Technical Thermodynamics and Heat Transfer II

Type	Credits	Grading scale	Recurrence	Version
Written examination	7	Grade to a third	Each summer term	1

Events					
WT 23/24	2100020	Technical Thermodynamics and Heat Transfer II (Repeater Tutorial)	2 SWS	Tutorial (/	Schießl
ST 2024	2166526	Technical Thermodynamics and Heat Transfer II	4 SWS	Lecture /	Maas
Exams					
WT 23/24	76-T-MACH-105287	Technical Thermodynamics and Heat Transfer II			Maas, Schießl
WT 23/24	76-T-MACH-105287-english	Technical Thermodynamics and Heat Transfer II			Maas, Schießl
ST 2024	76-T-MACH-105287	Technical Thermodynamics and Heat Transfer II			Maas, Schießl
ST 2024	76-T-MACH-105287-englisch	Technical Thermodynamics and Heat Transfer II			Maas, Schießl

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

Competence Certificate
Written exam, approx. 3 hours

Prerequisites
Successful participation in the tutorial (T-MACH-105288 - Exercises in Technical Thermodynamics and Heat Transfer II)

Modeled Conditions
The following conditions have to be fulfilled:

1. The course T-MACH-105288 - Excercises in Technical Thermodynamics and Heat Transfer II must have been passed.

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

V Technical Thermodynamics and Heat Transfer II
2166526, SS 2024, 4 SWS, Language: German, Open in study portal

Lecture (V)
On-Site

Content

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

Literature
Vorlesungsskriptum

Elsner, N.; Dittmann, A.: Energielehre und Stoffverhalten (Grundlagen der technischen Thermodynamik Bd. 1 und 2), 8. Aufl., Akademie-Verlag, 680 S. 1993.

Baehr, H.D.: Thermodynamik: eine Einführung in die Grundlagen und ihre technischen Anwendungen, 9. Aufl., Springer-Verlag, 460 S., 1996.

T 11.214 Course: Theory of Probability [T-ETIT-101952]

Responsible: Dr.-Ing. Holger Jäkel
Organisation: KIT Department of Electrical Engineering and Information Technology
Part of: M-ETIT-102104 - Theory of Probability
M-ETIT-105646 - Theory of Probability/Communication Engineering I

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

Events					
WT 23/24	2310505	Theory of Probability	2 SWS	Lecture /	Jäkel
WT 23/24	2310507	Tutorial for 2310505 Theory of Probability	1 SWS	Practice /	Jäkel
Exams					
WT 23/24	7310505	Theory of Probability			Jäkel
ST 2024	7310505	Theory of Probability			Jäkel

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

Prerequisites
Contents of higher mathematics are necessary (e.g. M-MATH-101731 und M-MATH-101732).

T 11.215 Course: Thermal Solar Energy [T-MACH-105225]

Responsible: N.N.
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102388 - Thermal Solar Energy

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

Events					
WT 23/24	2169472	Thermal Solar Energy	2 SWS	Lecture / 🗣	Stieglitz, Dagan
Exams					
WT 23/24	76-T-MACH-105225	Thermal Solar Energy			Dagan

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

Competence Certificate
Oral examination of about 30 minutes

Prerequisites
none

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

V Thermal Solar Energy

2169472, WS 23/24, 2 SWS, Language: German, Open in study portal

Lecture (V)
On-Site

Content
Basics of thermal solar energy (radiation, heat conduction, storage, efficiency...) Active and passive use of solar energy. Solar collectors (design types, efficiency, system technology). Solar plants (heliostats etc.). Solar climatisation.

In detail:

1 Introduction to energy requirements and evaluation of the potential use of solar thermal energy.

2 Primary energy source SUN: sun, solar constant, radiation (direct, diffuse scattering, absorption, impact angle, radiation balance).

3 Solar collectors: schematic structure of a collector, fundamentals of efficiency, meaning of concentration and their limitations.

4 Passive solar mechanisms: heat conduction in solids and gases, radiation heat transfer in transparent and opaque bodies, selective absorber - typical materials and manufacturing processes.

5 Momentum and heat transport: basic equations of single and multiphase transport, calculation methods, stability limits.

optional

6 Low temperature solar thermal systems: collector types, methods for system simulation, planning and dimensioning of systems, system design and stagnation scenarios.

7 High temperature solar thermal systems: solar towers and solar-farm concept, loss mechanisms, chimney power plants and energy production processes

The lecture elaborates the basics of the solar technology and the definition of the major wordings and its physical content such as radiation, thermal use, insulation etc.. Further the design of solar collectors for different purposes is discussed and analyzed. The functional principle of solar plants is elaborated before at the end the ways for solar cooling is discussed.

The aim of the course is to provide the basic physical principles and the derivation of key parameters for the individual solar thermal use. This involves in addition to the selective absorber, mirrors, glasses, and storage technology. In addition, a utilization of solar thermal energy means an interlink of the collector with a thermal-hydraulic circuit and a storage. The goal is to capture the regularities of linking to derive efficiency correlations as a function of their use and evaluate the performance of the entire system.

Recommendations / previous knowledge

Basics in heat and mass transfer, material science and fluid mechanics, desirable are reliable knowledge in physics in optics and thermodynamics

Oral exam of about 25 minutes, no tools or reference materials may be used during the exam

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

Literature
Bereitstellung des Sudienmaterials in gedruckter und elektronischer Form.

Stieglitz & Heinzel; Thermische Solarenergie -Grundlagen-Technologie- Anwendungen. Springer Vieweg Verlag. 711 Seiten. ISBN 978-3-642-29474-7

T 11.216 Course: Tutorial Advanced Mathematics I [T-MATH-100525]

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

Organisation: KIT Department of Mathematics

Part of: M-MATH-102859 - Advanced Mathematics

Type	Credits	Grading scale	Recurrence	Version
Completed coursework (written)	0	pass/fail	Each winter term	2

Events					
WT 23/24	0131100	Übungen zu 0131000	2 SWS	Practice	Hettlich
WT 23/24	0131300	Übungen zu 0131200	2 SWS	Practice	Hettlich
Exams					
WT 23/24	6700005	Problem Class for Advanced Mathematics I			Arens, Griesmaier, Hettlich

Competence Certificate
Learning assessment is carried out by written assigments (pre-requesite). Exact requirements will be communicated in the lectures.

Prerequisites
None.

T 11.217 Course: Tutorial Advanced Mathematics II [T-MATH-100526]

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

Organisation: KIT Department of Mathematics

Part of: M-MATH-102859 - Advanced Mathematics

Type	Credits	Grading scale	Recurrence	Version
Completed coursework (written)	0	pass/fail	Each summer term	2

Events					
ST 2024	0180900	Übungen zu 0180800	2 SWS	Practice	Arens
ST 2024	0181100	Übungen zu 0181000	2 SWS	Practice	Arens

Competence Certificate
Learning assessment is carried out by written assigments (pre-requesite). Exact requirements will be communicated in the lectures.

Prerequisites
None.

T 11.218 Course: Tutorial Advanced Mathematics III [T-MATH-100527]

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

Organisation: KIT Department of Mathematics

Part of: M-MATH-102859 - Advanced Mathematics

Type	Credits	Grading scale	Recurrence	Version
Completed coursework (written)	0	pass/fail	Each winter term	2

Events					
WT 23/24	0131500	Übungen zu 0131400	2 SWS	Practice	Arens
Exams					
WT 23/24	6700006	Tutorial Advanced Mathematics III			Arens, Griesmaier, Hettlich

Competence Certificate
Learning assessment is carried out by written assigments (pre-requesite). Exact requirements will be communicated in the lectures.

Prerequisites
None.

T 11.219 Course: Tutorial Engineering Mechanics I [T-MACH-100528]

Responsible: Prof. Dr.-Ing. Thomas Böhlke
Dr.-Ing. Tom-Alexander Langhoff

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102402 - Engineering Mechanics

Type	Credits	Grading scale	Recurrence	Version
Completed coursework	0	pass/fail	Each winter term	3

Events					
WT 23/24	2161246	Tutorial Engineering Mechanics I	2 SWS	Practice / 🗣	Kehrer, Klein, Böhlke
WT 23/24	3161011	Engineering Mechanics I (Tutorial)	2 SWS	Practice / 🗣	Gisy, Klein, Langhoff
Exams					
WT 23/24	76-T-MACH-100528	Tutorial Engineering Mechanics I			Böhlke, Langhoff
WT 23/24	76-T-MACH-100528-englisch	Tutorial Engineering Mechanics I			Böhlke, Langhoff

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

Competence Certificate
Successful solution of worksheets. Details are given in the first lecture "Engineering Mechanics I"

Passing this course allows to register to the exam "Engineering Mechanics I" (see T-MACH-100282).

Prerequisites
None

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

V Tutorial Engineering Mechanics I
2161246, WS 23/24, 2 SWS, Language: German, Open in study portal

Practice (Ü)
On-Site

Content
Please refer to the lecture Engineering Mechanics I.

Literature
Siehe Vorlesung Technische Mechanik I

V Engineering Mechanics I (Tutorial)
3161011, WS 23/24, 2 SWS, Language: English, Open in study portal

Practice (Ü)
On-Site

Content
See Lecture "Engineering Mechanics I"

Literature
See Lecture "Engineering Mechanics I"

T 11.220 Course: Tutorial Engineering Mechanics II [T-MACH-100284]

Responsible: Prof. Dr.-Ing. Thomas Böhlke
Dr.-Ing. Tom-Alexander Langhoff

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102402 - Engineering Mechanics

Type	Credits	Grading scale	Recurrence	Version
Completed coursework (written)	0	pass/fail	Each summer term	3

Events					
ST 2024	2162251	Tutorial Engineering Mechanics II	2 SWS	Practice / 🗣	Kehrer, Klein, Böhlke
ST 2024	3162011	Engineering Mechanics II (Tutorial)	2 SWS	Practice / 🗣	Langhoff, Gisy, Klein

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

Competence Certificate
Successful solution of worksheets. Details are given in the first lecture "Engineering Mechanics II"

Passing this course allows to register to the exam "Engineering Mechanics II" (see T-MACH-100283).

Prerequisites
None

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

V Tutorial Engineering Mechanics II

2162251, SS 2024, 2 SWS, Language: German, Open in study portal

Practice (Ü)
On-Site

Content
see lecture Engineering Mechanics II

Literature
Siehe Vorlesung Technische Mechanik II

V Engineering Mechanics II (Tutorial)

3162011, SS 2024, 2 SWS, Language: English, Open in study portal

Practice (Ü)
On-Site

Content
see lecture "Engineering Mechanics II"

Literature
see lecture "Engineering Mechanics II"

11.221 Course: Tutorial Engineering Mechanics III [T-MACH-105202]

Responsible: N.N.
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102402 - Engineering Mechanics

Type	Credits	Grading scale	Recurrence	Version
Completed coursework (written)	0	pass/fail	Each winter term	2

Events					
WT 23/24	2161204	Engineering Mechanics III (Tutorial)	2 SWS	Practice / 🗣	Proppe, Altoé, Fischer, Römer
WT 23/24	3161013	Engineering Mechanics III (Tutorial)	2 SWS	Practice / 🗣	Römer, Altoé, Fischer
Exams					
WT 23/24	76-T-MACH-105202	Tutorial Engineering Mechanics III			Proppe

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

Competence Certificate
Attestations, succesful accomplishment of exercise sheets

Prerequisites
None

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

V Engineering Mechanics III (Tutorial)
2161204, WS 23/24, 2 SWS, Language: German, Open in study portal

Practice (Ü)
On-Site

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

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

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

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

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

Göldner, Holzweissig: Leitfaden der Technischen Mechanik.

Hagedorn: Technische Mechanik III.

V Engineering Mechanics III (Tutorial)
3161013, WS 23/24, 2 SWS, Language: English, Open in study portal

Practice (Ü)
On-Site

Content
Exercises related to the lecture

T 11.222 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-103205 - Engineering Mechanics

Type	Credits	Grading scale	Recurrence	Expansion	Version
Completed coursework	2	pass/fail	Each winter term	1 terms	2

Events					
WT 23/24	2161255	Tutorial Mathematical Methods in Confinuum Mechanics	2 SWS	Practice / 🗣	Lauff, Sterr, Böhlke
Exams					
WT 23/24	76-T-MACH-110376	Tutorial Mathematical Methods in Continuum Mechanics			Böhlke

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

Competence Certificate
successfully solving the homework sheets. Details are announced in the first lecture.

Prerequisites
None

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

V Tutorial Mathematical Methods in Confinuum Mechanics

2161255, WS 23/24, 2 SWS, Language: German, Open in study portal

Practice (Ü)
On-Site

Content
See "Mathematical Methods in Continuum Mechanics"

Literature
Siehe "Mathematische Methoden der Kontinuumsmechanik"

T 11.223 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-102703 - Vehicle Lightweight Design - Strategies, Concepts, Materials

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

Events					
WT 23/24	2113102	Vehicle Lightweight design – Strategies, Concepts, Materials	2 SWS	Lecture /	Henning
Exams					
WT 23/24	76-T-MACH-105237	Vehicle Lightweight Design - Strategies, Concepts, Materials			Henning
ST 2024	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 23/24, 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 11.224 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-106515 - Vehicle Systems for Urban Mobility

Type	Credits	Grading scale	Version
Oral examination	4	Grade to a third	3

Events					
WT 23/24	2115922	Vehicle Systems for Urban Mobility	2 SWS	Lecture / 🗣	Cichon
ST 2024	2115922	Vehicle Systems for Urban Mobility	2 SWS	Lecture / 🗣	Cichon, Berthold
Exams					
WT 23/24	76-T-MACH-106428	Vehicle Systems for Urban Mobility			Cichon
ST 2024	76-T-MACH-106428	Vehicle Systems for Urban Mobility			Cichon, Berthold

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 11.225 Course: Vibration Theory [T-MACH-105290]

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

Part of: M-MACH-105091 - Advanced Topics and Methods in Mechanical Engineering (5 CP)

Type	Credits	Grading scale	Recurrence	Version
Written examination	5	Grade to a third	Each winter term	3

Events					
WT 23/24	2161212	Vibration Theory	2 SWS	Lecture	Römer
WT 23/24	2161213	Übungen zu Technische Schwingungslehre	2 SWS	Practice	Römer, Keller
Exams					
WT 23/24	7600055	Vibration Theory			Fidlin, Römer
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 23/24, 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 23/24, 2 SWS, Language: German, Open in study portal

Content
Exercises related to the lecture

T 11.226 Course: Virtual Engineering (Specific Topics) [T-MACH-105381]

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

Part of: M-MACH-104919 - Advanced Topics and Methods in Mechanical Engineering (4 CP)

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					
WT 23/24	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 11.227 Course: Virtual Engineering I [T-MACH-102123]

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

Part of: M-MACH-105293 - Virtual Engineering 1

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

Events					
WT 23/24	2121352	Virtual Engineering I	2 SWS	Lecture / 🗣	Ovtcharova
WT 23/24	2121353	Exercises Virtual Engineering I	2 SWS	Practice / 🗣	Ovtcharova, Mitarbeiter
Exams					
WT 23/24	76-T-MACH-102123	Virtual Engineering I			Ovtcharova
WT 23/24	76-T-MACH-102123-mdl	Virtual Engineering I			Ovtcharova
ST 2024	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
2121352, WS 23/24, 2 SWS, Language: English, Open in study portal

Lecture (V)
On-Site

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
2121353, WS 23/24, 2 SWS, Language: English, Open in study portal

Practice (Ü)
On-Site

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 11.228 Course: Wearable Robotic Technologies [T-INFO-106557]

Responsible: Prof. Dr.-Ing. Tamim Asfour
Prof. Dr.-Ing. Michael Beigl

Organisation: KIT Department of Informatics

Part of: M-INFO-103294 - Wearable Robotic Technologies

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

Events					
ST 2024	2400062	Wearable Robotic Technologies	2 SWS	Lecture / 🗣	Asfour, Beigl
Exams					
WT 23/24	7500073	Wearable Robotic Technologies			Asfour
ST 2024	7500219	Wearable Robotic Technologies			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
Attending the lecture Mechano-Informatics and Robotics is recommended.

Recommendation
Attending the lecture Mechano-Informatics and Robotics is recommended.

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

V Wearable Robotic Technologies

2400062, SS 2024, 2 SWS, Language: German/English, Open in study portal

Lecture (V)
On-Site

Content
The lecture starts with an overview of wearable robot technologies (exoskeletons, prostheses and ortheses) and its potentials, followed by the basics of wearable robotics. In addition to different approaches to the design of wearable robots and their related actuator and sensor technology, the lecture focuses on modeling the neuromusculoskeletal system of the human body and the physical and cognitive human-robot interaction for tightly coupled hybrid human-robot systems. Examples of current research and various applications of lower, upper and full body exoskeletons as well as prostheses are presented.

Learning Objectives:

The students have received fundamental knowledge about wearable robotic technologies and understand the requirements for the design, the interface to the human body and the control of wearable robots. They are able to describe methods for modelling the human neuromusculoskeletal system, the mechatronic design, fabrication and composition of interfaces to the human body. The students understand the symbiotic human–machine interaction as a core topic of Anthropomatics and has knowledge of state-of-the-art examples of exoskeletons, orthoses and prostheses.

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, Sportwissenschaften

Empfehlungen: Der Besuch der Vorlesung *Mechano-Informatik in der Robotik* wird empfohlen.

Arbeitsaufwand: 120h

Literature
Vorlesungsfolien und ausgewählte aktuelle Literaturangaben werden in der Vorlesung bekannt gegeben und als pdf unter http://www.humanoids.kit.edu verfügbar gemacht.

T 11.229 Course: Wildcard Additional Examinations 1 [T-MACH-106638]

Organisation: University
Part of: M-MACH-104332 - Further Examinations

Type	Credits	Grading scale	Recurrence	Version
Completed coursework	3	pass/fail	Each term	1

T 11.230 Course: Wildcard Additional Examinations 10 [T-MACH-106650]

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-104332 - Further Examinations

Type	Credits	Grading scale	Recurrence	Version
Examination of another type	3	Grade to a third	Each term	1

T 11.231 Course: Wildcard Additional Examinations 11 [T-MACH-113345]

Organisation: University
Part of: M-MACH-104332 - Further Examinations

Type	Credits	Grading scale	Recurrence	Version
Completed coursework	3	pass/fail	Each term	1

T 11.232 Course: Wildcard Additional Examinations 2 [T-MACH-106639]

Organisation: University
Part of: M-MACH-104332 - Further Examinations

Type	Credits	Grading scale	Recurrence	Version
Completed coursework	3	pass/fail	Each term	1

T 11.233 Course: Wildcard Additional Examinations 3 [T-MACH-106640]

Organisation: University
Part of: M-MACH-104332 - Further Examinations

Type	Credits	Grading scale	Recurrence	Version
Completed coursework	3	pass/fail	Each term	1

T 11.234 Course: Wildcard Additional Examinations 4 [T-MACH-106641]

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-104332 - Further Examinations

Type	Credits	Grading scale	Recurrence	Version
Examination of another type	3	Grade to a third	Each term	1

T 11.235 Course: Wildcard Additional Examinations 5 [T-MACH-106643]

Organisation: KIT Department of Mechanical Engineering
Part of: M-MACH-104332 - Further Examinations

Type	Credits	Grading scale	Recurrence	Version
Examination of another type	3	Grade to a third	Each term	1

T 11.236 Course: Wildcard Additional Examinations 6 [T-MACH-106646]

Organisation: KIT Department of Mechanical Engineering
Part of: M-MACH-104332 - Further Examinations

Type	Credits	Grading scale	Recurrence	Version
Examination of another type	3	Grade to a third	Each term	1

T 11.237 Course: Wildcard Additional Examinations 7 [T-MACH-106647]

Organisation: KIT Department of Mechanical Engineering
Part of: M-MACH-104332 - Further Examinations

Type	Credits	Grading scale	Recurrence	Version
Examination of another type	3	Grade to a third	Each term	1

T 11.238 Course: Wildcard Additional Examinations 8 [T-MACH-106648]

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-104332 - Further Examinations

Type	Credits	Grading scale	Recurrence	Version
Examination of another type	3	Grade to a third	Each term	1

T 11.239 Course: Wildcard Additional Examinations 9 [T-MACH-106649]

Organisation: KIT Department of Mechanical Engineering
Part of: M-MACH-104332 - Further Examinations

Type	Credits	Grading scale	Recurrence	Version
Examination of another type	3	Grade to a third	Each term	1

T 11.240 Course: Workshop Mechatronical Systems and Products [T-MACH-108680]

Responsible: Prof. Dr.-Ing. Sören Hohmann
Prof. Dr.-Ing. Sven Matthiesen

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102749 - Mechatronical Systems and Products

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

Events					
WT 23/24	2145162	Workshop Mechatronical Systems and Products	2 SWS	Practical course / 🗣	Teltschik, Matthiesen, Hohmann
Exams					
WT 23/24	76-T-MACH-108680	Workshop Mechatronical Systems and Products			Hohmann, Matthiesen

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

Competence Certificate
Alongside the workshop, deliverables will be requested at defined milestones. In these, the application of the knowledge that has been developed within the framework of the module will be examined. These deliverables consist of CAD designs, control software and reflection reports, for example, are defined in a workshop assignment at the beginning of the semester. The milestones are announced in a calendar at the beginning of the semester and are available to students through ILIAS. The demanded deliveries are uploaded to ILIAS.

Prerequisites
none

Annotation
All relevant content (scripts, exercise sheets, etc.) for the course can be obtained via the eLearning platform ILIAS. To participate in the course, please complete the survey " *Anmeldung und Gruppeneinteilung* " in ILIAS before the start of the semester.